

5/ Author WILLIAMSON

Class Mark NK 7690. A5

Book No. 79122



UNIVERSITY
OF NOTTINGHAM
LIBRARY

UNIVERSITY OF NOTTINGHAM

WITHDRAWN

FROM THE LIBRARY

60 0252667 6

UNIVERSITY OF NOTTINGHAM



739

WITHDRAWN

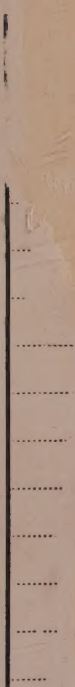
FROM THE LIBRARY

T yshir.

COUL

late e
return

d h



THE BOOK OF AMBER

TO THE
KEEPERS AND THEIR ASSISTANTS AT THE
BRITISH MUSEUM

AND TO THEIR BRETHREN IN
JERMYN STREET AND SOUTH KENSINGTON

THIS IS RESPECTFULLY DEDICATED
WITH UNCEASING GRATITUDE FOR THEIR INVARIABLE
KINDNESS, COURTESY AND FORBEARANCE



THE BOOK OF AMBER

SPECIMENS OF AMBER FROM DIFFERENT PARTS OF EUROPE

Of the three in the top row, the first is the cloudy Amber from Northern Europe, this piece having come from Denmark.

The second, an oval bead, is of the exceedingly rare green Amber occasionally found in Catania, and still more seldom in Northern Europe. This piece came from Latvia, and has leaves from a plant in it.

The third is the osseous Amber from Danzig.

Below, the shuttle-shaped piece represents the ordinary glorious golden-coloured Succinite from the Danzig coast.

Below, there are three more pieces: the first, ruby-coloured Burmite from Burmah; the second, luminous Amber from Siam; the third, silvery Rumanite from Roumania. This latter has a lovely scale-like effect of silver on the surface.

In the bottom row, the first piece is deep red Rumanite from Roumania. The only other Amber that possesses this strange, deep colour is that found in Siberia, near to Lake Baikal.

The central piece is an exceedingly rare specimen, probably unique, of Simitite from Catania, deep greenish-blue in colour, almost like lapis lazuli, with a clot of brilliant clear ruby colour, resembling a gem.

The last piece is also Simitite from another place in Sicily, and is equally rare, as the bloom upon it is not blue, as is so often the case, but a rich grape purple.

Frontispiece.

1932

LONDON

ERNEST BENN LIMITED

BOUVERIE HOUSE, FLEET STREET, E.C.4

THE BOOK OF AMBER

BY
DR. GEORGE C. WILLIAMSON

WITH A FOREWORD BY
EDWARD HERON-ALLEN, F.R.S.



1932
LONDON
ERNEST BENN LIMITED
BOUVERIE HOUSE, FLEET STREET, E.C.4



First Published in
1932
Printed
in
Great Britain

Ut paleam succinum sic amorem forma trahit

UNIVERSITY
LIBRARY
NOTTINGHAM

DERBYSHIRE
COUNTY LIBRARY

Accession No. 129,500

Class 739

FOREWORD

THE difficulty of distinguishing between the functions of the writer of a Foreword and those of a Reviewer is, I make bold to say, insurmountable. When, as in the present case, one whole-heartedly admires the work of the Author, his admiration runs grave danger of becoming fatuous; when, on the other hand, he regards the work of his Author as contemptible, it is more than is to be expected of mortal man that his pen should not drip gall at every sentence. Then why write the Foreword? the Reader may ask. The answer is that presumably the writer of the Foreword is an Expert upon the subject-matter of the book, and he feels it his duty mercilessly to expose what seems to him to be a literary villainy. (This happened to me on one occasion, and it killed a publisher.) Fortunately this danger is at this moment of time non-existent. I am not an Expert upon the general subject of this book, but I have a genuine interest in and appreciation of it, and have made a study of certain not unimportant aspects of it, which are here treated in so masterly, and withal so agreeable a manner, that I have no difficulty in assuming that Experts in the remaining branches of the subject will pay a like tribute of admiration to the Author's work where it deals with their speciality. Thus a strong and cohesive Platoon of Experts will be ready to present a bold front to any Sciolists who may exercise the time-dishonoured privilege of the ill-equipped Reviewer who can find "naught to admire."

It is interesting to note that, as in the case of Fitzgerald's "Ruba'iyat," this volume fills the void occasioned by the loss of a threepenny "Opusculum," now unattainable except at an exorbitant price. Here we have a census of information on the subject of Amber, the gathering together of which must have been a labour of love of years—twelve, as the Author informs us. He has garnered the whole of the information to be found scattered over wide fields of knowledge, and has, very wisely, not separated the wheat from a

certain amount of indicated chaff. This is particularly noticeable in his chapter of Classical Allusions, where we are presented with the whole treasure of a diver who has collected a rich harvest of pearls, and, not content with that, lays before us for purposes of comparison the Artifacts of Messrs. Ciro and Tecla. Among the former, what can arouse a more sincere gratitude to the literary diver than the quatrain "On a Bee enclosed in Amber" on p. 32, the work of an unknown translator in 1695? Upon our Author has fallen the mantle of Pliny, who was just such another diver, for full extracts from whose work in this field we must be grateful to him.

Who among us has not lost himself in the delight of "Imaginary Voyages"? For him one of the most fascinating chapters in the book will be that upon the "Amber Routes," whilst the vast research embodied in the chapter headed "Anthropology" cannot but arouse our most reverent admiration. If I can pick a quarrel with the Author, it would be anent the absence of copious footnotes, but this is a passion which, as indulged in by myself, has been stigmatised as pathological.

I will also confess that the chapter on Ambergris came upon me with a shock; it gave me a sensation that I might have experienced had I found an excogetical study of the Catechism in Mivart's well-known work on the Cat. But the Reader will no doubt take it as a danger-signal, like the chapter on Pseudo-ambers, to warn him not to fall a victim to the notorious treachery of Philology.

EDWARD HERON-ALLEN.

PREFACE

So far as I know, there are but two serious books on Amber in English, and both of these are long out of print.

“The Tears of the Heliades,” by W. A. Buffum,¹ is very largely concerned with the beauty of Sicilian Amber (Simetite), the glories of which are illustrated in its coloured frontispiece, and described in fitting language in its pages.

It also deals with the legends concerning Amber, and with the places where it is found, but it does not claim to be scientific or exhaustive in its treatment of the subject. It is, moreover, quite a difficult book now to obtain.

The other, curiously enough, is the more important of the two, although originally only issued at the absurd price of threepence, and forming No. 7 of Cope’s Smoke Room Booklets, issued by the enterprising firm of Cope Bros. & Co. to advertise their Golden Cloud and Prairie Flower tobaccos. The other booklets in the series relate wholly to tobacco, and are full of quotations concerning the use of the “fragrant weed.”

By very good fortune, Messrs. Cope met with a scholarly old man, Mr. William Maccall, who had for years accumulated a mass of material about Amber, mainly translated by him and by a friend of his from German sources. Some of this he contributed to a magazine called *Cope’s Tobacco Plant* (1875-81).

After his death Messrs. Cope instructed Mr. J. G. Haddow to gather up his somewhat disjointed material, and weld it into a book, a task he accomplished with great skill, and actually it is to the pages of a threepenny book that English readers have to turn if they desire to know anything about this fascinating material.

Some of Mr. Maccall’s unpublished and published material came, however, many years ago, into my possession

¹ Sampson Low & Co., London, 1898; 2nd ed., 1900.

(and some of his German pamphlets), with full permission from him to make use of it if I was ever able to carry out a long-cherished ambition.

Messrs. Cope have with great generosity allowed me to quote at will from their booklet in this volume, and for such permission I return them my grateful thanks. I may perhaps mention that the booklet no longer sells at its original price. Few copies escaped the smoking-room wastepaper basket, and it is now a rare thing. I had to pay a sovereign for my copy, and not threepence!

I must not forget that Amber occupies a small but important section in Dr. Bauer's great work on Precious Stones, and some few pages (twenty in number, pp. 535 to 555) deal with it in very full and adequate fashion in the edition of that work translated by Dr. L. J. Spencer, F.R.S., and issued in 1904 by Griffin & Co. From this also I have by permission made some extracts.

Beyond these, there is in English only a Short History of Amber issued at Königsberg in 1913, in explanation of the exhibits shown by the Royal Amber Works in that year, similar but rather fuller catalogues of the Amber exhibited at the Exhibition in Paris in 1909, and at the St. Louis Exhibition in 1904, and a graceful little booklet prepared by my good friend Brig.-General Hanna for the Exhibition at Wembley, when the Amber Trading Company in London set out a fine show of specimens. To that Company, and to its learned and most charming representative, Mr. M. W. Bursey, who himself owns one of the most complete collections of Amber that could possibly be brought together, including many very rare and unusual specimens, and who is also the owner of a vast series of insects of all kinds in Amber; and has always most readily placed his treasures at my disposal: I am particularly indebted for constant assistance, and for very much information given me from time to time. From the Company I have acquired a considerable proportion of the specimens of Amber that I possess in my own extensive collection, small indeed, in comparison with that of Mr. Bursey, but to his kindness I owe one or two very unusual specimens which he presented to me.

I am also indebted to my good friend General Hanna for information that he has gathered up concerning Amber in

his extensive travels and for permission to quote from whatever he has written on the subject.

To the authorities of the Danzig Museum I owe many thanks. From them I was able to purchase many of the rare books on Amber written by Berendt, Göppert, Klebs, Helm, Menge and others, and innumerable pamphlets on the same subject, some of which were long ago out of print and practically unobtainable without such assistance.

I have also obtained unusual examples of Amber from them, and have visited their Exhibitions both in England and in Prussia and in the Baltic provinces. Without the researches of the German scientists, the world would have known little of Amber, and hardly anything of its constituents, or of the objects that it enshrines.

To Dr. Rendel Harris and to Mr. J. M. de Navarro I owe information concerning Amber routes very fully set out in their writings to which I refer in that chapter, and I have been allowed by each author to quote—not, I hope, beyond fair dealing—from their pamphlets.

Dr. Black sent me his paper on Amber, reprinted from the *American Mineralogist* of 1919, vol. iv., and permitted me to use its contents, while by his Introduction I gained other information concerning Amber in America.

Dr. Perry, of University College, presented me with his pamphlet on "The Significance of the Search for Amber in Antiquity," reprinted from the *Journal of the Manchester Oriental Society*, and gave me similar permission; while my late friend and constant correspondent in Roumania, Dr. Murgoci, sent me much information on Rumanite.

Dr. Murgoci was most kind to me, and introduced me to the writings of Dr. Istratti, the first writer of any eminence to deal with Rumanite.

From Mrs. Murgoci I purchased several of her late husband's choicer specimens.

I have to thank my friend Mr. Henry D. Roberts, of Brighton, for information respecting the famous unique Amber cup under his care, and for permission to examine it very closely; and I have to thank Captain Acland and Mr. Bond for similar information concerning the Dorchester cup, and Mr. Griffin for the photograph of it. I would like also to thank the many owners of Amber ornaments who

have allowed me to see their treasures, and have placed information at my disposal: my friend Mr. Horace C. Beck, for very much anthropological material respecting beads, of which he has perhaps the largest collection in existence; Mr. Leader-Williams, for constant aid as to Sicilian Amber; Messrs. Figgis & Co., and Messrs. Lewis & Peat, for information as to Foreign Gums and for samples of many of them; Dr. Spurrier, C.M.G., for full details about Zanzibar Gum and specimens of it; my kind friend Dr. Leveen, of the Oriental Book Department of the British Museum, for constant and most generous aid; the Rev. Canon D. S. Guy and the Rev. A. L. Williams, of Cambridge, for reading part of my manuscript and verifying the accuracy of my use of Hebrew and Greek words; and Dr. Ephraim Levine, for writing out in beautiful fashion my Hebrew and Syriac words for the better service of the printer.

In this respect I must not also forget to thank one of my oldest friends, Geh. U. von Wilamovitz-Möllendorff, for advice and aid concerning Greek words. He was indeed *facile princeps* in Greek literature, and I regret that he passed away while this book was yet in typescript, and it therefore lacks the corrections he would so readily have supplied had he been asked so to do.

My friend Mr. Harry Burton most kindly photographed for me the fine Amber treasures in Florence, and I have to thank the authorities of the British Museum and the Victoria and Albert Museum for similar assistance.

I am further indebted to an old and valued friend, Mr. Edward Heron-Allen, F.R.S., for his careful perusal of my manuscript, and for numerous most valuable suggestions, as also for the gracious Foreword he has contributed to my pages.

May I add that the compilation of this book has occupied my leisure, in the intervals of other work, for the past twelve years or more?

Finally, a word of homage to my father, who, a skilled analytical chemist in his early days, taught me to study and love the sciences that he was forbidden to pursue.

TABLE OF CONTENTS

	PAGE
FOREWORD - - - - -	v
PREFACE - - - - -	vii
LIST OF ILLUSTRATIONS - - - - -	xiii
ON AMBER GENERALLY - - - - -	15
CLASSICAL ALLUSIONS TO AMBER - - - - -	26
NOMENCLATURE - - - - -	49
THE AMBER ROUTES - - - - -	60
AMBER CONSIDERED FROM THE POINT OF VIEW OF ANTHROPOLOGY - - - - -	70
AMBER CONSIDERED AS A MINERAL - - - - -	87
THE HOME OF SUCCINITE - - - - -	96
THE ZOOLOGY AND BOTANY OF AMBER - - - - -	133
AMBER IN ART - - - - -	151
THE LOCALITY IN WHICH AMBER IS FOUND - - - - -	184
ENGLISH AMBER - - - - -	195
AMBER CONSIDERED FROM THE POINT OF VIEW OF MEDICINE AND FOLKLORE - - - - -	203
SICILIAN AMBER OR SIMETITE - - - - -	208
RUMANITE OR ROUMANIAN AMBER - - - - -	210
BURMITE OR BURMESE AMBER - - - - -	218
AMBERGRIS - - - - -	220

TABLE OF CONTENTS

	PAGE
GEDANITE AND PSEUDO-AMBERS - - -	227
AMBER VARNISH - - -	231
AMBROID OR PRESSED AMBER - - -	236
BIBLIOGRAPHY - - -	239
APPENDIX, WITH A CHAPTER ON OTHER RARE MINERAL HYDROCARBONS AND GUMS - - -	249
INDEX - - -	257

LIST OF ILLUSTRATIONS

SPECIMENS OF AMBER FROM DIFFERENT PARTS OF EUROPE - - - - -	<i>Frontispiece</i>
	<small>FAUW</small>
SEVENTEENTH-CENTURY AMBER GATHERERS, NORTH PRUSSIA - - - - -	14
<i>From "Succini Prussica, Physica et Civilis Historia," by P. J. Hartmann. Frankfort, 1677.</i>	
AMBER CUP IN THE BRIGHTON MUSEUM -	<i>facing 82</i>
PINE CONES IN AMBER - - -	<i>facing 134</i>
<i>From "Organische Reste im Bernstein." Berendt, 1845.</i>	
A SWARM OF FLIES IN AMBER - -	<i>facing 146</i>
CARVED AMBER RELIEF IN THE VICTORIA AND ALBERT MUSEUM - - - - -	<i>facing 158</i>



SEVENTEENTH-CENTURY AMBER GATHERERS, NORTH PRUSSIA.

Two fishermen with their net and their leather bags
for collecting Amber.

From the first book that was written on the Amber industry,
"Succini Prussica, Physica et Civilis Historia," by P. J. Hartmann,
published in Frankfort in 1677. A very rare volume.

THE BOOK OF AMBER

ON AMBER GENERALLY

THERE are many persons who habitually use objects made of Amber, or admire and wear ornaments composed of the same beautiful material, who are wholly unaware of its composition or of its history, and who at times put questions about it, or make statements concerning its age, and reveal how little they know or understand about it.

It is no unusual thing for me as a collector of Amber to have specimens submitted to me with an enquiry whether this or that piece is " antique " Amber, " old " Amber, or merely " modern " Amber, and I am asked how it obtains its colour, how and by whom it is manufactured, and why it cannot be purchased in other colours than the various shades of yellow.

I am asked from whence it comes, what is its purpose, is it of any historical importance, and other such questions.

It is the purpose of this book to try to answer all these queries, and to set forth as clearly as may be the history of this very beautiful material, seen and appreciated on all hands, but so little understood even by those who possess a keen sense of its beauty.

Let it be very briefly stated in the first place, even though the statement be a very broad one and not wholly satisfactory, that all Amber is many thousands of years old, was formed perhaps a million years¹ ago, and cannot be manufactured.

¹ Sir Arthur Keith's computation of the Geological epoch is thus:

Miocene period, 900,000 years.

Pliocene period, 500,000 years.

Pleistocene period, 400,000 years.

With imitations and with gums that are of the same sort of character, I will deal later on. Amber, then, is a fossil resin derived from certain extinct varieties of trees, mainly pines that flourished in great abundance during a very remote epoch.

In certain periods known to geologists as the Eocene and Miocene periods of the Tertiary system, the northern parts of Europe had a tropical climate, and districts that we now know as Scandinavia, Northern Germany, and the Baltic coast were covered with a strange and luxuriant vegetation such as we now find in Southern Asia.

There were palm trees and aloes, camellias, and various trees of the oak and cypress family, but there were also in great abundance pine trees and thujas of extinct species, and notably one that we now call *Pinus succinifera*, the resin of which is our Amber.

Much of what we describe as Europe was in those days covered by the sea, which spread over part of France, Belgium, England, Holland, Northern Germany, and probably Hungary and Italy.

There, however, existed a vast continent in the North, embracing not only the present Scandinavia and part of Russia, but extending away beyond Spitzbergen into the Arctic circle, joining probably to Iceland, the British Isles, and Northern France, and also connected with Greenland and North America.

Professor Boyd Dawkins¹ has most clearly set out that the existence of such a continent is the only satisfactory explanation of the presence in Europe in these Eocene and Miocene

Since the close of the Pleistocene period he estimates that 15,000 years have elapsed. The Miocene and Pliocene periods are those of the mastodon and dinothereum, and in Pliocene times the mastodon existed in Europe. With the Pleistocene period the mammoth passed away.

¹ See "Early Man in Britain."

ages of the Tertiary system of plants and animals whose nearest allies belonged to North America.

This continent possessed, as I have said, even in its extreme northern districts a tropical or subtropical climate, and trees, the descendants of which we now find in the swampy land in Mexico, Louisiana, and Texas, or in the glorious climate of California and the tropical parts of Asia, flourished there abundantly.

Dr. Black has pointed out that there must have been forests of cypress (*Taxodium*), cedars notably (*Libocedrus decurrens*), and Sequoia (*sempervirens*), together with magnolias, date palms, oaks and poplars, walnuts (*Salisburia*, *Planera*) and thujas, vines and tulip trees, while even the mammoth redwood tree of America (*Sequoia gigantea*) found its original home in that continent.

The bulk of the forest which one may speak of in generic terms as "the amber forest," consisted of coniferous trees, of which nearly forty varieties are known to have existed, and these were resiniferous trees. Amber is the product, not of one but of several of those extinct conifers, the most common, however, being one which closely resembled the American *Thuja occidentalis*, and this tree seems to have occurred, so Professors Göppert and Menge assure us, in a proportion of about ten to every other conifer.

Amongst the trees in this forest must also be mentioned the camphor tree (*Cinnamomum*), now only to be found to any extent in Formosa, Japan, and China.

Proof of the existence of all the other trees still remains to us in the remains of their twigs, leaves, blossoms, bark, catkins, filaments, anthers, ramenta, and similar particles enshrined in the Amber. Moreover, the district had fungi, foliaceous mosses, ferns, heaths, bilberries, mulleins (note the *Verbascum thapsus*), honeysuckles, and plants akin to *Caprifoliaceæ*, and with these were of course associated the larvæ, bees, ants, flies, chafers, earwigs, spiders, myriapods,

moths, snails, and small crustaceans, such as would be expected, and the Amber has enshrined over a thousand species of such creatures. In some instances, as we shall see later on, the creatures as well as the plants possess the forms of the existing world, but in many they present to us forms now entirely extinct.

Of all this vast plant and animal creation not a vestige now remains. Gradually the temperature of this part of the world decreased, and slowly the sea invaded and eventually destroyed this forest, the land sank, the cliffs and shores gave way and became submerged, drastic changes took place in the configuration of the dry land, continents and islands vanished, new islands and new continents were raised up from the sea, and the Amber forests became submerged.

Moreover, a great glacial current flowing from Scandinavia and Finland covered the plains with ice, and perhaps the deflection of the Gulf Stream was one of the means by which the climate so completely changed.

Dr. Klebs, in alluding to the Glacial epoch, writes thus :

“ A mighty glacier must have extended from the northern mountains and covered with its icy shroud the whole northern part of Europe, Russia, and America. The masses of ice, pushing and pressing, bore slowly but surely, like gigantic ploughs, through the lower strata, carrying with them, and mixing up into what is called a Ground Moraine, everything that could not withstand them. Thus we find in this ground moraine, not only debris of the oldest crystalline formations, but specimens of all the rocks the glacier encountered on its way. Even hard rocks like granite and gneiss could not resist the impact, and fragments of them are scattered about as erratic boulders wherever a former moraine exists. It is natural that a comparatively soft stratum like the Blue Earth (*Bläue Erde*) was easily pushed onwards and absorbed into the ground moraine. In this way, Amber is distributed over the whole of the North German land, so that it is to be found, though only erratically, in the marls, clays, and sands of the whole of North Germany.

“ Then the Glacial Period passed away, the land was freed from its icy armour, the masses of ice thawed, the released waters formed river-beds and valleys, collected together in the hollows which had no outlet, and in this way the Baltic Sea was formed. Here we reach a period in the history of our globe which we call the Alluvial Period.

“ The North of Europe practically assumed its present form. Water, wind, vegetation, and animal life combined to form deposits such as continue to be formed now before our own eyes.

“ By the fretting of the waves on the shore cliffs of the Baltic, a quantity of Amber had been loosened and carried to sea, and collected in the sea-bed, whence it is thrown out after every violent storm which blows in the direction of the coast.

“ Considering the enormous pressure of the glacier on the underlying earth, it may be counted a happy chance that the Blue Earth and the superimposed Tertiary system were able to resist the impact, but the only known spot at which this is completely the case is a part of the north-west corner of Samland.”

All this movement, needless to say, took untold centuries of time, and these vast forests fell, decayed, disintegrated, fossilised, until a forest floor of what we now term “ blue earth ” came into existence, and from it Amber is at the present day to be obtained.

In this very bald summary of the history of the amber forests, it must not be forgotten that we deal with an age so remote that man had not yet appeared upon the scene; and yet, again, it must be realised that what we call the Tertiary system is geologically so young that behind it stretches system upon system, back to the rocks that we call Laurentian or Cambrian that form the very base of the world, and represent a duration of time so vast that human reason reels at an attempt to grasp it. More than halfway back in this inconceivable distance we should have come upon the carboniferous vegetation that survives in our coal measures, and which in its magnificent flora, and notably in

its gigantic rushes, is alone comparable for grandeur with the much later amber age.

Such was the vegetation from whence Amber was obtained, but the problem thus baldly stated is by no means solved. Of the enormous amount of timber that must have belonged to these amber forests we have very small remains.

True, as recent writers have pointed out on the evidence of the German authorities Berendt, Genthe, Göppert, and Runge, there are certain ligneous remains to be found in the "blue earth" of Prussia, which is the chief source of Amber in the present day. They are, however, only small boughs and fragments, and although it is certain that they belong to the amber-bearing trees, because many of them are full of the resin, and although they are water-worn, as would be expected, yet they represent but an absurdly small proportion to the huge amount of timber of the amber-bearing trees that must have perished.

Moreover, the question must arise, why in other geological strata we find accumulated the remains of their vegetation, and yet we have an entire absence of substantial remains of the amber forests.

Amber, let me now go on to state, such as one usually sees in the form of ornaments, cigar or cigarette holders or necklaces, is of two sorts, generally called Clear and Cloudy.

Some persons prefer one, some the other. It is not easy to determine the actual reason for the clearness of golden Amber. Göppert declares that on exuding, the Amber was probably dim, and this dimness was produced by the cell-sap distributing itself in minute bubbles through the clear resin. The sun and general warmth, however, soon dried up the mass; the little bubbles of cell-sap flowed together, causing an increase in size; some kept rising to the surface of the still soft mass of resin, causing it to become clearer, and finally quite clear. This explanation is probably the

correct one, although it leaves certain manifestations of clear Amber unexplained.

Göppert also states that the dark colour in Amber is caused by foreign matter, and produced by deposits of pyrites being present in the cavities and cracks of the resin. This is certainly reasonable, and I have myself proved the presence of iron salts in a very dark red piece of Amber. In rare cases the cell-sap may have been coloured, and hence we get occasionally but very rarely, in succinite, green and reddish-brown hues.

The opaque Amber usually called "osseous" or "bone," if seen enlarged about a hundred times, shows a structure of hollow spaces lying more or less thickly next to one another, often having an appearance like the hollows of a sponge.

Berendt is of opinion¹ that the white colours of this Amber occur through the condensation of water particles.

Dragendorf also is of opinion² that the opaque bone Amber may have arisen, through hydration, out of the clear Amber. Also the appearance of milky places in the interior of the Amber he declares to be a hydrated formation, which has resulted from the inflow of atmospheric sediments, while the Amber-turpentine was flowing out of the plants and hardening. There is every likelihood that water is still contained in the delicate hollow spaces of the freshly dug opaque bone Amber.

Drops of water, Dr. Otto Helm says, are sometimes met with in Amber, generally in connection with a little air-bubble, which moves like a dragon-fly on the surface of the water. The water, after the Amber has been resting for a long time, dries up in the fresh air, but often many years

¹ "Organic Remains in Amber," Berlin, 1845, vol. i., part i., p. 38.

² "Report of Sitting of the Dorpat Nature Society," 1877, p. 555.

pass before the drops entirely disappear. Insect bodies are sometimes filled with clear water, but the well-preserved form of the insect can be seen. He has given the following interesting account of the appearance produced in succinite by the enclosing in or entering in of water :

“ When pure water,” he says, “ in the form of raindrops fell on resin that was rich and extensive in its outflow, it formed the effect of a cover to the resin, or when the resin was meagre in outflow the fallen drops sank in. In the latter case, the covering and enclosing of water-drops was of similar formation, the drops maintaining more or less their form.

“ In other cases the water that had fallen on the outflowing resin was compressed by a fresh flow of resin, the drops flattened out, extended and took peculiar forms which they have retained until the present day, when (or ‘ if ’) the contents evaporated again.” In some specimens of Amber, he says, water “ is still present,” and “ little air-bubbles float about,” or they have “ dried up, and only retain their shape.”

When the water was compressed in the resin, various markings of elegant appearance resulted.

Unlike the case of other minerals, water did not enter through cracks in Amber, and in this way cause indentations, and this is ascertained by the fact that after the water has evaporated no trace of the repository can be found.

The forms left in succinite through the evaporation of water are similar to those of moss, lichen, and feathers.

The water in Amber is seldom preserved in its original state, being affected like other enclosures by chemical and other influences.

Some of the osseous Amber is exactly like yellow bone, and this, curiously enough, is very popular in Africa. I have several examples of this kind obtained at Dar-es-Salaam, Omdurman, Nairobi, Zanzibar, Pemba, and in Nigeria, usually perforated and intended for ornament. The clear Amber is rejected with disdain by the natives of Africa.

Certain pieces of osseous Amber in the Northern Prussia amber mines are known as Blue Amber, by reason of a strange bluish tinge that occurs in them, largely due to the presence of carbonate of lime. There are examples of this kind, in which the carbonate of lime forms separate lumps of a white material in the centre of the Amber, but on examination under the microscope, it is found that the limestone has lost many of its most characteristic features during the vast ages in which it has been imprisoned in the Amber, and that it has a much closer resemblance now to meerschaum (silicate of magnesium), or to that unusual material known in Sweden as aphrodite. It is very light, very porous, and highly absorbent.

Respecting the very clearest of all Amber, Dr. Klebs makes the following interesting remarks:

“By the commingling of two streams of resin,” he says, “containing respectively a great and a lesser admixture of cell-sap, and by unequal changes having taken place in different zones of the same piece, we obtain the varieties of Amber known as mottled or cloudy bastard and mottled osseous Amber.”

Besides the ordinary succinite, we find a second sort of Amber, which had been subjected to transformation before being deposited in the forest soil of that time. Under the glow of a tropical sun, or perhaps the heat of forest fires engendered by lightning, the dim, or in many cases already half clear, Amber was often melted again, then flowed down in thin liquid threads, scales, and stalks, which the air quickly hardened at the surface, thus preventing the subsequent streams from solidifying with it into one mass.¹

¹ I have, in my own collection, examples of Amber that has hung free from a branch or tree, and formed long, scaly stalactites, evidently to a certain extent water-worn; but I possess also still more interesting examples where such stalactites of Amber have been enclosed in Amber of a subsequent flow, and therefore, in

Thus arose another sort of Amber, distinguished by its great clearness, somewhat higher specific gravity, and especially by its possessing a lesser degree of cohesion in the direction of its original course than at right angles to the same.

On account of its high liquidity, combined with the circumstance that it existed just where the sun called into being a multitude of minute denizens of the air, these streams of resin formed a trap for everything that chanced into their vicinity. The essential oil given off must have killed the creatures instantaneously, so that there was hardly time for their attitude while alive to be altered by death. Once caught fast, they were drawn deeper and deeper into the liquid resin, and the next exudation covered them completely, preserving them up to the present time.

The osseous is called in Dantzic *Knochig*, the mottled osseous *Buntknochig*; the oily-looking dim Amber *Flohmig*, the clear, *Klar*, and the Bastard *Kunst*.

The bony or osseous Amber is softer than the golden, and requires more care in use. It is richer on analysis in succinic acid than is the clear Amber. Some pieces are bleached almost white, and are spoken of as ice-coloured Amber. These were probably bleached by the tropical sunlight when lying in dry places.

Some dark Amber certainly obtains its colour from an admixture of wood-dust or decay, some from the sulphuric acid solutions which result from decomposition, some from the actual presence of iron pyrites.

A considerable proportion of the Amber from the Baltic Sea shows evident signs of being water-worn. It is full of irregularities, and there are cavities on its surface and a

these pieces, one has Amber of two different periods, one enclosed in the other, with insects attached to the surface of the inner stalactites and other insects that belong to the subsequent flow that has enclosed the first stalactite.

coarse kind of patina covers it in places, all evidence of the effect of water upon it during an enormous period.

Occasionally, when Amber is incrustated by pyrites, a strange milky-coloured Amber is found underneath, sometimes in a kind of stratified effect. More often it is only cloudy, hazy, or down-like in appearance.

Bright, clear, cloudless Amber¹ is of all the most valuable and the most beautiful. It seems to possess a soul, to have a fire blazing in its heart. Its glowing colour is full of life.

¹ There is a town in India which bears the name of Amber. It is in ruins, and was the ancient capital of the Jaipur State in the Rajputana Agency. The name of Amber connected with this city is mentioned by Ptolemy. The city was flourishing in A.D. 967. In 1728, it was supplanted by the modern city of Jaipur, from which it is distant five miles. It is a very fine ruin, with magnificent sculptures in it, but its name has no connection in any way with the fossil resin with which we are concerned.

CLASSICAL ALLUSIONS TO AMBER

WE have to go back to a very remote period for the history of Amber as already set out, but equally we have to allude to the most distant ages of classical lore, when we seek for allusions to it in Greek and Roman writers.

The two periods are, of course, not comparable one with the other: one extends backwards to vast æons of time, the other to the days of Homer and Herodotus; but it is interesting to note that from the earliest days of literature Amber has been known and admired, and has been regarded as of high value.

There has been, in fact, an attempt made to connect a reference in the Book of Genesis with Amber, and to say that the "Land of Havilah" was none other than the amber-bearing Samland, and the "River Pison" alluded to the Baltic Sea, while the German exponents of this theory, notably Dr. Johann Gottfried Hasse (1799), have not hesitated to say that the *Pinus succinus* was the Tree of Life, and the place where it was found was "Paradise."

The Marquis de Saporta was disposed to accept this theory, and to regard the regions of the North as the probable cradle of primitive humanity.¹

Be this as it may, the oldest allusion to which one can refer is in the "Odyssey," where the Greek work for Amber (electron) occurs three times.

Scholars have, however, on more than one occasion raised the question whether this word should always be translated as Amber.

The palace of Menelaus (see book iv., 53-84) was said to

¹ "Un Essai de Synthèse Paléolithique," by Marquis de Saporta, 1883.

be ornamented with the magnificence of gold and electron, silver and ivory and shining copper. We read the description thus:

“ Now when they had put from them the desire of meat and drink Telemachus spake to the son of Nestor, holding his head close to him, that those others might not hear:

“ ‘ Son of Nestor, delight of my heart, mark the flashing of bronze through the echoing halls, and the flashing of gold and of amber and of silver and of ivory. Such like, methinks, is the court of Olympian Zeus within, for the world of things that are here; wonder comes over me as I look thereon.’ ”¹

Surely in such a statement, Amber is more likely to be meant than a combination of gold with silver which formed a metal also called by the Greeks electron.

We have in this passage the very natural contrast of gold with amber and of silver with ivory, and Geh. Ulrich von Wilamovitz-Möllendorff, the very distinguished authority on Greek, was convinced that the allusion was to Amber and not to a metal.

Χρυσοῦ τ' ἤλεκτρον τε καὶ ἀργύρου ἠδ' ἐλέφαντος.

The other two allusions both refer to a necklace of gold with ambers (*ἤλεκτροισιν*), the plural in each case being adopted, and this, in the opinion of most scholars, implies that lumps of Amber—Amber beads, in fact—are alluded to. These allusions will be found in book xv., 458-490, and book xviii., 267-299.²

“ Eumæus the swineherd tells Odysseus how a ship belonging to the Phœnicians came to his home, and the Phœnician woman, his nurse, made plans to kidnap him:

“ ‘ There came a man versed in craft to my father's house, with a golden chain strung here and there with amber beads. Now the maidens in the hall and my lady mother were handling the chain and gazing on it, and offering him their price; but he had signed silently to the woman, and

¹ Butcher and Lang's translation.

² *Ibid.*

therewithal gat him away to the hollow ship. Then she took me by the hand and led me forth from the house.'

(xviii.): " ' Then Antinous, son of Eupheithes, answered her again: " Daughter of Icarius, wise Penelope, the gifts which any of the Achæans may choose to bring hither, do thou take; for it is not well to refuse a gift. But we for our part will neither go to our lands or otherwhere, before thou art wedded to the best man of the Achæans." ' "

" ' So spake Antinous, and the saying pleased them well, and each man sent a henchman to bring his gifts. For Antinous his henchman bare a broidered robe, great and very fair, wherein were golden brooches, twelve in all, fitted with well-bent clasps. And the henchman straightway bare Eurymachus a golden chain of curious work, strung with amber beads, shining like the sun.' "

Pope renders the passages thus :

" They share the honours of the rich repast.
Sufficed, soft whispering thus to Nestor's son,
His head reclin'd, young Ithacus begun.
' View'st thou unmov'd, O ever honour'd most !
These prodigies of art, and wondrous cost !
Above, beneath, around the palace shines
The sumless treasure of exhausted mines:
The spoils of elephants the roofs inlay,
And studded Amber darts a golden ray:
Such, and not nobler, in the realms above
My wonder dictates is the dome of Jove.' " ¹

" ' An artist to my father's palace came,
With gold and amber chains, elaborate frame:
Each female eye the glittering links employ;
They turn, review, and cheapen every toy.
He took th' occasion, as they stood intent,
Gave her the sign, and to his vessel went.' " ²

" The peers despatch'd their heralds to convey
The gifts of love; with speed they take the way.
A robe Antinous gives of shining dyes,
The varying hues in gay confusion rise

¹ Pope's translation of Homer's " *Odyssey*," book iv., 80-90.

² *Ibid.*, book xv., 495-500.

Rich from the artist's hand ! twelve clasps of gold
 Close to the lessening waist the vest infold ;
 Down from the swelling loins the vest unbound
 Floats in bright waves redundant o'er the ground.
 A bracelet rich with gold, with Amber gay,
 That shot effulgence like the solar ray,
 Eurymachus presents: and ear-rings bright,
 With triple stars, that cast a trembling light.
 Pisander bears a necklace wrought with art:
 And every peer, expressive of his heart,
 A gift bestows: this done, the queen ascends,
 And slow behind her damsel train attends."¹

It is well to notice in these quotations that the necklaces were gifts from the Phœnicians, and *they* have always been regarded as the people who introduced Amber into Europe.

Hesiod also uses the same word ἤλεκτρον in his description of the shield of Hercules (v. 141), and there we have gypsum and white ivory and electrum connected with shining gold where, says Dr. William Smith in his "Dictionary of Antiquities," "Amber is the more natural interpretation." He draws attention, however, to the fact that the Roman imitator Virgil evidently understood it as metal (see "Æneid," viii. 402).

In addition to these references, one would imagine that two other references in the "Iliad" and the "Odyssey" may also refer to Amber, although there is no distinct evidence to support the theory. In one place, Juno is declared as wearing triple-gemmed earrings:

"Far-beaming pendants, trembling in her ears,
 Each seems illumined with a triple star."
 ("Iliad," xiv. 183.)

And in the other reference in the "Odyssey," practically the same words occur:

"Earrings, bright
 With triple stars that cast a trembling light."
 ("Odyssey," xviii. 298.)

¹ Pope's translation of Homer's "Odyssey," book xviii., 335-350.

Herodotus, father of all history, makes one allusion to Amber.

He writes:

“Of the extreme tracts of Europe, towards the west, I cannot speak with any certainty; for I do not allow that there is any river, to which the barbarians give the name of Eridanus, emptying itself into the Northern Sea, whence (as the tale goes) Amber is procured; nor do I know of any islands called the Cassiterides (Tin Islands), whence the tin comes which we use. For, in the first place, the name Eridanus is manifestly not a barbarian word at all, but a Greek name, invented by some poet or other; and, secondly, though I have taken vast pains, I have never been able to get the assurance from an eye-witness that there is any sea on the further side of Europe. Nevertheless, tin and Amber do certainly come to us from the ends of the earth.”

This quotation is of very special importance, because, as Dr. Rawlinson pointed out, the name of the river Eridanus still lingers in the place-name for a stream to the west of Danzig, in the very midst of the amber-bearing strata. This stream is called the Radaune.¹

Virgil was fully acquainted with the fact that Amber was resin that had flowed from a tree, and in *Eclogue viii.* thus refers to it:

“Begin with me, my Pipe, Mænalian Strains. Now let the Wolf of himself fly from the Sheep: The hard Oaks bear golden Apples: The Alder with Narcissus bloom: The Tamarisks distil rich Amber from their Barks.”

Aristotle, in his “*Meteorologica*” (iv. 10), was also well aware of its gummy origin, and writes thus concerning it:

“Of these bodies, those from whom all the moisture has gone, are all of them of earth, like pottery or Amber.

“For Amber also, and the bodies called ‘tears,’ are formed by refrigeration like myrrh, frankincense and gum.

¹ See a reference to this river in chapter on Nomenclature, p. 54. See also p. 40.

Amber, too, appears to belong to this class of things. The animals enclosed in it show that it is formed by solidification. . . . Some of these bodies cannot be melted or softened; for instance, Amber, and certain stones, *e.g.* the stalactities in caves."¹

Tacitus has quite a lengthy allusion to Amber where, in his History, he is speaking of the Germans.

"They," says he, "explore the sea for Amber, in their language called *Glese*,² and are the only people who gather that curious substance. It is generally found among the shallows, sometimes on the shore. Concerning the nature or the cause of this concretion, the barbarians, with their usual want of curiosity, make no inquiry."

"Amongst other superfluities discharged by the sea, this substance lay long neglected, till Roman luxury gave it a name, and brought it into request.

"To the savages, it is of no use. They gather it in rude heaps and offer it for sale, without any form or polish, wondering at the price they receive for it. There is no reason to think that Amber is a distillation from certain trees, since, in the transparent medium, we see a variety of insects and even animals on the wing, which, being caught in the viscous fluid, are afterwards, when it grows hard, incorporated with it.

"It is probable, therefore, that as the East has its luxurious plantations, where balm and frankincense perspire through the pores of trees, so the continents and islands of the West have their prolific groves, whose juices, fermented by the heat of the sun, dissolve into a liquid matter which falls into the sea, and being there condensed, is afterwards discharged by the winds and waves on the opposite shore.

"If you make an experiment of Amber, by the application of fire, it kindles like a torch, emitting a fragrant flame, and, in a little time, taking the tenacious nature of pitch or resin."

¹ From Aristotle, "Meteorologica," iv. 10. See Oxford edition of 1908 in fifteen volumes (B.M. 08461 f.), and the four volumes of 1812 (B.M. 8462, 1, 1).

² From Tacitus, "On the Germans," chap. xlv. See four-volume edition by Murphy, 1793 (B.M. 1308, 1, 4-7).

Juvenal, in his fourteenth Satire, refers to a Ball of Amber as one of the most precious possessions of the rich Licinus, and to his being alarmed for the safety of it.

Martial, in his "Epigrams," has several allusions to Amber.

One occurs in Book ix., Epigram xiii., which was thus translated by an anonymous writer of 1695:

"ON EARINUS, THE FAVOURITE OF DOMITIAN."

(*The name is from the Greek word ἔαρ, for "spring."*)

"Thy name the sweetest season in does bring,
 (Joy of the plund'ring bees) the flow'ry spring;
 Which to decypher Venus may delight,
 Or Cupid, with a plume from's own wing, write;
 Which those, that amber chafe, should only note,
 Or be upon, or with a jewel wrote;
 A name the cranes do figure as they fly,¹
 And boast to Jove, as they approach the sky:
 A name that does with no place else comport,
 But where 'tis fix'd, only in Cæsar's Court."

"Et latet et lucet Phaethontide condita gutta,²
 Ut videatur apis nectare clusa suo.
 Dignum tantorum pretiunt tulit illa laborum:
 Credibile est ipsam sic voluisse mori."

Another is a most important quotation, because Martial so clearly recognised the cause of the death of the bee enshrined in the fossilised resin, when he wrote thus (Book iv., Epigram xxxii.):

"ON A BEE ENCLOSED IN AMBER.

"Here shines a bee closed in an amber tomb,
 As if interr'd in her own honey-comb.
 A fit reward fate to her labours gave;
 No other death would she have wish'd to have."³

¹ The cranes as they fly form the letter V, the first of the word *ver*, "spring."

² See the story of the tears of the sisters of Phaëthon, p. 42.

³ Hay.

Or, by another rendering:

“ The bee enclosed, and through the amber shown,
Seems buried in the juice which was his own.
So honour'd was a life in labour spent;
Such might he wish to have his monument.”¹

And again twice in similar strain:

Book iv., Epigram lix.:

“ ON A VIPER ENCLOSED IN AMBER.

“ Creeping among the boughs, where gums doe drop,
The flowing amber did a viper stop:
Amaz'd awhile how in that dew she's held,
That straight turn'd ice, and shee in it congeal'd.
Of your vast shrine bee n't, Cleopatra, proud,
Since Vipers now are nobler tombs allow'd.”²

Or, in another translation:

“ As 'mong the poplar boughs a viper crawls,
The liquid gum upon him struggling falls
With drops alone, while wond'ring to be held,
He straight within the amber was congeal'd.
Then of thy tomb, proud queen, think not too high:
A worm far nobler here entomb'd doth lie.”³

Book vi., Epigram xv.:

“ ON AN ANT ENCLOSED IN AMBER.

“ A drop of amber, from the weeping plant,
Fell unexpected, and embalm'd an ant;
The little insect we so much contemn
Is, from a worthless ant, become a gem.”⁴

“ Dum Phaethontea formica vagatur in umbra,
Implicuit tenuem sucina gutta feram.
Sic modo quæ fuerat vita contempta manente,
Funeribus facta est nunc pretiosa suis.”

¹ Hay.

² Old MS., sixteenth century.

³ Anon., 1695.

⁴ Rev. R. Graves.

Sir Thomas Browne, in his "Pseudodoxia" (1650), thus comments upon Martial:

"Lastly, we will not omit what Bellabonus upon his own experiment writ from Dantzich unto Mellichius, as he hath left recorded in his chapter *De Succino*, that the bodies of Flies, Pismires and the like, which are said oft times to be included in Amber, are not reall but representative, as he discovered in severall pieces broke for that purpose. If so, the two famous Epigrams hereof in Martiall are but poetically, the Pismire of Brassavolus Imaginary, and Cardans Mousoleum for a flie, a meer phancy. But hereunto we know not how to assent, as having met with some whose reals made good their representments." (Page 64.)

A locust embedded in Amber is mentioned in the "Museum Septalianum" of Terzagus (Dertonæ, 1664).

Georg Agricola, in his "De Fossilibus," speaks thus of Amber:

"For they discoursed . . . touching jeat and yellow Amber, dug at the Tower of B—— By occasion whereof he fell to argue, that Amber was a thing which naturally grows in the earth, and is from thence dug out. For they dig it also up in Sicily; where, by the violent force of running waters it is discovered, and carried as far as to the Sea, and beaten back by the waves of the Sea, it is often found upon the shore. And that therefore he said, It is probable that the Amber, which they fish out of the Baltick Sea, was pluckt out of the earth by the violence of land-waters, and brought into the Sea, especially seeing it contains in like manner flies, and other such like creatures enclosed therein. And therefore that it was fabulous which hath been reported by some, that there are very great trees in Norway, out of which this kind of Amber drops like a Gum, and then congeals and becomes hard."

References could also be given from the "Timæus" of Plato, from the "Materia Medica" of Dioscorides, from Theophrastus on "Stones," and from many other Greek

writers, most of whom are, however, quoted by Pliny in his "Natural History."¹

Pliny says also that an amber necklace will cure fevers and diseases: "hoc collo adalligatum mederi febribus et morbis" ("H.N.," xxxvii. 13); and Story ("Roba di Roma," ii. 329) says it is still used in Italy as a child's amulet. According to Pliny, Amber is also useful for ear troubles, powdered and mixed with honey and oil of roses; with Attic honey it is good for dim sight.

Pliny also quotes opinions concerning the origin of Amber from Æschylus, Philoxenus, Euripides, Satyrus and Nican-der, and ridicules the theories adopted by all these writers.

"We can forgive them the more readily," says he, "for knowing nothing about Amber when they betray such monstrous ignorance of geography."

Then he quotes Theophrastus, who said that Amber was extracted from earth in Liguria; Philemon, who declared that it came from Scythia, white and waxy called *electrum*, and red called *sudlitternicum*.

He laughs at Demostratus, who said that Amber originated in the urine of the wild beast known as the Lynx, the red being voided by the male and the white by the female; and then explains that another writer, Sudines, says that a tree in Etruria produces Amber, and is known by the name of Lynx, an opinion also adopted by Metrodorus. He adds that Sotacus says that Amber was exuded from certain stones found in Britain, but that Pytheas, possessed of more knowledge, declares that it is washed up by the sea near to the Isle of Abalus at the mouth of an estuary in Northern Germania called Mentonomen, and that it was an excretion of the sea in a concrete form and used as fuel, as it burned well.

Nicias, he declares, says that Amber is a liquid produced by the rays of the sun striking with great force at the moment

¹ See book xxxvii., chaps. xi., xii., and xiii.

of setting upon the surface of the soil, and so producing an unctuous sweat which is carried off by the waves of the ocean, solidified in the water, and thrown upon the shores of Germania.

Theochrestus said that Amber was thrown up by the tides of the ocean at the foot of the Pyrenees. Xenocrates was of the same opinion; and Asarubas, a contemporary writer, whom Pliny says was even then living, stated that Amber came from the slime of the lake Cephisis, and was found on the surface of the water when the lake had become very shallow by the action of the sun.

Other writers whom Pliny quotes stated that Amber fell from the leaves of poplars, that it was a discharge from birds known as *meleagrides*, or that it came from a cedar tree on an island called Serita or Osericta,¹ but Pliny's special indignation in all this consensus of opinion is reserved for Sophocles.

“The one that has surpassed them all,” says he, “is Sophocles, the tragic poet; a thing that indeed surprises me, when I only consider the surpassing gravity of his lofty style, the high repute that he enjoyed in life, his elevated position by birth at Athens, his various exploits, and his high military command. According to him, amber is produced in the countries beyond India, from the tears that are shed for Meleager, by the birds called ‘meleagrides’!² Who can be otherwise than surprised that he should have believed such a thing as this, or have hoped to persuade others to believe it? What child, too, could possibly be found in such a state of ignorance as to believe that birds weep once a year, that their tears are so prolific as this, or that they go all the way from Greece, where Meleager died, to India to weep? ‘But then,’ it will be said, ‘do not the poets tell many other stories that are quite as fabulous?’ Such is the fact, no doubt, but for a person seriously to advance such an absurdity with reference to a thing so common as amber, which is imported every day

¹ Identified by Ajasson with Oesel in the Baltic.

² See book x., chap. xxxviii.

and so easily proves the mendacity of this assertion, is neither more nor less than to evince a supreme contempt for the opinions of mankind, and to assert with impunity an intolerable falsehood.”

Then with that marvellous skill and insight that distinguishes him from all other writers of history, Pliny goes on to give the story of Amber in a form which is so nearly accurate as to astonish all modern investigators. Says he:¹

“ There can be no doubt that Amber is a product of the islands of the Northern Ocean, and that it is the substance by the Germans called ‘ glaesum ’; for which reason the Romans, when Germanicus Cæsar commanded the fleet in those parts, gave to one of these islands the name of Glæsaria, which by the barbarians was known as Austeravia. Amber is produced from a marrow discharged by trees belonging to the pine genus, like gum from the cherry, and resin from the ordinary pine. It is a liquid at first, which issues forth in considerable quantities, and is gradually hardened by heat or cold, or else by the action of the sea, when the rise of the tide carries off the fragments from the shores of these islands. At all events, it is thrown up upon the coasts, in so light and voluble a form that in the shallows it has all the appearance of hanging suspended in the water. Our forefathers, too, were of opinion that it is the juice of a tree, and for this reason gave it the name of ‘ succinum ’: and one great proof that it is the produce of a tree of the pine genus, is the fact that it emits a pine-like smell when rubbed, and that it burns, when ignited, with the odour and appearance of torch-pine wood.”

“ Amber is imported by the Germans into Pannonia, more particularly; from whence the Veneti, by the Greeks called Eneti, first brought it into general notice, a people in the vicinity of Pannonia, and dwelling on the shores of the Adriatic Sea. From this it is evident how the story which connects it with the Padus first originated; and at the present day we see the female peasantry in the countries that lie beyond that river wearing necklaces of amber, principally as an ornament, no doubt, but on account of its remedial virtues as well; for amber, it is generally believed,

¹ Bohn’s translation, by Bostock and Riley.

is good for affections of the tonsillary glands and fauces, the various kinds of water in the vicinity of the Alps being apt to produce disease in the human throat."

"From Carnuntum in Pannonia, to the coasts of Germany from which the Amber is brought, is a distance of about six hundred miles, a fact which has been only very recently ascertained; and there is still living a member of the equestrian order, who was sent thither by Julianus, the manager of the gladiatorial exhibitions for the Emperor Nero, to procure a supply of this article. Traversing the coasts of that country and visiting the various markets there, he brought back Amber, in such vast quantities, as to admit of the nets, which are used for protecting the podium against the wild beasts, being studded with Amber."

"The arms too, the litters, and all the other apparatus, were, on one day, decorated with nothing but Amber, a different kind of display being made each day that these spectacles were exhibited. The largest piece of Amber that this personage brought to Rome was thirteen pounds in weight."

"That Amber is found in India too, is a fact well ascertained. Archelaus, who reigned over Cappadocia, says that it is brought from that country in the rough state, and with the fine bark still adhering to it, it being the custom there to polish it by boiling it in the grease of a sucking-pig. One great proof that Amber must have been originally in a liquid state, is the fact that, owing to its transparency, certain objects are to be seen within, ants for example, Gnats and Lizards, which, no doubt, were entangled and stuck within it when it was green and fresh and so remained enclosed within it as it waxed harder."

His detailed description of Amber in his Natural History reads thus (Pliny, book xxxvii., chap. xii.):

"There are several kinds¹ of Amber. The white is the one that has the finest odour,² but neither this nor the

¹ These so-called kinds or varieties are mostly accidental variations only in appearance.

² Which is perceptible on its being rubbed: in some cases the odour of Amber is very fine, in others it is perfectly fetid; though in the latter case, as Ajasson remarks, it is doubtful whether it may be considered to be genuine Amber.

wax-coloured Amber is held in very high esteem. The red Amber is more highly valued; and still more so, when it is transparent, without presenting too brilliant and igneous an appearance. For Amber, to be of high quality, should present a brightness like that of fire, but not flakes resembling those of flame. The most highly esteemed Amber is that known as the 'Falernian,' from its resemblance to the colour of Falernian wine; it is perfectly transparent, and has a softened, transparent, brightness. Other kinds, again, are valued for their mellowed tints, like the colour of boiled honey in appearance. It ought to be known, however, that any colour can be imparted to Amber that may be desired, it being sometimes stained with kid-suet and root of alkanet; indeed, at the present day, Amber is dyed purple even. When a vivifying heat has been imparted to it by rubbing it between the fingers, Amber will attract chaff, dried leaves, and thin bark, just in the same way that the magnet attracts iron. Pieces of Amber, steeped in oil, burn with a more brilliant and more lasting flame than pith of flax.¹

"So highly valued is this as an object of luxury, that a very diminutive human effigy, made of Amber, has been known to sell at a higher price than living men even, in stout and vigorous health. This single ground for censure, however, is far from being sufficient; in Corinthian objects of vertu, it is the copper that recommends them, combined with silver and gold; and in embossed works it is the skill and genius of the artist that is so highly esteemed. We have already said what it is that recommends vessels of murrhine and of crystal; pearls, too, are of use for wearing upon the head, and gems upon the fingers. In the case of all other luxuries, in fact, it is either a spirit of ostentation or some utility that has been discovered in them that pleads so strongly in their behalf; but in that of Amber we have solely the consciousness that we are enjoying a luxury, and nothing more. Domitius Nero, among the other portentous extravagances of his life, bestowed this name upon the ringlets of his wife Poppæa, and, in certain verses of his, he has even gone so far as to call them 'succini.' As fine names, too, are never wanting for bodily defects, a third

¹ "Lini." Salmasius suggests "pini," "pith of pine."

tint has been introduced for hair among our ladies, under the name of 'amber-colour.'"¹

Finally, he refers to its use in medicine, and here he must be quoted in another chapter.

One important Greek story, however, concerning the origin of Amber, must be specially mentioned.

Ovid, in his "Metamorphoses," gives it in full detail. It concerns Phaëthon when he attempted to drive the chariot of the sun.

He was the son of Phœbus by the famous beauty Clymene of Libya, and on his strenuous entreaty was permitted for one day to try and control the impetuous wild horses of the Sun, which his sisters had harnessed.

Quickly he lost control of them, and dashing close to the Earth set it on fire, and hence, it is said, the volcanoes of the present day. Libya was parched, Africa ablaze, rivers dried up, vegetation was destroyed, and so intense was the heat that the inhabitants of the stricken countries changed from white to black. Gæa implored the mighty Zeus that she might not be consumed, and he with a thunderbolt killed Phaëthon in a moment, and his body fell on to the earth and into the river Eridanus.

The naiads of the stream rescued the body and buried it, and then Clymene and Phaëthon's three sisters, the Heliades (Phaëthusa, Ægle, and Lampetia) descended to search for the grave, and having found it, wept ceaselessly over the remains of the reckless charioteer.

Unable to tear themselves away, the Heliades took root in the ground and became trees with bark, boughs, and leaves. Their tears, however, continued to flow, and hardened by the sun in his wrath, became lumps of Amber, "with which all women love to adorn themselves."

¹ "Natural History," Book xxxvii., chap. xii., Bohn's translation.

To this story, so well known, Martial alludes, but a very interesting reference to the story occurs in Milton, where he writes:

23. " HELIADES TURNED INTO TREES.¹

" Climen all wandring finds out Phaetons tom(b)
 She with her daughters there laments his dome
 So long till they, the faire Heliades,
 Were turned by their brothers tomb to trees:
 The mother whilst that they were turned s(o)
 Doth on them many a tender kiss bestow,
 Whilst Amber from these sisters thus forelorn
 Distilleth downe, nice dames for to adorne."

He also writes in his " Poems " (1645):

" Ye golden flood
 Which from ye Amber weeping Tree
 Distilleth downe so plenteously."

And again in " Comus ":

" Sabrina fair,
 Listen where thou art sitting
 Under the glassie, cool, translucent wave,
 In twisted braids of Lillies knitting
 The loose train of thy amber-dropping hair."²

While the colour of Amber is twice alluded to by the same poet, in " L'Allegro," thus:

" Right against the Eastern gate,
 Where the great Sun begins his state,
 Roab'd in flames, and Amber light."

And in " Paradise Lost " (book iii., lines 358-359), where he says:

" And where the river of Bliss through midst of Heavn
 Rowls o're Elisian Flours her Amber stream."

¹ " Some New Stanzas," by Milton, p. 95.

² " Comus," 963.

Ben Jonson has a very interesting allusion to Amber:

“My meat shall all come in, in Indian Shell, dishes of agat set in gold, and studded with emeralds, sapphires, hyacinths, and rubies. The tongues of carps, dormice, and camels’ heels, boiled in the spirit of Sol, and dissolved pearl. Apicius’ diet ’gainst the epilepsy. And I will eat these broths with spoons of Amber, headed with diamond and carbuncle.” (From Sir Epicurus Mammon’s statement in “The Alchemist,” Act II., sc. 1.)

Bacon, in his “Historie of Life and Death,” thus writes:

“The Spider, Flye, and Ant, being tender dissipable substances falling into Amber, are therein buryed, finding therein both a Death, and Tombe, preserving them better from Corruption than a Royal Monument.”

A remarkable allusion to the glorious colour of Amber is to be found in Holy Writ, where the Prophet Ezekiel thrice refers to it:

Ezekiel (i. 4): “And I looked, and, behold, a whirlwind came out of the north, a great cloud, and a fire infolding itself, and a brightness was about it, and out of the midst thereof as the colour of amber, out of the midst of the fire.”

(i. 27): “And I saw as the colour of amber, as the appearance of fire round about within it, from the appearance of his loins even upward.”

(viii. 2): “Then I beheld, and lo a likeness as the appearance of fire: from the appearance of his loins even downward, fire; and from his loins even upward, as the appearance of brightness, as the colour of amber.”¹

It is possible that even in the days of Nineveh, Amber was known to the Assyrians, because Professor Oppert translates a cuneiform inscription on a broken obelisk as indicating that very early commercial relations existed between Assyria and the North of Europe. He says that the words should be thus read:

¹ Specific allusion to these passages is made in the chapter on Nomenclature.

“ In the sea of changeable winds [this he identifies with the Persian Gulf]
 His merchants fished for pearls,
 In the sea where the North Star culminates [this he identifies with the Baltic]
 They fished for yellow Amber.”¹

There are several references in early English literature to Amber, as quoted in the first volume of Murray’s “ English Dictionary ”:

- Circa 1400. “ Destruction of Troy,” v. 1666:
 “ Bourdourt about all with bright Aumber.”
 Circa 1450. “ Book of Curtasye,” iii. 481:
 “ The wardrop he herbers and eke of chambur
 Ladyes with bedys of coralle and lambur.”
 1529. Skelton’s “ Elynour Rummyng,” 603:
 “ But my bedes of amber Bere them to my chamber.”
 1552. Huloet:
 “ Ambre called lambre or yelow Ambre.”
 1556. Richmond Wills (1853), 89:
 “ One paire of long beads of awmer.”
 1602. Shakespeare, “ Hamlet,” II. ii. 200:
 “ Thicke Amber or Plum-Tree Gumme.”
 1658. Sir Thomas Browne, “ Urn Burial,” ii. 18:
 “ That Romane Urne wherein were found an Ape
 of agate, an Elephant of Ambre.”

Amber was in constant use in Catholic England for rosaries, often in those days called “ a pair of beads,” and in consequence we find frequent allusions in wills to bequests of such precious objects.

For example, one John Baret, of Bury St. Edmunds, in 1463 bequeathed a “ peyre ” of Amber beads to each of seven legatees, as well as to “ eche yoman of my household.”²

In this case it is quite possible that complete rosaries are not alluded to. A man would hardly have possessed a

¹ “ L’Ambre Jaune chez les Assyriens,” J. Oppert.

² Will 15.

dozen Amber rosaries, and very possibly the bequest was actually of two Amber beads to each person, to be put on to his rosary in the places of importance in the rosary, where one finds larger beads in use.

The same testator, says Mr. Maccall, left to the Abbot of Bury St. Edmunds, in whose city he resided, for a "token of remembrance" his "bedys of white ambyr with the ring of silvir and ovir gilt longyng thereto." This is clearly a complete rosary with its gilt cross.

Another Bury St. Edmunds testator, one Anne Barrett, according to the same writer, left to the Lord Abbot of Bury St. Edmunds by her will of 1504 her "grete bedys of whyght Ambyr," and this was again probably a complete rosary.

The will of William Askme, he says, made in York in 1389, contains a bequest of a "payr bedys of lawmbyr," and Sir Brian Stapleton, whose descendants still belong to the Old Faith, by his will proved at York in 1394, gives to his nephew his "grandes paters nosters de l'awmbre," clearly again complete rosaries.

Another similar bequest was quite recently noticed by Miss D. O. Shilton, when working in the Diocesan Registry at Wells.

Issabelle Walle of Lymplesham, widow, bequeathed by her will, dated 2 July, 1544:

"To the said Christen (wife of John Sayarde) my amber beades."

An inventory made in 1381 of the stock of Adam Ledyard, "paternosterer," and quoted by Dr. Joan Evans in her "English Jewellery," mentions four sets of white Amber, sixteen sets of ordinary Amber, five of coral and jet, six sets of aves of jet with paternosters of silver-gilt, thirty-eight sets of similar aves with gaudees of silver-gilt, fourteen sets of blue glass with silver-gilt paternosters, twenty-eight sets

of paternosters of jet, and fifteen of "mazer" or maple wood, and five sets of white bone for children.

Of later quotations the "Oxford Dictionary" refers to one in 1794. Sullivan, "View Nat." ii. 27:

"Amber, when rubbed, was observed to attract bits of straw, down, and other like bodies."

1847. Blackwell, Malet's "Northern Antiquities," p. 374:

"Byron caught him and preserved him like a fly in amber, for future generations to wonder at."

And Carlyle, in his "Frederick the Great," i., II. II. 54, writes thus:

"Amber, science declares, is a kind of petrified resin, distilled by pines that were dead before the days of Adam."

Poets have always loved to allude to Amber.

Moore, in "Lalla Rookh," gives the story of the Heliades, and in three other pieces mentions Amber:

"Around thee shall glisten the loveliest amber
That ever the sorrowing sea-bird has wept;
With many a shell, in whose hollow-wreathed chamber
We, Peris of Ocean, by moonlight have slept."¹

"While thus she mused, her pinions fann'd
The air of that sweet Indian land,
Whose air is balm; whose ocean spreads
O'er coral rocks and amber beds."²

Christopher Marlowe alludes to Amber in his —

"THE PASSIONATE SHEPHERD TO HIS LOVE.

"Come live with me, and be my love,
And we will all the pleasures prove
That hills and valleys, dale and field,
And all the craggy mountains yield.

¹ From "The Lament of the Peri for Hinda," in "The Fire-worshippers," verse 8.

² From "Paradise and the Peri," verse 7.

“ There will I make thee beds of roses
 With a thousand fragrant posies,
 A cap of flowers, and a kirtle
 Embroidered all with leaves of myrtle.

“ A belt of straw, and ivy-buds,
 With coral clasps and amber studs;
 And if these pleasures may thee move,
 Then live with me, and be my love.”

But, alas ! if Sir Walter Raleigh has recorded the truth in his “ Nymph’s Reply,” all pleading was in vain. The answer was decisive :

“ If that the World and Love were young,
 And truth in every shepherd’s tongue,
 These pretty pleasures might me move
 To live with thee, and be thy love.

“ Thy gowns, thy shoes, thy beds of roses,
 Thy cap, thy kirtle, and thy posies,
 Soon break, soon wither, soon forgotten,
 In folly ripe, in season rotten.

“ Thy belt of straw, and ivy-buds,
 Thy coral clasps and amber studs;
 All these in me no means can move
 To come to thee, and be thy love.”

Few quotations are better known than the four lines from Pope :

“ Pretty in Amber to observe the forms
 Of hairs and straw and dirt and grubs and worms.
 The things, we know, are neither rich nor rare,
 But wonder how the devil they got there !”

“ Ep. Arbuthnot,” 169.

And to come to more modern days, Tennyson at least thrice makes mention of Amber :

“ And all those names, that in their motion were
Full-welling fountain-heads of change,
Betwixt the slender shafts were blazon'd fair
In diverse raiment strange :

“ Thro' which the lights, rose, amber, emerald, blue,
Flush'd in her temples and her eyes.”¹

And:

“ And on the tables every clime and age
Jumbled together; celts and calumets,
Claymore and snowshoe, toys in lava, fans
Of sandal, amber, ancient rosaries.”²

And:

“ The loud stream,
Forth issuing from his portals in the crag
(A visible link unto the home of my heart),
Ran amber toward the west.”³

To come down to the present day, here is a poem on Amber by an American poet, certainly worthy of appearing in this chapter:

“ TO A PIECE OF AMBER.

“ Limpid lump with light refulgent,
Tawny tinted, cold yet warm,
Whence has come your mystic beauty,
Your alluring wondrous charm ?
Are you blood of Forest Monarch
Slain by the storm King's might,
Clotted in earth's cold bosom
Through ages of Arctic night ?
Or tears of a Druid Maiden
For a lover found untrue ?
Tell me the tragic story
That is hid in the heart of you.
Are you frozen sunshine,
Chilled by a world unkind,
Or the golden pearl of an Elfin Earl
Whose castle none may find ?

¹ “ The Palace of Art,” section beginning, “ Then in the towers,”

v. 10, 11.

² “ The Princess,” Prologue.

³ “ The Lover's Tale.”

“ I *am* blood of Forest Monarch,
I am tears of a Druid Maid,
I am congealed sunshine
From the haunts where Elfin played.
I am all of these and more than these,
For a token of love am I,
To be worn next the heart of your true love
To prove her constancy.
An amulet 'gainst grief and pain,
'Gainst sorrow, sin and care,
For none may harm where I cast my charm
O'er beauty pure and rare.”

WALTER S. PARK.

NOMENCLATURE

THERE are several interesting questions concerning the nomenclature of Amber which should be set out and examined.

We derive the name that we give to this substance from the Arabic *منسجس*, *anbar*, through its Spanish rendering, *ambar*. The Italian *ambra gialla* and the French *ambre* are from the same source. The Latin word used, as we have seen, by Pliny is *succinum*, from *succus*, gum, and from this we take the name given to the tree that exuded the gum, *Pinus succinifera*, but whether it is a pine or a fir tree has not yet been determined. From this, also, we take the name which Amber bears in the mineralogical world, *succinite*, and the name of the acid obtained from it.

Tacitus,¹ however, who actually picked up some specimens on the Baltic shores, called it *glæsum* or *glesum*, and the Old German word for it is similar, *gles*; all alluding to its shining qualities, which it is declared to have in common with glass. The Germans, however, call it *bernstein*, the Dutch *barnsteen*, the Scandinavians *bernsten*; all having a common origin and implying a stone that can be burned or set alight. In some Latin writers it is spoken of as *lapis ardens*, with the same meaning. In Friesland, however, it is not called *barnsteen*, but *röv*, and this word appears in Danish as *rav*, and in Swedish and Norwegian as *raf*; all derived from a far older Norse word sometimes applied to gum, *rafr*. Professor Elton derives this word from the name of an island, Raunonia, mentioned by Pliny, where he quotes from

¹ "On the Germans," chap. xlv. See Murphy's edition of 1793 (B.M., 1308, 1, 4-7).

Pytheas, and where he says Amber was cast up by the waves of the sea.

In French it is *ambre*, in Spanish *ambeur* and *ambar*, in Italian *ambra*, in Portuguese *alambre*.

In Esthonia, Finland, and Latvia it is called *merre-kivvi* or *meri-kivi*, meaning sea stone.

Pliny tells us that the Egyptians called it *sacal*,¹ and in Dalmatia it is known as *schechel*, both tracing back to the Latin *succinum*. The Greeks, however, spoke of it as *ἤλεκτρον* (*electron*) from its colour, no doubt connected with the word *ἠλέκτωρ*, applied to sunshine and given to Amber on account of its gleaming, sunlike lustre. Thence we obtain our word "electricity," because Amber has the power of attracting light substances to itself.

That quality was well known even to Pliny, who in his "Natural History" (book xxxvii., chap. xi., Bohn's translation), thus writes:

"To come into the properties that Amber hath; if it bee well rubbed and chaufed between the fingers, the potentiall faculty hath within is set on work and brought into actuall operation whereby you shall see it to draw chaffe, strawes, drie leaves, yea and thin rinds of the Linden or Tillet tree after the same sort as the loadstone draweth yron."

In Persia it was called *Kâhrubâ* (*Kâh*=straw, *rubâ*=robber), hence straw-robber or straw-attractor, the same quality being recognised in this word.

Avicenna (*Ibu Sinâ*), the great Arab physician, thus speaks of it (see "Canona Medicinæ Giunta," ed. Venice, 1608):

"*Kârabè quia est? Gumma sicut sandaraca, tendens ad citrinitatem, & albedinem, & peruietatem, & quandoque*

¹ It is very interesting to notice that this Egyptian word is almost identical with a word in the Lithuanian and Lettish languages used for Amber, *Saka*, and this word also appears in place-names on the Baltic: *Sakastina* (valley of Amber), a place in Latvia north of *Liepaja*, and *Sakasosta* (port for Amber), a place north of *Königsberg*.

declinat ad rubedinem, quæ attrahit paleas, & (fracturas) plantarum ad se, & propter hoc nominatur Kârabè, scilicet rapiens paleas, persice. . . . Kârabè confert tremori cordis, quum bibitur ex eo medietas aurei cum aqua frigida, & prohibet sputum sanguinis valde. . . . Retinet vomitum, & prohibet materias malas a stomacho, & cum mastiche confortat stomachum. . . . Retinet fluxum sanguinis ex matrice, & ano, et fluxum ventris, & confert tenasmoni” (liber, ii., cap. 371, p. 336).

It has already been pointed out that Thales in 640-546 B.C., Theophrastus in 321 B.C., and Pliny in A.D. 70, mention the interesting fact that Amber, and also jet (believed at one time to be black Amber), and one or two other substances, possess the power, when rubbed, of attracting fragments of straw, leaves, or feathers. Allusion has also been made to the name given to Amber by the Persians, with special reference to this power of attraction.¹ The mysterious property of Amber was, however, very little understood until the time of William Gilbert (1544-1603), when in his wonderful treatise, “De Magnete Magneticisque Corporibus et de Magno Magnete Tellure,” published in 1660, he made special reference to this power and was the first person to use for it the word “electrum,” derived from ἤλεκτρον, denoting substances that possess a quality similar to Amber of attracting light objects when rubbed. The use of the term “electrical” for the phenomena that ensued was first used by William Barlowe, Archdeacon of Salisbury, in 1618, and he it was who applied the term “electrical science” to the study of such phenomena, little knowing, however, what mysteries existed in them.

Robert Boyle, in his book “The Origin of Electricity,” gave many new facts which Gilbert did not know. Otto

¹ In the Talmud, Amber and loadstone are given the same name, *achzkale 'Hi*, “the stone which attracts.” In the Midrash (Targum of 1 Chr. xx. 2) it is Eben Shoebeth, practically with the same meaning *lapis attriticus*: אבן שואבת

von Guricke (1602-86) constructed the first electrical machine, making it on a revolving ball of sulphur, and he it was who first noticed that light objects were repelled after being attracted by the excited electricity.

Sir William Newton substituted a ball of glass for the ball of sulphur, and from his time commences the important study of electrical science. It was left for Du Fay (1699-1739), however, to produce the discovery that electricity was of two kinds, vitreous and resinous, the second being produced when Amber or other similar materials are excited by friction with flannel.

The electricity produced by friction with Amber is negative.

When we come to the words translated Amber by the compilers of the Authorized Version in the three passages from Ezekiel quoted in a preceding chapter, we are in the midst of a difficult controversy, and one that is still unsettled.

The word is לְשֵׁמֶל, *ghashmal*. This, it is possible, is related to the Egyptian word *Hesmer*, meaning a kind of metal allied to bronze or to gold, and Fred Delitsch identified both *ghashmal* and *Hesmer* with the Assyrian *ešmāru*, which he stated meant a rare and brilliant metal.

Recent Egyptologists tell us that *Hesmer* is certainly an alloy of gold and silver, and yet to render these passages as alluding to such a metal seems absurd, on the face of it, involving, as it does, a repetition of words, a duplication of ideas, and confusion of what would appear to be the desire of the author to convey.

Moreover, the Septuagint (LXX.) translates the Hebrew *ghashmal* by ἤλεκτρον and the Vulgate by "electrum."

It is certain that in some classical writers the word ἤλεκτρον does mean an alloy of gold and silver, being akin to the λευκὸς χρυσός or pale gold. Surely, however, the word cannot always have the same meaning.

In Homer it is used in the plural, and the sense of the

passages already quoted would hardly be that the necklaces were strung with pieces of gold and silver alloy, and Amber would be the fitting explanation. We know so well that Amber was well known to the ancient Greeks. We find it in the tombs in Mycenæ and Tiryns, to which allusion will be made later on, and we know of its use by the Phœnicians, and of the high value that people placed upon it. From a point of view of meaning, it would surely seem that ἤλεκτρον meant Amber in the time of Homer and of Plato.

From the point of view of archæology, there is no difficulty, and it would appear that the writers of the versions in using ἤλεκτρον and "electrum" in translating the word used by Ezekiel in the sixth century B.C., really thought that *ghashmal* meant Amber.

There arises, however, another consideration. The Vision of St. John the Divine (Rev. i. 15 and ii. 18) has certainly some kinship with the Vision of Ezekiel, and there we read of burnished brass, χαλκολίβανον, which the Vulgate translates again as "electrum," and if St. John was thinking of what Ezekiel calls *ghashmal* when he wrote his Vision, then *ghashmal* must mean a burning, bright, shining, smooth metal.

Gesenius¹ ingeniously supports this view, saying that the word מִשְׁחָה distinctly involves a sense of smoothness, brightness, and glitter, and is allied to the Arabic ماس ملس, and to *mulceo* and *mollis*, and that it may mean a metal made smooth or a bright metallic-looking substance. Fuerst, in his Lexicon of 1871, says that probably the word was foreign, e.g. Assyrian, and might be so known to Ezekiel in Mesopotamia, and used of a shining bright substance not necessarily metallic.

The only conclusion that one can arrive at is that *ghashmal* refers to some yellow, shining, smooth substance, probably rightly translated as Amber, but possibly having more than

¹ Gesenius, F. H. W.: Lexicon, 1892.

one meaning, and sometimes applied to metal and sometimes to this shining gum that so closely resembled it in many of its finer attributes.

Professor Ridgeway is emphatic in his statement that the word used by Ezekiel is rightly translated Amber. On the other hand, commentators from Talmudic times have argued out the question, and many of them have insisted that a metal and not a fossil gum is intended.

No real conclusion can be determined, and it is surely possible to conclude that the word has not always the same meaning, but in every case implies yellow colour, shining lustre, and gold-like appearance.

Ghashmal is not, however, the only word in Hebrew for Amber. The Rabbis employed other words to express Amber, as, for example, *Kēphath Hayardēn*, Amber of the Jordan.¹ This occurs, says Kozmnisky, in a curious passage in which Rabbi Nathan states that if honey (דבש) were mixed with the Amber of the Jordan it became "profane." Honey, according to Porphyry, is a symbol of death, and hence could not be mixed with Amber, which is a symbol of life. This would be as repulsive to the Rabbinical mind as the violation of the command, "Thou shalt not seethe a kid in its mother's milk," would be. Libations of honey could only, according to Porphyry, be offered to the terrestrial gods. Philo Judæus, in two references in book iii., explains the matter as follows: "Moreover, it also ordains that every sacrifice shall be offered up without any leaven or honey," not thinking it fit that either of these things should be brought to the altar. "The honey, perhaps, because the bee which collects it is not a clean animal, inasmuch as it derives its birth, as the story goes, from the putrefaction and corruption of dead oxen, or else it may be forbidden as a figurative declaration that all superfluous pleasure is unholy, making indeed the things

¹ An adaptation of Eridanus; see pp. 30 and 40, and Jastraw, p. 365.

which are eaten sweet to the taste, but inflicting bitter pains difficult to be cured at a subsequent period, by which the soul must of necessity be agitated and thrown in confusion, not being able to settle on any resting-place." In addition, the lines of Virgil, *Georgic iv.*, may be considered:

" His mother's precepts he performs with care:
 The temple visits, and adores with prayer;
 Four altars raises: from his herd he culls
 For slaughter, four the fairest of his bulls:
 Four heifers from his female store he took,
 All fair and all unknowing of the yoke.
 Nine mornings thence, with sacrifice and prayers,
 The powers atoned, he to the grave repairs.
 Behold a prodigy! for, from within
 The broken bowels and the bloated skin,
 A buzzing noise of bees his ears alarms:
 Straight issue through the sides assembling swarms.
 Dark as a cloud, they make a wheeling flight,
 Then on a neighbouring tree, descending, light:
 Like a large cluster of black grapes they show.
 And make a large dependence from the bough."

(*Dryden's translation.*)

It is of some special interest to note how far the Syriac language lends any support to the use of the word Amber in the Book of Ezekiel, in the three passages already quoted.

There appears to be *no* equivalent in Syriac for the Hebrew *ghashmal*, and *no* word that was used for Amber apart from the appearance that it presents to shining metal, so that in the words in Ezekiel the Syriac version uses the word ܐܘܪܘܚܐ ܕܥܘܠܐܝܘܬܐ, that is to say, "the light or vision of God" (i. 27 and viii. 2), showing that the translators were, to use the phrase adopted by my friend Dr. Leveen, of the British Museum, "floored by the difficulty of finding the right word." In Ezek. i. 4 they omit the word altogether!

When we come to the Peshitta,¹ the high antiquity of

¹ See Duval's *Lexicon*, Brockelmann, Payne-Smith (20, 224), and the *Damascus Codices*.

this version of the New Testament, and the fact that the language used in it is so closely allied to that spoken in Palestine in the first age of Christianity, even possibly the actual vernacular language used by our Lord Himself, gives to it a special and remarkable importance.

We turn with eagerness to the Revelation of St. John, where our Authorized Version gives "shining brass," *χαλκολίβανον*, but find only the ordinary word such as appears in Ezekiel, with slight vowel changes and modified in Rev. i. 15 and ii. 18 by the adjective *לִבְנוֹן* (of Lebanon).

In these two cases, the word used is *לִבְנוֹן לְבָנוֹן*, and in Rev. xviii. 12 and ix. 20 it is *לְבָנוֹן* alone. The Coptic version of the Old Testament uses the word *ΗΛΕΚΤΡΙΝΟΝ ΚΑΨΑΒΕΛ*¹ for brass, and in Ezek. viii. 2 the ordinary Greek word *ἤλεκτρον* where *ghashmal* appears in the original, but for brass (*orichalcum*) it uses in Rev. i. 15 and ii. 18 *χαλκολίβανον*, but in the other two references, ix. 20 and xviii. 12, the word *ΧΟΥΝΤ* or *ΧΟΥΤ*, which really means copper.² Exactly the same word is used for *pecunia* or *pretium* in Deut. viii. 9, Exod. xxvii. 19, *תְּשֻׁנֶת* (*nechosheth*) and 1 Cor. xiii. 1.

It should be remarked that there is no Coptic manuscript in existence belonging to any early date that relates to the first part of Ezekiel, so that I can only speak of the allusion in chap. viii. Of all the early references in the Book of Ezekiel, I can say nothing.

The Ethiopic version of the Sacred Scriptures in use in Abyssinia at the present day has no references to Amber, and the Abyssinians seem to be hardly aware of its existence, and only very seldom use it in ornament. They use the word "electrum" in the passages in Ezekiel.³

¹ See Peyron's Dictionary, p. 75; see Rossio, p. 82.

² See Peyron's Dictionary, p. 352.

³ See "The Liturgy of the Church," in Swainson's "Greek Liturgies."

A very important aid in determining the difficult question of the proper translation of *ghashmal* in Ezekiel is given by a consideration of the language of the Phœnicians.

These mysterious people, who dwelt in that part of the seaboard of Syria that extended down to Mount Carmel, were in possession of the mountain range of Lebanon, and their chief cities were those of Tyre and Sidon. They, of course, were the great traders of their period, and accomplished seamen.¹

Whether they migrated from Persia or from Babylonia is unknown, but they were an offshoot from the Semitic stock, and belonged to the Canaanite branch of it.

Their language so closely resembled Hebrew that it must have developed—so says the Rev. Dr. Cooke, Oriel Professor, the greatest authority on Phœnicia—from an origin common to it and to Hebrew, some ancient Canaanite tongue of which we find traces in the Amarna Tablets.²

They were not a literary people, but they were largely responsible for the development and diffusion of the alphabet which forms the foundation of Greek and of all European writing.³ Their letters were probably identical with those used in early Hebrew, although later on they adopted a “more cursive, flowing style,” but what is of great importance is the fact that many of their words made their way into Greek, more especially those that denoted the goods with which, or for which, they traded. In that way the word *χρυσός* (with other words) came into the Greek language.

From such evidence as we possess respecting the Phœnicians, it would appear that this word was applied to a bright, shining substance, and so eventually to gold. The Phœnicians, however, spoke of a *χρυσός* from Lebanon,

¹ See Ezek. xxvii. 12-25.

² See Winckler, “Tell-el-Amarna Letters,” and Sir F. Petrie’s “Syria and Egypt.”

³ See Herodotus, v. 58, and ii. 112.

but although some minerals, notably iron, are found in that mountain range, gold is *not* amongst them.

There are, however, traces of digging for Amber along the Syrian coast, and, moreover, Amber can still be found in small quantities in Syria, and of a golden-yellow colour (I have a specimen of it in my own collection). It is not important Amber, nor has it any high decorative or commercial value, and probably when the Phœnicians found they could obtain far better Amber from the Baltic Sea, bringing it by way of the Rhine and the Rhone, they ceased to trouble about the inferior gum to be dug up on their own coast. Meantime, however, they had given it this name, calling it, in fact, the shining golden substance from Lebanon, and realising that the same precious substance was to be obtained in the Baltic—access to which was then almost exclusively in their hands—they no doubt gave the same name to Baltic Amber as they had given to Syrian Amber. It was an excellent material for trading purposes, very popular and in great demand. It was no doubt one of their most precious commodities, and they would keep secret the place of its origin or the means of obtaining it, as they carefully guarded all “the secrets of their trade routes and discoveries, and their knowledge of winds and currents.”¹ In that curious mixture of Arabic and Aramaic with local tongues, tinged with French pronunciation, we are told by recent travellers that the Syrians speak of Amber as *crûsel* or as *kâlke*, and these names are surely closely related to *χρυσός* and to *χάλκεος*. Moreover, the word used in the Book of Revelation (i. 15, ii. 18), *χαλκολίβανον*—the derivation of which is still unknown or at least uncertain—may surely have some connection with Mount Lebanon and with a

¹ See various articles by Dr. Cooke on Phœnicia, and in his “North Semitic Inscriptions,” 149, and the writings of Winckler and Max Müller (p. 306); also Neh. xiii. 16, and Herodotus, iii. 107.

bright, shining substance, and hence with what the Vision of St. John calls "fine brass," and that of Ezekiel "Amber."

Dr. Th. Henri Martin, in his paper before the Académie des Inscriptions et Belles-lettres in 1860, gives so admirable a summary of the names given to Amber that one cannot do better than repeat it in full. He thus writes in Tome vi., 1^{re} series, 1^{re} partie :

"Le succin a reçu chez les anciens des noms très-divers. Sans parler du nom de *λυγκόυριον*, *lyncurium*, qui peut-être ne lui appartient pas, comme nous le montrerons plus loin, il s'est nommé chez les Grecs, le plus souvent *ἤλεκτρον* au neutre (see Herodotus and Aristotle), mais aussi *ἤλεκτρος* au masculin (see Sophocles), et même au féminin (see Alexander), *χρυσῆλεκτρος* (see Psellus), *χρυσοφόρος* (see Dioscorides), et peut-être, comme nous l'avons vu, *χαλκολίθανον* plus tard *σοῦχίον* (see St. Clement) ou *σουχινος* et *ἤλεκτριανός λίθος* (see Zoroaster), plus tard encore *βερενίκη*, *βερονίκη*, ou *βερνίκη* il s'est nommé *ἄρπαξ* chez les Grecs établis en Syrie (see Pliny); chez les Latins *succinum*, *electrum*, et deux variétés, *chryselectrum* et *sualiternicum* ou *subalternicum*; chez les Germains, *Gless*; chez les Scythes, *sacrium*; chez les Égyptiens, *sacal*; chez les Arabes, *kârabé* ou *kâhraba*; en persan, *kâruba*. Ce mot, qui appartient bien à la langue persane, y signifie *attirant la paille*, et par conséquent exprime l'attraction électrique, de même que le mot *ἄρπαξ* des Grecs de Syrie. En outre, le nom de *haur roumi* (*peuplier romain*) était donné par les Arabes, non-seulement à l'arbre dont ils croyaient que le succin était la gomme, mais au succin lui-même. *Haur roumi*, transformé en *aurum* par les traducteurs latins des auteurs arabes, et confondu mal à propos avec *ambar* ou *ambrum*, nom arabe latinisé de l'ambre gris, a produit le nom moderne d'*ambre*, nom commun à l'*ambre jaune* ou succin, qui est une résine fossile, et à l'*ambre gris*, concrétion odorante qui se forme dans les intestines des cachalots. On ne peut dire avec certitude si le nom de basse grécité *βερενίκη* est la source ou le dérivé de *Bern*, radical du nom allemand du succin (*Bernstein*). Quoi qu'il en soit, le mot *βερενίκη* a produit *vernix*, nom d'une gomme dans la basse latinité, d'où nous avons fait *vernis*.

THE AMBER ROUTES

DR. RENDEL HARRIS, in the course of his investigation into the origins of mythology, has, in a special treatise on Apollo,¹ made important allusions to Amber, and, setting himself the task "of determining the routes by which the uncivilised North sent its treasures to the civilised South," proves that the Amber route "is the original trade route along which the luxuries of life went out in search of the necessities."

The same theory has been worked out in greater detail by Mr. J. M. de Navarro,² who, by means of five maps and many careful observations, set himself in this most important and scholarly paper to define exactly the prehistoric routes between Northern Europe and Italy, as explained by the trade in Amber.

First of all, it is clear that, in Mr. de Navarro's words, while "Northern Europe may have had various raw stuffs at its disposal for purposes of bartering with the South, Amber was the one distinguishable and imperishable substance which it exported on an extensive scale."³

He established without very much difficulty the fact that the Amber found in tombs and barrows in Central and Southern Europe was succinite, and therefore came from the North; and he drew attention to the fact that even if classical authorities knew of the lovely fluorescent Sicilian Amber (Sime-tite) they never mentioned it. He then dealt

¹ *Journal of Hellenic Studies*, xlv., 1925, p. 229.

² *Geographical Journal*, lxvi. 6, December, 1925.

³ There was, of course, gold, but it was not exported to any considerable extent. Some came from Britain, but there was little of it.

with the Bronze Ages, and then with the Iron, and plotting out the various places in which tomb Amber has been discovered, proceeded to describe by what routes exactly it had travelled across the Continent.

His main Central route was from Jutland and Hamburg, by way of the Elbe, where, according to Montelius,¹ it bifurcated, and the main route passed along the Saale. An important find of Amber took place at Dieskau, just where this branch route would start off.

From the Saale, the route would join the Inn by way of the Danube, and it would then cross the Alps by way of the Brunner Pass, taking to the water again in the river Eisack, and thence by the Adige right into Italy.

Branch routes turned off at Passau, where the main route entered, and these extended to Linz, and so to Upper Austria, while one route certainly used the Salzach, as proved by the hoard of Amber found at Hallau and Hallstadt.

Mr. de Navarro gives clearly reasoned explanations for all his conclusions in respect to these routes, and shows clearly how Amber has been found in quantities in all the various tombs that have been opened, and which in those days could only have been reached by traders moving along such long-established routes.

Then he comes to the Eastern route. Dr. Rendel Harris points out that Danzig is the natural beginning of such a route.

Mr. de Navarro says that the main Eastern route was established during the early Iron Ages, and that the route was by way of the Vistula, towards Nakel, through the lakes that lie between that river and the Warthe, into this last-named stream, thence reaching the Oder near Clogan. By the Oder we trace it to Breslau and to the Glatz Pass, thence by the river March (a branch going off towards Brno on to Hohenau and to Vienna), then south through Carniola

¹ *Prähistorische Zeitschrift*, 1910, p. 249.

and so towards Italy, to enter the Adriatic near Trieste, or to extend through Croatia and Bosnia to Rome and further south to Naples.

The Central route, as Mr. de Navarro shows, was the route of the Bronze Ages, which he defines as in three periods:

Early Bronze Age, circa 2000-1800 B.C.
Middle „ „ „ 1800-1200 „
Late „ „ „ 1200-1000 „ ¹

Then he divides, for the purpose of his paper, the Early Iron Age into two divisions, which he names Hallstadt and La Tene periods, from the two places, one in Upper Austria and the other in Switzerland, where very extensive finds of Amber ornaments have been made, and in rough fashion dates them:

Hallstadt, circa 1000-500 B.C.
La Tene „ 500- I „

It is clear, however, that in addition to the routes that he so cleverly defined, there must have been another route from the Baltic to the Black Sea, by which probably the Amber came which is found in the Ægean regions.

This Mr. de Navarro conceived to have been established much later than the routes to which he gave such careful attention, and probably it was by way of the Vistula and the Dnieper into the Black Sea and thence to Greece.

As regards Greece, it is most probable that the route was by way of the Vistula and the Dniester to the Greek port of Olbia, at the mouth of the Dniester. That this route was used later on by Greek traders is made certain by the discoveries of Greek silver coins at places *en route*, notably at Schubin, near Bromberg.

¹ Reginald Smith gives somewhat different figures, putting the end of the Bronze Age, not at 1000 B.C., but at 700. He adds, however, "Frontier at present rather disputed."

Then, as evidence at the other end, we find in Samland Macedonian gold coins, a Rhodian coin, and one from Thasos.¹

It has been suggested, however, by Sir William Ridgeway that this route was not in use before the fourth century.

The great importance of all these considerations consists in the fact that where by the very nature of things there can be no historical evidence, archæology steps in, and by means of the ancient finds of this most precious and beautiful object found in the North and eagerly desired in the South, we can trace the earliest great trade routes—water-ways, of course, for the most part—right across Europe.

No other material could have given us this information in so clear a form. As ornaments, and especially as beads, we find Amber in all the graves adjacent to these great routes, especially where the rivers join one another, or where the trader had to take to the road before joining the river, or at the entrance to a pass, and where towns had begun to cluster.

Eager barter must have taken place in order to obtain the much desired ornament, so novel in appearance, and so beautiful and so rare; and then these cherished treasures found their way to the grave, for use in another world, the choicest of the possessions of the dead chieftain or his wife, and remaining unaffected by the passage of ages, are discovered in these days, and point out with unerring distinctness which way the ancient traders came, where they settled, and where they left their choicest treasures.

When we come to times concerning which we have some history to guide us, we are in some respects less well off for data.

Rome in its early conquering days was not much concerned with luxury or adornment.

¹ Von Sadowski, "Handelsbrassen der Griechen und Römer," p. 71.

From the Etruscans the Romans appear to have imported some Amber, but until the period of the Christian era we know of little use of it in Roman life.

Gradually, however, as the Roman civilisation tended to wealth and luxury, the value and use of Amber increased, and it came into use not only for ornamental purposes, but cups and goblets were fashioned from it.

By chance, we are told, Pompey found a quantity of Amber on an Assyrian privateer he had captured, and learned that it was procured among the white shore cliffs of the Northern seas. This he reported to Nero in Rome, who was so much pleased with the news that he equipped a special military expedition, and sent it to the North to procure Amber. To this expedition both Pliny and Tacitus owe their knowledge of the Teutons.

Once in direct intercourse with Rome, East Prussia was glad to purchase art objects of Roman manufacture, and thousands of such things found in East Prussian tombs in the first, second, and third centuries, and innumerable pieces of Amber found in Italy belonging to the same period give evidence of the extent of commercial intercourse.

With the incursions of the Teutons, however, into the Roman Empire, a decline of the Amber trade set in, and this is reflected in the diminishing presence of objects of Roman origin in the tombs of the Amber country.

In the Early Middle Ages, the trade was still inconsiderable, though in the sixth century Theodoric, the renowned East Gothic King, wrote a letter to the Æstiers, thanking them for the Amber sent to him; and Amber beads have been found in tombs in South Germany, dating from the seventh and eighth centuries, while articles of Byzantine and Arabian silver workmanship, and other objects of diverse origin, have been found in East Prussia.

When, in later days, the Southern roads through Egypt or Syria and the Red Sea were closed to traffic by the rise

of Islam, the Northern route by the Black Sea and the Caspian alone remained available for traffic, and then Constantinople grew wealthy, and also naturally sought to exclude all her rivals. The Frankish and the restored Greek Empires were short-lived, and finally Islam closed all trade routes. Then came a new trade route to the East round the Cape, and the rivalry of nations manifested itself on the high seas.

France in modern times made a bid for the Eastern trade. Napoleon aimed at reopening all Southern routes through Egypt, but desired to hold the key himself. Great Britain contested the mastery of all, and by her sea-power she prevailed.

Two other prehistoric routes remain to be noticed. One along the coast of the Netherlands, up the Rhine and down the Rhone into the Mediterranean,¹ discovered by finds of Amber and of Bronze, and probably in use in the Early Bronze Age.

Then there is the sea route by Gades and the Straits of Gibraltar, a great neolithic highway, as Miss Bacon points out, but little used for Amber, finds of it being "scarce and sporadic." This learned writer, in her delightful book on "The Voyages of the Argonauts," asks the question whether it can possibly be a mere coincidence that "The Argonauts in one account or another are credited with travelling by all the Amber routes, or by routes so like them as to be probably garbled versions of the same trade highways."

She shows that it is hardly possible to entertain the idea of "a fourfold coincidence," and then goes on to prove, as I am disposed to believe, her contention that such statements have a basis of truth, and that the Amber routes are actually identical with those that are described as "The Voyages of Argo."

¹ Bacon's "Voyages of the Argonauts," 1925, p. 121.

Into the details of this fascinating theory I cannot enter here. All is clearly and agreeably set out in scholarly fashion by Miss Bacon, and it is surely most probable, as she states, that Argo "stands for a concentration of world history, a single embodiment of all the pioneers who followed a road that led past Colchis to the riches of a vast continent, and the Golden Fleece becomes a type of all those riches"—gold, gems, jade, Amber—"brought to the shores of the Mediterranean." It, of course, started with the narrative of a real voyage or of several, and then became embellished with myths that eventually became part and parcel of it.

The first traders in Amber were almost certainly the Phœnicians—the commercial race *par excellence* of antiquity. They bought the Amber from their middlemen, the Ligurians, on the Gulf of Genoa.

Their commercial pre-eminence and their close connection with the Jews (there was a commercial treaty between their King Hiram and King Solomon in 990 B.C.) make it probable that they were the first to make Amber known to the races round the Mediterranean.

Amber beads, of which Schliemann found in Mycenæ about 400 in two tombs, and near Ancona many more, some as large as pigeon's eggs, were very probably brought there by the Phœnicians.

After the Ligurians, the inhabitants of Massilia (the Marseilles of today, founded in the sixth century B.C.) rapidly raised their city to great importance as a commercial centre. Massilia even equipped and sent out an independent expedition under Pytheas to the shores of the Baltic to procure Amber.

One can hardly maintain that Pytheas was the first to undertake a sea voyage to the Baltic, but it is certain that oversea commerce was extremely limited at that time.

In about 500 B.C. the Etruscans were, it is stated, successful in discovering the rich deposits of Amber on the Baltic

Sea, and it is probable that about 400 B.C. the Massilians gave up entirely their independent importation of Amber, and contented themselves with what the Etruscans supplied them.

The retail market of the Massilians was chiefly Southern Switzerland, as we may judge by the great quantity of Massilian coins we find in Graubunden, Tessin, Wallis, Genf, and Bern.

The Etruscans had a very active trade in Amber. Fifteen hundred years B.C. they had great maritime power, were highly cultivated, and could work bronze and other metals in an artistic manner. It is therefore to be assumed that they were also engaged in the Amber trade on a large scale.

It was not until the sixth century, when their maritime power had been broken, and one after another of their colonies had been taken from them, that they were forced to turn their attention to the development of their inland trade.

About 150 B.C. the Roman power had made great advances, and eventually entirely put an end to Etruscan trade.

The Ligurians inhabited the country between Massilia and Etruria. We have no reliable records about their Amber trade; but the fact that at one time Amber was called "Ligurious" indicates that the trade was considerable.

The name Ligurious was still in use in Pliny's time, although the origin of the word had apparently been forgotten.

Dr. Laistener, Professor of Ancient History in Cornell University, writes concerning an enterprising knight of the Middle Ages, who explored what he terms "the amber route," from Italy to the Baltic, going by way of Carnuntum on the Danube, a site which lies about thirty-five miles east of Vienna. The distance he estimates to the Baltic at five hundred miles. He imagined that the route followed the valley of the Elbe, a highway for trade already in use in

prehistoric times, and says that the knight found large quantities of Amber, prized not only for jewellery, but for its supposed medicinal qualities.¹

In the same volume, Professor Claude Jenkins speaks of an allusion in a book by an ancient author called Brevarius, a short description of Jerusalem, assigned to 527-30, but possibly as early as 500, in which he speaks of the ring of Amber with which Solomon sealed his books. "There," says he, "is that horn wherewith David was anointed and Solomon, and that ring wherewith Solomon sealed" ("his books," says Beazley; "his writings," says Sir Charles Wilson), "and it is of Amber." Of this book there are two MSS., one at St. Gall, dated 811, the other one in the Ambrosian Library at Milan, belonging probably to the twelfth century. In that MS. the word is not "sermones"—that is, "books or writings," but "demones"—that is, "demons," and it is probable that the ring was the one with which Solomon is said to have sealed up certain demons in twelve water-pots of silver, a statement which Eusebius refers to as being "omnino incredibile."

In the same book, dealing with the Arab trade, Sir T. W. Arnold refers to a Mohammedan Manual for traders called "Kitab al-Isharati Ila Mahasini 'T-tijara," belonging to the same period as that of Ghazali (who flourished towards the middle of the eleventh century), Cairo, A.H. 1318 (A.H. is reckoned from A.D. 622). It gives a list of the various articles in which the Arab trader was specially interested, and after alluding to precious stones, the next group is that of scents, which are set out as musk, amber, camphor, sandalwood and cloves, and the statement goes on to say that the best amber comes from South-East Arabia, and the next best from Spain or Morocco. Further objects of trade were spices, of which there is a very long list;

¹ See "Travel and Travellers in the Middle Ages," edited by D. Newton (Kegan Paul, 1926), pp. 20, 94.

paper, silk and woollen stuffs, furs and skins, and various metals.

Again, in the same book is an article by Baron Mayendorff in which he writes about Roman trade routes, and alludes to the question as to which of them has survived down to our own period, connecting the old and new centres of civilisation, and maintaining the exchange of goods, which had already become an essential of social life in the countries surrounding the Mediterranean. Amongst the material so traded in was Amber, required for jewellery and for various artistic pursuits, and which comes into many lists of goods.

AMBER CONSIDERED FROM THE POINT OF VIEW OF ANTHROPOLOGY

THE earliest appearance of Amber in the Paleolithic period is, I am informed by my friend Mr. Horace Beck, who has given some special reference to this subject, an unworked lump found in a cave called the Grotto of Aurensan, in the Hautes Pyrenees, and this has been assumed to be of local Amber, and not to have come from Samland, because Amber has been found to a slight extent in conjunction with lignite in France. Some similar pieces, also unworked, were found at Judenus, near to Krems in Austria, in the caves of Kostelik, and at Zitmy in Moravia.

Next to these in importance come two extraordinary figures, one of which is now in the Museum at Stettin, and the other in the Natural History Museum in Berlin.

The first is evidently intended to represent a bear. It is about 4 inches long, it is perforated, and therefore was probably intended to be worn as a piece of jewellery; and although there are no feet, or only the vestiges of feet to the figure, and the very slightest carving on the ear and the nose, yet the primitive carver has so evidently shown his intention that it is quite easy to realise what he was striving to represent as nearly as he could—the bear with which he was so familiar.

The other piece, in Berlin, is rather larger, and is again a very definite representation of an elk, with its head bent down. This also may have been intended as an ornament, although there is no perforation in it, but the legs are joined in such a way that it could quite well be worn, although, if worn in that way, it would be upside down.

Then there are three very extraordinary ornaments coming

from Russia, partly of gold and ivory, and partly of Amber. They were all found fairly near to one another, to the south of Kieff, one at Wasilkof and the other two at Kelernes. The one at Wasilkof is evidently intended to represent the head of a lion, and is carved in ivory, but the eyes are of Amber, and produce a very extraordinary and wonderful effect.

The other two pieces, when I saw them, were in the Hermitage, and were large clasps of gold, intended probably to ornament a cloak or mantle, wonderfully wrought and representing animals, mainly composed of ivory, but having transparent plates of Amber used as decoration. One of them is nearly oval, the other is rounded, and represents a beast with four legs and a very long tail, and with extremely large ears, decorated on the tail, the ears, and the feet with Amber.

Again, in the Museum at Sarajevo, taken from a grave in Bosnia, is a very notable ornament, consisting of a large gold pin, on which are three lumps of Amber, and pendent from it are chains of Amber and pearl, giving to it a remarkable beauty.¹ As a rule, however, the objects in Amber that are discovered in graves consist of beads or else of ornaments to be attached to necklaces. It was to female adornment that Amber was generally applied, and beads can be found from the most remote periods.

Amber beads appear in the tombs in Egypt as far back as the VIth Dynasty (3200 B.C.), and were evidently then regarded as of very high value.

Belonging to the Stone Age, large quantities of Amber beads have been found in barrows and in cists, and sometimes in mosses or bogs. They are generally to be discovered in countries not far removed from the place of origin of the Amber—Scandinavia and Northern Germany. In Jutland there were many found in conjunction with flint axes (celts), and some of these are in the British Museum. Others were in the form of studs, axeheads, crescents, and

¹ Pelka illustrates all three: see Figs. 8, 9, and 10.

what archæologists call "dumb-bell toggles," and many of the best of these were found in a chambered barrow at Veiby, North Zealand. These are in the British Museum, and are to be found in Case 137.

In the Early Iron Age, Amber was extensively used for ornamentation, and again a large number of beads have been discovered, some small oblate, others of large size, and often extremely well formed. Almost all the barrows of any special importance that have been opened belonging to this particular period have yielded amber beads.

"The decoration of the earliest jewellery of Europe—that of the Bronze Age, which dates roughly from about a thousand years before the Christian era—is by means of spiral and zigzag patterns. Ornaments have free endings, bent in spiral, snail-shell coils. The earliest were cast, though the hammer was used towards the close of the period; solder was unknown, and rivets alone employed. Gold and bronze were the only metals employed, the latter being sometimes gilt by means of thin gold plates, while amber is often found used as a jewel."

In this Bronze Age, Amber was abundantly used, and large strings of beads have been discovered in various barrows and cairns. From a barrow at Aldbourne there were taken many beads, and some ornaments of Lignite; others were found in a barrow at Kelleythorpe.

A very large amber necklace, numbering, it is said, many hundreds of beads, was found by Sir R. Colt Hoare in a barrow in which he excavated, and these probably belonged to a lady of unusually high rank.

In 1879 there were discovered in a barrow at Upton Lovell, near to Norwich, over a thousand beads, and in 1806, in another barrow, some tablets of Amber, perforated in places, and evidently intended to be strung together to form an ornament.¹ At Little Cressingham, in Norfolk,

¹ See "Norfolk Archæological Society," vol. viii., part v., pp. 330-334; and see also "Archæologia," xliii., p. 506.

a very large number of beads were discovered in 1849, and altogether many thousands of amber beads have been found in barrows in England that have been opened, in some cases even surrounding the neck of the skeletons. It was during the Bronze Age that the trade in Amber developed along the definite trade routes alluded to in a separate chapter. No doubt the Amber was intended to be used in exchange for bronze weapons. In a cist opened near Mold, in Flintshire, many Amber beads were discovered in 1833. The Wiltshire barrows have also yielded large quantities of Amber beads, also the mosses and peat bogs of Denmark. The beads found in Denmark are sometimes of very large size, measuring from $2\frac{1}{4}$ to 3 inches, or even more, in diameter. They are covered with a hard, crusty patina, but this, when broken, reveals beautiful golden Amber underneath. They are perforated, and were evidently cherished ornaments; some exceedingly fine examples of these are in Mr. Beck's collection.

In Ireland, amber beads have frequently been discovered. Mr. Beck has one extremely fine necklace of about 120 beads, and in the centre of it, separated from each other by much larger beads of Amber, are two beads of bright blue glass. These give a highly ornamental character to the necklace, and show that it was intended for a person of some distinction, as it is unusual to find glass beads in connection with amber strings. An important anthropologist in Ireland has made the suggestion that perhaps the beads found in the country may have been from some local source, and not derived from trade with North Germany and the shores of the Baltic. There is not at present, however, any evidence to support such a theory, as no Amber has yet been found in Ireland, with the exception of some extremely small morsels, of a pale, yellowish character, flocculent, and resembling Hachettite, discovered in a bog in the southern part of Ireland some years ago.

No fine golden Amber, anything approaching to Succinite, has yet been recorded as discovered in that country.

Torques are the most frequent of ancient Irish ornaments. The largest known, over 5 feet long and upwards of 27 ounces in weight, is supposed to have been worn over the shoulder and across the breast. It is the property of the Royal Irish Academy. Some of them are decorated with lumps of amber. In addition to torques and gorgets, neck ornaments were also formed of beads of gold, and some of these have been found accompanied by beads of amber.¹

In the Lake dwellings of Central Europe, amber ornaments of beads have frequently been discovered, and what is of special importance with regard to them is that a few are made of Simeitite, and not of Succinite, showing that Italy was known in those remote times to produce Amber, The presence of Simeitite ornaments is, however, exceedingly rare; almost all the Amber that is found in Central Europe had its origin on the shores of the Baltic.

Some very important discoveries were made at Hallstadt, in Austria, in a tumulus which was opened, and which contained hundreds of amber ornaments, and one string of beads said to be as long as 9 feet. The beads in the Hallstadt find were associated with decorated plates of bone inscribed with a series of ornamental circles, and some of the beads were unusually large, oblate or oval in shape, the whole effect being particularly good. In North-West Bohemia, almost every important burial-ground yielded spoil of amber ornaments. In Dieskau, south-east of Hallé, over 120 pieces of Amber came to light, many of them flat centre-pieces, covered with a crusty patina similar to those found in Denmark, some axe-shaped and some rectangular with rounded corners. At Strombing, in Lower Bavaria, there were similar finds; also in

¹ See Dr. Joan Evans' work on 'English Jewellery,' 1921.

Silesia, quite near to the amber beds, in Tyrol, and in South Switzerland.

In France, during the Neolithic period, Amber is rare, but some specimens, Mr. Beck tells me, have been discovered in the Neolithic graves in Petit Morin (Marne). A very important discovery of beads was found at Pontivy, Morbihan, in a tumulus. The most important discovery in France, however, connected with Amber was in the Marne district, where it is stated that a large figure was found, carved on the side of a rock tomb. This represented a female, whose only suggestion of clothing was a necklace, and in the centre of the necklace was, it is declared, a large bead, which still showed a yellowish colour, from which it was presumed that it was either of gold or of Amber. This very notable discovery, Mr. Beck informs me, was duly recorded, but the data at the disposal of anthropologists is insufficient to enable the cave to be now identified, and a search is at the moment in progress, in order to find out where this cave is, and to make quite certain that the discovery is properly recorded. It is one of great moment, and it is unfortunate that the discoverer omitted to leave behind him such information as would enable the place of discovery to be identified.

In Italy, strings of beads have been found in ancient sepulchres in Ancona, some of them, it is stated, as large as hen's eggs, and, in one place, in such numbers that it is said a bushel measure could have been filled with them.

An exceedingly fine string of amber beads was found at Cumæ, in South Italy, and now belongs to Mr. Beck. Its age is approximately given at from five to six hundred years B.C.

In examining these very primitive necklaces discovered in various tombs in Italy, especially in Etruria and Latium, the extraordinary abundance of the Amber at once attracts attention. The Amber of this ancient jewellery of Italy has also accessories, sometimes of gold, and more frequently

of silver, or else of an alloy of gold and silver termed *electrum*. A noteworthy early necklace of these materials found at Præneste, and now in the British Museum, is composed of amber cylinders, and pendent vases alternately of amber and electrum.

There was, in the Hermitage Museum at St. Petersburg, until quite recent times, an archaic Lydian necklace and pectoral belonging to the eighth century B.C., which was part of the famous collection of gold ornaments, mainly of Scythian work, that was preserved in the basement of that important museum, and there I examined it. Quite recently, part of the gold jewellery forming that treasure was sold at Sotheby's in London (on Monday, November 9), and this particular necklace and pectoral realised £52. It consisted of a disc 7·4 cm. in diameter, ornamented with swastikas and inset with amber beads, of which only one now remains, and having a hook in the form of a double spiral, with two amber beads originally inset, one only of which is now in existence. The designs are outlined and ornamented with granulations, and there are three ornaments, each 3·3 cm. long, consisting of two pairs of spirals with a cylinder between. These were found with the pectoral, and belong to the necklace worn with it.¹

This pectoral is illustrated in Messrs. Sotheby's catalogue, Plate II., item 142.

Spain and Portugal produced amber ornaments, some specially fine ones being found in the celebrated excavations at Los Millares, in Almeria. There was also a small discovery in South-East Spain at Argor, so Mr. Beck states, but it has not been decided as to whether that was Succinite from the Baltic or whether it was a local Amber. As already stated, Amber is found in Spain near to Santander, and it

¹ Described by Ludwig Pollak in "Klassisch-antike Goldschmiedarbeiten-im-Besitze . . . Nelidow in Rom.," Leipzig, 1903 (see xvi. 399).

is possible that the discovery at Argor, about which there are not very full details, was of a Spanish Amber.

Earrings of Amber were found at Charvais, in France, in a cemetery, the contents of which bore great resemblance to the discoveries at Hallstadt. Somewhat similar earrings were also found in Switzerland at Giubiasco, which is on the Italian slope of the Alps. In Switzerland have been found beads, and also what appear to be hairpins made of bronze, ornamented with lumps of Amber; and in England ornaments of somewhat similar form, also composed of bronze and Amber, have been discovered.

In the Gaulish cemeteries, especially in those in the Marne district, quantities of amber beads have been found, some urns discovered at Prosles, near to Moronvillers, containing Amber beads in abundance, as also did some similar burial urns found near to Bergères les Vertus, and again, near to Champaubert, the latter cemetery revealing a very large quantity of beads.

In Antrim, a brooch with terminals in the form of birds' heads was discovered, and these birds were supplied with amber eyes, and in other parts of Ireland beads, large and small, and brooches ornamented with Amber have been found; but one bead was discovered in Ireland which it is stated had upon it an Ogham inscription, and which, it has been declared by antiquaries, was intended to be worn as a charm in maternity cases. A somewhat similar brooch to the one found in Ireland was found in Spain. It was circular, and "has rounded inlays of Amber," and "yellow glass with foil between." This was Gothic in its character, and resembled some Amber that was found in the Herpes excavations. Further, some spindle whorls of Amber were found there, a fine necklace, and many large amber ornaments, all belonging, it is said, to "a Frankish rather than a Visigothic population."

During Greek supremacy, many writers, as we have

already seen in the chapter on Classical Allusions, revealed a great interest in the origin of Amber, and there is no doubt that the merchants who brought it were mysterious as to its quality, and especially as to its home. Hence there were all sorts of theories respecting the place where Amber was found.

There have been some important discoveries of Amber in Greece, and Mr. Beck has in his collection three beads that are cleverly engraved, one of which evidently represents a bear.

In the Crimea there have been some notable discoveries of Amber, especially at Kertch, and Mr. Beck has an almost complete necklace of many beads, having a remarkable pear-shaped pendant in the centre. This is clearly Amber from the North of Europe.

The Romans also wore necklaces (*monilia baccata*) composed of beads of various materials, both precious stones and glass, of many colours and various shapes. Amber was largely employed for the same purpose, and held in high estimation by Roman ladies, who regarded it not only as an ornament, but as a talisman for protection against danger, especially witchcraft. Amber in which small insects were enclosed was particularly prized: "the price," says Pliny, "of a small figure in it, however diminutive, exceeds that of a living healthy slave."

But little Amber has, I am informed, been found in Egypt. A few beads of large size have been discovered, but nothing is known of their history. Mr. Beck, however, tells me that a scarab of the XXIst Dynasty was once discovered, and was declared to be of Amber, but there seem to be no available details concerning it. Amber, he also says, has been found at Mesopotamia and at Nineveh; the pieces appear to be like parts of large imported Etruscan pendants, belonging, perhaps, to the ninth century A.D.

In the Acropolis at Mycenæ, Dr. Schliemann found

enormous quantities of amber beads, and as he says in his narrative,¹ their presence in the tombs, amongst many large treasures of golden ornaments, proved that Amber was considered a magnificent and valuable treasure in the days of the Mycenæan Kings.

Damascus has yielded certain discoveries of amber beads, which are believed to belong to the Roman period.

In England, as specially mentioned in another chapter, there have been many discoveries of amber beads, and in one or two cases pieces of Amber have been found mounted in gold as ornaments. The Anglo-Saxon discoveries show that as a rule the beads were mainly just small lumps of Amber, drilled and very roughly polished, not shaped. There are, however, some much larger beads found, and in various cases those are covered with the same sort of pale fawn-coloured crust or patina, such as that which surrounds the beads found in the peat bogs or mosses of Denmark, and when broken away, the centre is rich golden, somewhat friable Succinite.

Some important Anglo-Saxon discoveries of Amber were found in the Kentish graves, especially at Faversham, a large necklace being discovered at Stouting, in Kent. Beads have also been found at Ixworth, and many beads at Long Wittenham, the special interest of that discovery being that these beads were found lying close up to the left wrist of the skeleton of a woman. Some unusually large beads were found in a grave at Birdlip, near to Gloucester, in 1879.

Anglo-Saxon necklaces are as a rule composed of beads of many varieties. The commonest, of glass, of numerous colours and shapes, are very similar to the Roman beads. Beads of amethystine quartz, probably of Transylvanian or German origin, or even, as Mr. Heron-Allen suggests, from

¹ See Schliemann's "Narrative of Discovery," London, 1878, pp. 214-245.

Western Ireland, where amethyst is very common, and particularly beads of Amber from the Baltic, are found strung on necklaces, or were hung singly from the neck. When one remembers the superstitious respect in which Amber was held from very early times, it is probable that some of these were regarded as amulets. The more sumptuous necklaces, which must have been worn by ladies of rank, are composed of gold beads or of precious stones or Amber in delicate settings of twisted or beaded gold.

In the Saxon cemetery discovered in 1929 at Guildown, Guildford, Surrey, in the sixth-century graves, were found twelve Amber beads and a few fragments of a thirteenth, four of them being found in the grave that was numbered 85 in the list prepared by Mr. Lowther. These were carefully turned, but the other beads were of rough disc shape. The Amber, according to his statement, was of a beautiful deep colour, but this could only be seen where there was a recent fracture. The main point of interest respecting these beads is that they do not form part of a necklace, as is usually the case with amber beads discovered in Anglo-Saxon graves. These were probably worn as separate ornaments, possibly stitched to the cloth, as all but one appear to have a hole in the centre, and they may have been used for buttons. Some of the graves only had one, others two; there were never more than four in a grave.¹

The discovery of some beads of Amber in South America in Lake Guatavita is one of great moment. It has always been said that part of the tribute obtained from Montezuma, the fifteenth-century Aztec King, was ornaments of Amber, but until these beads, which were probably thrown into the lake before the arrival of the Spaniards, were discovered, we had no evidence of the use of Amber in South America. None of the Inca remains are associated with Amber. Some of the beads found in Lake Guatavita, such as the five

¹ See "Surrey Archæological Collections," vol. xxxix., p. 13.

fine specimens¹ in Mr. Beck's necklace, appear to be very primitive, and only quite roughly shaped. They are of gorgeous red Amber, almost as red as that of Burmite. Others in the same necklace show signs of a very different civilisation. They are oblate,² smoothly polished, and with a very large perforation. They are of grey or dark brown Amber, that has a nearer resemblance to the Amber of Roumania. In the same necklace are two or three beads, again different, smaller, and different in shape, and in colour almost resembling tortoiseshell.³ The necklace came from Colombia, and is a very rare treasure, as beyond the existence of one or two beads in North America in one of the museums, South or Central American Amber is hardly known at all. Dr. Thomas, of Jermyn Street, has examined the material, so Mr. Beck tells me, and states that it is true Succinite, but up to the present moment, I am not aware that it has been subjected to careful analysis. Its specific gravity is given on page 89. There is no evidence of Amber in mining discoveries in Central or South America, but that does not say that no discoveries will be made. At present these are the only examples of that type of Amber that I have seen.

All the evidence for the discoveries of Amber go to prove that the material, from the most remote periods, has been regarded as a very precious substance, perhaps, next to bronze or iron, the most precious substance known, at least equal in value if not superior to gold. It is clear that it was in great demand for ornamentation, and that the wearing of amber necklaces goes back to the very earliest periods of human history. Moreover, the discovery of such ornaments in the barrows shows that they were buried with the

¹ Weight in grammes, 11·875, 9·550, 9·455, 8·379, and 9·490.

² Weight in grammes, 8·680, 7·812, 3·560, 2·172, 2·184, and 1·768.

³ Weight in grammes, 3·713; specific gravity, 1·263. Evidently this is not Amber.

chieftains or their wives, to whom they had belonged, that they might possess and use them in the world to which they had passed.

The most important object in Amber that has ever been found in Europe in a tumulus is the famous cup now preserved in the Brighton Museum, and to see and examine it experts have come from all over the world.

Unfortunately, without special permission to remove it from its case, it is not very easy to study the cup, and its position in the museum could be very much improved, and it could be far better illuminated for viewing. It is unique because the somewhat similar one found at Clandown, Dorset, and now in the County Museum at Dorchester, is of a different shape, and is not in perfect condition. Two somewhat similarly shaped cups of shale have been found embedded in Kimmeridge clay, one especially at Honiton, and a cup of wood was found in Schleswig, but the only ones of Amber are those in Brighton and Dorchester.

The Brighton one was discovered in 1857, in a barrow at Hove, which was removed when a roadway was made from Church Road to the first Hove Railway Station, then situate at the top of Holland Road, and its position may be roughly stated as at the back of 13, Palmeira Avenue, 340 feet north of Church Road and 76 feet east of Salisbury Road.

Mr. Eliot Curwen, in describing it, says that at a depth of some 9 feet the workmen came upon a rude coffin of oak, apparently hollowed out of a tree-trunk, and shaped with an axe. It was between 6 and 7 feet long, and placed roughly east and west. In the centre of the coffin, as though placed resting on the breast of the body, was found the cup, and with it a polished axehead of obsidian, a whetstone or amulet of smooth stone, and a bronze dagger.

In the broken coffin there were, he says, many fragments of decayed bones, mixed with soil and some charred wood.¹

¹ See "Sussex Archæological Collections," vol. ix., pp. 119-124.



DRAWING OF THE AMBER CUP FOUND IN A TUMULUS AT
HOVE, AND NOW IN THE BRIGHTON MUSEUM.

Composed of one large piece of Amber, and
actually the finest object in Amber that has ever been found
in any tomb in Europe.

To face page 82.

Dr. Montelius, the eminent Danish archæologist, pronounced that the remains belonged to the second period of the Bronze Age, which in Scandinavia is regarded as from 1450 to 1250 B.C.

Sir John Evans, Sir Arthur Evans, and other English archæologists, concur in this period, but they consider that the second period of the Bronze Age in Britain should be taken as from 1500 to 1150 B.C., which Dr. Curwen suggests would be roughly between the time of Moses and that of the prophet Samuel.

The cup in question (illustrated in these pages from a drawing) is hemispherical in shape, $2\frac{1}{2}$ inches (62 mm.) high, $3\frac{1}{2}$ inches (90 mm.) wide, and would hold nearly half a pint.

It is formed from one piece of Amber, has a smooth surface, and was turned upon a pole lathe which left a segment of the circumference untouched, and at this place is situate the handle of the cup. This handle is solid, measures 20 mm. across and 21 mm. in the interior. Around the cup is a band of raised lines 7 mm. wide, placed $\frac{1}{2}$ inch below the lip, but this decoration does not encircle the cup, but stops short at the handle.

It must have been cut from a superb piece of Amber, and it is beautiful in colour as well as in design—a reddish-golden hue throughout. The discovery of such large pieces of Amber is a very rare occurrence, and to form this cup a very unusual piece must have been adapted, and no small skill has been shown in producing the cup, as its proportions are excellent, its decoration suitable and well planned, and fortunately also it is quite perfect.

The Dorchester cup, which is somewhat similar, was discovered between September 15 and September 20, 1882, in Clandown Barrow, Martinstown, by Mr. E. Cunningham, and is unfortunately in many pieces, and has been put together very badly and inaccurately. The

barrow was a large round one, and is still in fair condition, although mutilated. In it were also found a bronze dagger and a bronze ring, a finely tooled diamond-shaped ornament of gold, a sceptre head of jet ornamented with gold discs, an incense cup, parts of a burial urn, and a portion of a sheath of wood belonging to the dagger; but it does not seem to be recorded where the amber cup was placed, whether upon a body, and, if so, whether there were any bones found, nor whether the funeral urn contained bones or ashes.¹ I am indebted to Mr. Charles Prideaux and Captain John Acland for these details, and to Mr. Bernard Griffin for the photograph of the cup.

The British Museum contains a collection of pieces of carved Amber of Etruscan work, unique in Europe. There is nothing so remarkable or so fine in any of the Continental museums.

The principal piece in the collection came from Canusium (Canossa), at one time one of the chief commercial cities in Italy. It originally belonged to Prince San Giorgio Spinelli, and many of the pieces are illustrated in Detken's book known as "Collection d'Ambres."

Other pieces came from Armento di Basilicata, and from the Castellani Collection; and one most important piece, a pyxis with a cover, from Aquileia, at one time the fourth city of importance in Italy. Several of the pieces are referred to in Helbig.²

The principal piece of the San Giorgio Spinelli Collection is No. 2 in the catalogue that was issued in 1878, and now long out of print, and represents a Satyr kneeling with an amphora and a wine-skin. This is $4\frac{1}{2} \times 4$ inches: Detken VII. It belongs to the early part of the fifth century.

¹ See "Proceedings of Dorset Natural History Club," vol. xxxvii., p. 42.

² See Helbig, "Osservaz. sopra il commercio del Ambra," 1876-77.

No. 3 in the collection represents a quadriga being driven by a female, and this is carved on both sides, the opposite side representing a nude female figure. This is 5×5 inches. Detken V. It illustrates the story of Phaëthon.

No. 4 is a figure of Athene in low relief, $2\frac{5}{8} \times 2\frac{5}{8}$ inches.

No. 5, a male figure, $3 \times 2\frac{1}{2}$ inches, is Detken IV.

No. 6 is the figure of an ape, $2\frac{1}{2}$ inches high.

No. 7, a male figure draped, $2\frac{3}{8}$ inches.

No. 8, a pendant shaped as a bird, $2\frac{3}{4}$ inches.

Nos. 9, 15, and 16 represent heads of women.

Nos. 10, 11, 12, 13, and 14 are pendant masks of remarkable merit.

No. 17 represents a horse's head.

No. 18, a dolphin; and it is impossible to say what No. 19 really represents.

From Armento di Basilicata comes a very important piece representing Peleus, King of the Myrmidones in Thessaly, carrying off the goddess Thetis, by whom he had the child Achilles, and it is clear that this piece of Amber was originally intended to be turned round and round in the hand to be examined, as the design runs round corners in a curiously illogical but distinctly whimsical fashion.

The little pyxis from South Italy ($6\frac{3}{4} \times 3\frac{3}{4}$ inches), which bears the number 52, is carved with Cupids and vine-leaves. It has a cover, and it may possibly have been the container of some expensive ointment or precious scent. It is a piece of Amber of remarkable importance, and is considered to belong to the third century. Other fine pieces came from Nola. In a necklace in this room is an amber ornament resembling an amphora, and of high antiquity. There is also in the same collection the figure of a lion, $4\frac{1}{4}$ inches high, which came from some other Etruscan discovery, the details of which have been lost. In addition to these, there is the carved figure of a comic actor and a head of Tiberius.

In the Gold Room at the British Museum there are four unusual beads or buttons that were discovered at Enkomi, in Cyprus; and there are two rings belonging to the fourth century B.C. that came from the Augustus Franks Collection, and were originally found at Crete. These are plain gold, but the gem in them is a rough piece of Amber which appears to have some carving upon it. There are many other pieces in the Greek and Roman domestic collection, including an important vase and two figures of animals.

AMBER CONSIDERED AS A MINERAL

MINERALS may be roughly divided into two classes—metallic and non-metallic.

Amber belongs to the latter group.

The non-metallic minerals may be further subdivided and classified into different groups, of which two important ones are:

(1) The Carbon group, which, when transparent and crystallised, is known as the diamond; scaly and crystalline as graphite, plumbago, black lead; and amorphous as lamp-black, charcoal, and soot.

(2) The group of the Hydrocarbons, which consist of carbon and hydrogen with oxygen, and may be again subdivided into Coals and Bitumens.

In the former we find various species of Coal, Peat, Lignite, Cannel Coal, Torbanite, Anthracite, and Jet.

In the latter, the Bitumens are included: Crude Petroleum, Asphaltum or Mineral Pitch, Elaterite or Elastic Bitumen, Albertite, Ozokerite, Hachtettite, Copalite and Gum Copal (to all of which attention will be given later on), and Amber.

The composition of Amber varies according to specimen, but it is usually given as:

Carbon	..	..	78·96	per cent.
Hydrogen	..	..	10·51	,,
Oxygen	..	..	10·52	,,

and it is therefore very similar in composition to Camphor.

There is also present, especially in certain varieties of Amber such as Rumanite, a small amount of sulphur and some inorganic material, depending mainly upon the enclosures of vegetable or animal substance, which remains

behind in the form of ash when the Amber is burned. These hardly count in the general composition, and Amber may therefore be represented by the formula $C_{10}H_{16}O$.

The sulphur contents of Amber can be isolated by heating the substance in a retort, and the results of Professor Helm's experiments were to set out that the quantity of sulphur organically combined with different sorts of Amber was as follows:

0·26	per cent.	in clear yellow.
0·38	„	in a piece of dark colour.
0·42	„	in what is called slaty Amber (<i>schlauben</i>).
0·34	„	in bony Amber.

It is very different in asphalt-bitumen, to which Amber is so closely allied. However, in Syrian¹ specimens can be found 8·78 per cent. of sulphur in combination with organic remains, and in American examples 10·85 and 0·40 per cent. of sulphuric acid.

The elementary analysis of Amber, says Schrotte, excluding a very small quantity of nitrogen, is:

78·60	per cent.	of carbon.
10·19	„	of hydrogen.
10·99	„	of oxygen.

Draping found in some Amber that he collected:

80·59	per cent.	of carbon.
7·31	„	of hydrogen.
6·73	„	of oxygen.
3·77	„	of ash.

Helm says he has never found so large a quantity of ashes in any Amber, and he believes that Draping's statement cannot have been correct, unless it was due to the presence

¹ The Amber very occasionally found in Syria, of which I have one specimen, is very poor quality Succinite, and quite useless for commercial or artistic purposes. Its specific gravity is from 1·051 to 1·067.

of a considerable amount of organic remains in the Amber. His analysis has only yielded 0.08 to 1.002 per cent. of ashes, and they consisted of calcareous earth, peroxide of iron, and sulphuric acid.

The hardness of Amber is represented by 2 to 2.5, its specific gravity 1.08, that is to say, very little heavier than water. The hardness is expressed according to Mohr's scale of minerals, ranging from talc with hardness 1 to diamond with hardness 10.

Below the diamond come corundum (including ruby and sapphire) 9, topaz 8, quartz 7, felspar 6, apatite 5, fluor 4, calcite 3, and gypsum 2. Amber is slightly harder than this last. It has a perfectly conchoidal fracture.

The quality of Amber is extremely varied in its specific gravity. Berzelius gives it as between 1.065 and 1.070, but Helm and Dahms say that this is not always the case, and Helm goes on to state that he has tested the specific weight of a large number of pieces of Amber, and found it vary, at wide intervals, from 1.05 to 1.095.

Mr. Beck has been good enough to give me the specific gravity of the various beads in the necklace from South America alluded to at some length in the chapter on Locality.

The rough-shaped pieces have a specific gravity, he says, respectively of 1.061, 1.065, 1.049, 1.045, and again 1.045. The large dark, barrel-shaped piece has a specific gravity of 1.055. The four smaller barrels are respectively 1.056, 1.056, 1.053, and 1.060, but associated with them is a large grey barrel weighing in grammes 7.812, and having a specific gravity of 1.127. I am inclined, therefore, to think that this large grey barrel is not Amber at all, and I am convinced that the black disc barrel associated with it, which weighs in grammes 3.713, and has a specific gravity of 1.263, cannot possibly be Amber.

Mr. Beck arrived at his specific gravity by displacement in water, the normal method.

Helm's test, he says, is by flotation in methylene iodide. This is, of course, a somewhat rough method of testing, really only useful for specific gravities between 2·8 and 3·33, and even then not wholly trustworthy.

The pale modification of Amber which is called "bony" is lighter still, and Helm had in his collection a couple of pieces of it, the specific gravity of which was under 1, and which floated in water like meerschaum. Of foreign Amber (that is to say, not Prussian) he tested a couple of pieces of Simitite from Sicily, and their specific weight was 1·056 to 1·066.

Amber is insoluble in water, and only very slightly, after long duration, and hardly to perceptible degree save by close chemical examination, in alcohol, sulphuric ether or acetic ether. It is, however, soluble in chloroform after very lengthy duration, so Mr. Heron-Allen tells me. I have never myself succeeded in dissolving it completely in chloroform. There has always remained an insoluble residue.

In concentrated sulphuric acid, however, Amber is soluble, but it must be crushed into fine particles for the acid to have a proper effect upon it.

It can be completely decomposed in hot nitric acid.

These qualities of insolubility afford an easy test for distinguishing real Amber from other similar resins.

Amber can also be slowly heated, and when soft and swelling, yields an agreeable and very characteristic aromatic odour.

On the conduct of Amber in the mediums of solution, Helm made various experiments, which did not confirm the generally accepted statement that alcohol and ether only absorb 10 to 12 per cent. of the soluble parts of Amber. The proportions of its dissolubility, he says, are greater. From the clear bright to the golden-yellow Amber, he proclaims the solubility to be thus: in ether, 18 to 23 per cent.; in alcohol, 20 to 25 per cent.; in turpentine, 25 per cent.; in chloroform, 26 per cent.; and in benzine only a trace.

He then goes on to state, in the paper that he read before the Pharmaceutical Society in Berlin in 1877, that the bone-coloured Amber has a certain power of resistance to mediums of solubility, its solubility being in ether 16 to 20 per cent. (against the golden 18 to 23), in alcohol 17 to 22 per cent. (against the golden 20 to 25). If the etheric alcoholic extract of Amber is evaporated, there remains, says Helm, a considerable triturable resin, which possesses a particular amber scent of very high grade.

Amber can be melted, but not actually liquefied, and requires a high temperature, Professor Bauer giving it as 280° to 290° C., Friend at between 600° and 615° F. Fictitious Amber has a far lower melting-point, and can therefore be easily detected.

There are thrown off in the melting process white fumes, oil of Amber, and succinic acid. These are aromatic, but very irritating to the throat of the operator. This analysis is by no means a recent discovery. Georg Agricola made the same observation nearly four centuries ago, on the residue of distilled Amber. If the operation be managed by a gentle heat, cautiously conducted, and the quantity of Amber be considerable, the products may all be obtained separately, by changing the receivers. It is usual, however, to receive them in the same vessel, and afterwards to rectify by a gentle heat; the acid being partly discoloured by this rectification. The oil, which becomes black at the end of the operation, on account of the carbonaceous portion, may be rendered clear and light by several successive distillations.

This analysis shows that Amber consists of a large quantity of oil rendered concrete by an acid, and that it likewise contains a very small quantity of earth, whose nature has not been yet examined, with a few particles of iron.

The oil of Amber appears to resemble essential oils in volatility, smell, and inflammability; it is capable of forming a soap with alkalis. In fact, the essential oil of Amber will unite

with caustic ammoniac, and forms by simple mixture and agitation a kind of liquid soap, of a milky white, and very penetrating odour, known in pharmacy by the name of *Eau de luce*.

The residue in an experiment of this sort is a black lustrous charcoal or bituminous substance called colophony of Amber. This is the main ingredient in what is commercially termed Amber varnish, as it is quite soluble either in turpentine or in linseed oil, and then dries quickly and with great hardness.

When set alight, Amber will burn with a bright yellowish flame, variegated with green and blue, discharging a considerable amount of soot, and throwing off the aromatic odour already alluded to.

Another substance known as Amber camphor, crystalline pyretine, or volatile resin of Amber, can be obtained as a yellowish light sublimate, towards the end of the process of the destructive distillation of Amber in close vessels; it comes over after the last portion of the oil, and is found in the neck of the retort.

In order to distinguish chemically between the different kinds of Prussian Amber, and to have a scale of comparison with Amber from other countries, it is not enough to learn the contents of the amber acid, one has also to find out the capacity of the different resins, taking into consideration their different melting-points. Helm divides Prussian Amber as follows:

1. In a resin soluble in alcohol, the melting-point of which is 105° C., it amounts in Prussian Amber to 17 to 22 per cent.

2. In a resin that is insoluble in alcohol, but, on the other hand, soluble in ether, it is 145° C. melting-point, amounting to 5 to 6 per cent.

3. In a resin insoluble in alcohol and ether, but soluble in alcoholic potash of a melting-point 175° C., it amounts to 7 to 9 per cent.

4. Bitumen, insoluble in all mediums of solution, amounts to 44 to 66 per cent.

Amber is one of the few and special solid substances that are fluorescent.

This effect of light was first made clear by Sir George G. Stokes, F.R.S., who gave to the phenomenon the name of Fluorescence.

The substances in question have the property of absorbing the very short waves of ultra-violet light and transforming them into waves of longer length, and so rendering them visible to our eyes. The best known of such substances are fluor spar (from which the phenomenon derives its name), genuine uranium glass (prepared with nitrate of uranium), first introduced into scientific work by my maternal grandfather, Mr. J. O. N. Rutter; Willemite (silicate of zinc), and Scheelite (tungstate of calcium). To these may be added certain liquids—petroleum for example, lubricating oil, vaseline, and many of the dyestuffs derived from coal-tar, notably pale pink eosin—magdala red—and yellow fluorescein.

In order to test fluorescence, an optical lamp is provided with quartz lenses and a cap of dark violet glass “to cut off all the visible light except a little violet that unavoidably accompanies the invisible ultra-violet waves.”¹

Under a beam of light so projected the various substances exhibit a more or less vivid light in the darkness.

The most highly fluorescent of all materials, leaving radium wholly out of consideration, is platino-cyanide of barium, a pale yellow powder, which in the ultra-violet ray emits a brilliant light far greater than that exhibited by any other material, solid or liquid. Moreover, a screen prepared with this crystal is almost permanent, and can be made to produce its wonderful light after intervals of very many years' disuse.

There is a phenomenon closely associated with fluorescence known as Luminescence, in which substances raised

¹ See “Light Visible and Invisible,” by Sylvanus Thompson

to a very high degree of heat or in a state of decay emit light, but the only way in which Amber produces this type of light is when it is oxidising, and then to such a feeble extent as to be practically immaterial.

In fluorescence I have made certain experiments resulting in evidence that of all forms of Amber, Rumanite is by far the most important in the emission of light under the ultra-violet rays, and that Gedanite, a pseudo-amber, is, on the other hand, the very least in such importance.

Next to Rumanite comes the osseous Succinite, and the clear Succinite very much lower down in the list.

My own experiments being, however, wholly inadequate for scientific purposes, I have submitted a long series of examples of Amber to the National Physical Laboratory at Teddington, and the Director of the Physics Department has been good enough to make a careful examination of the fluorescence of all my specimens.¹

He says that "all of these fluoresce with a bluish-grey light, the intensity of fluorescence ranging from that produced by ordinary lubricating oil at the maximum to that emitted by vaseline at the minimum." Such a long series of experiments has, to the best of my knowledge, never hitherto been carried out, and in fact the fluorescence of Amber has been overlooked by the majority of writers on the subject.

The order of fluorescence, according to this most interesting and valuable report from Teddington, runs as follows:

1. Yellow Rumanite.
2. Osseous Succinite.
3. Mottled Rumanite.

(There is *very* little difference in light between 1 and 3.)

¹ The apparatus that I used consisted of a quartz-mercury burner, used with a Home Sun lamp supplied by the Hanovia Quartz Lamp Co., and with, of course, a diagnosis filter, but I had no apparatus by which I could tabulate the different degrees of fluorescence on the part of the different specimens of Amber.

4. Blue Simeite from Catania.
5. Red Burmite.
6. Unpolished Succinite from Latvia.
7. More or less clear golden Succinite from East Prussia.
8. Cloudy Succinite, partially clear in places, from Denmark.
9. Semi-clear golden Succinite from Esthonia (three different examples, all fluorescing to about the same degree).
10. Quite clear golden Succinite from Lithuania.
11. The same from Prussia.
12. Dark brown Amber from the Behring Sea.
13. Siamese (so-called "luminous") Amber.
14. Ordinary Simeite, opalescent.
15. Gedanite.
16. Dongola Gum.
17. Unpolished and heavily-crusted Succinite from Latvia.
18. A Perforated Bead of very dense osseous Amber, obtained in Omdurman market, near to Khartoum, with many similar beads, and stated to have come from Germany. It may very possibly be a form of copal of great age, and not Amber at all. Similar beads are to be obtained in Zanzibar.

My old friend Professor Sylvanus Thompson, F.R.S., assured me that under the infra-red or calorific rays there is practically no change in the appearance of Amber.

Questions concerning the commercial value of Amber I have not dealt with in this book for two reasons. The values, of course, vary from time to time, but a very full statement concerning the commercial importance of Amber is contained in Bauer's "Precious Stones," to which book I have referred in other places. The learned author deals, in somewhat elaborate fashion, with the cost of Amber, and with the money that is received from its sale. He treats the matter so fully and so completely that there is no occasion for me to venture into a field of information with which I cannot possibly claim to have any special acquaintance. Only a German writer, aware of the variations of the market in Amber, could deal in satisfactory fashion with such a topic. (See pp. 547-550.)

THE HOME OF SUCCINITE

EASTERN PRUSSIA is the home of true Amber, but today that phrase needs explanation and variation.

What was at one time called Prussia, or spoken of as the Baltic Provinces, is now the possession of various Powers, youthful in their age as separate European countries and in their present condition, but representing ancient nationalities that have renewed their youth, have attained to liberty and independence, and are fast justifying all the best hopes of their friends concerning them.

Lithuania and Latvia, Poland, Esthonia, and the Free City of Danzig, now represent what was for centuries called by other names, and ruled by other Powers.

Much of the Amber coast is still German, belonging to East Prussia, and this includes the famous peninsula of Samland, from whence the best of the Northern Amber derives its generic name.

Dr. G. C. Berendt, as the result of his investigations, places the centre part of the primeval amber forests near to and above the extreme north-west point of Samland, latitude 55° and longitude 19° to 20° E. of Greenwich.

He says, of all the Baltic shores, the west of Samland and the north coast of the Frisches Sandbank, the parts lying nearest the point he has fixed on, supply Amber in the greatest abundance, and have always done so.

He points out also that in this region storms from the north-west for Samland bring in the Amber from the sea in the largest quantities. Beyond Brusterort the supply is little in Courland, in Pomerania much less.

The Frische Nehrung is a long spit of sand-dune which

projects out from the neighbourhood of Danzig, and cuts off a part of the gulf, forming a lagoon known as the Frische Haff. On the other side of the peninsula of Samland extends another and longer sand-dune known as the Kurische Nehrung, and this extends almost up to the port of what used to be called Memel, but which now, as it forms part of Lithuania, is known as Klaipeda. This sand-dune encloses a far larger lagoon called the Kurische Haff, the shores of which are mainly in Prussia, but all the northern and the greater portion now belong to Lithuania. The river Vistula forms a boundary of the so-called Polish Corridor to the sea, and this corridor possesses a third sandbank, called Hela, that extends southwards towards Danzig and part of the Polish Corridor, and part of the possessions of the Free City include the river Radoune, to which allusion has been made (see pp. 30 and 54).

Königsberg, the capital of East Prussia, is situate almost inside the peninsula of Samland, which juts right out into the Baltic with these two long reefs or sand-dunes, one on either side of it, and to the north of Samland lies the submerged Amber reef.

The Kurische Nehrung starts from Kranz, due north of Königsberg, and extends, as just stated, north, almost to the gates of Klaipeda.

Hence it is that Lithuania and East Prussia, with Latvia and the Free City of Danzig, are the only places from whence any considerable amount of Amber is exported.

The total world production of Amber is about 250,000 lbs. per annum, and of this 220,000 comes from the Amber coasts of the Baltic.

Included in the Amber district is the province of Courland, now part of Latvia, with its important ports once known as Libau and Windau, but now in Lettish as Liepaja and Ventspils, and from these two places Amber is also sent forth.

It is also found on the shores of the Jutland peninsula and in Schleswig-Holstein. It can be collected on the islands of Saare Maa and Hiiu Maa and on some of the smaller islets, such as Muru. It is washed up on some of the shores of Livonia, which is now part of Latvia, and is found to a meagre extent in Pomerania and Mecklenburg, but Danzig and Klaipeda are the centres of the commerce in Amber, only rivalled by Königsberg, and all the shores of this interesting district produce Amber, and are therefore closely protected by State laws.

Some is found on the west of France, some on the east of Suffolk, as hereafter specially mentioned, but it is probable that all this has been brought by the waves from the Baltic Sea, and only finds its resting-place on French or English coasts when the waters recede and leave it on the shore.

The records concerning the rich Amber field of Samland and its commercial value begin in the fourteenth century, so Dr. Klebs has ascertained.

Amber seems to have been, in early times, the absolute property of the finder. Later on the Dukes of Pomerania claimed the Amber for themselves as far as to the confines of Danzig.

When the "Ritterorden" (Order of Knights) took possession of Prussia in the thirteenth century, not only did it take over the monopoly of the Dukes of Pomerania, but it extended this monopoly over the entire line from West to East Prussia. From this time onwards, the German "Ritterorden" (Order of Knights) was the rightful owner of every piece of Amber found, and any finder was obliged to give it up to the Knights for a small settled recompense. This law is still practically in force, and all the changes in the production and sale of Amber during the last eight hundred years have been effected by it, with the usual result, dissension between producer and buyer—on the one hand, says Dr. Klebs, with the continual striving of the

producers to turn the prerogative into a direct monopoly in order to keep the quotation of price in their own hands, and thus to rule the market, and, on the other hand, with the efforts of the manufacturers to break through the monopoly so as to procure their raw Amber as cheaply as possible. All the time there was the earnest endeavour of the reigning Government of the country to do away with abuses and to do justice to both sides.

After having parted with their Amber fishing rights on the coast of Samland to the Bishop of Samland in 1257, and those on the coast of Danzig to the Danzig fishermen in 1312 and to the monastery of Oliva in 1340, the Knights attempted to declare that the contracts they had made were only annual, and to get the monopoly back into their own hands. Not until after many unsuccessful attempts did they succeed in overcoming all the difficulties in the way, and gaining their purpose in the middle of the fifteenth century. When, in 1466, a large proportion of territory was alienated from the Order, these alienated lands obtained a license by Polish law to extract Amber from their own ground, a right which West Prussia succeeded in obtaining also on the partition of Poland, in 1773. Accordingly the Pomeranian inland Amber monopoly is limited to East Prussia and the diocese of Pomerania, while in other inland places the right of amber mining rests with the owner of the soil. It is otherwise with the right of collecting Amber by the seashore; on the shores of Jutland, Schleswig, Mecklenburg, Rugen, and Neuvorpommern, Amber is the property of the owner of the shore. Along the shore from the mouth of the Weichsel to Polsk, near Danzig, Amber is the property of the City of Danzig. In all other parts of the Baltic coast of West or East Prussia, as well as in the Pomeranian districts Neu-Stettin, Dramburg, Belgard, and Butow, Amber belongs to the State, it is a State prerogative.

The Order of Knights exercised the prerogative over the

lands which remained to it in 1466 with the greatest rigour. Any suppression of Amber was punished by hanging on the nearest tree; so that all the communities along the shore groaned under this severity. The Order conducted the sale of the Amber in an eminently business-like manner. It erected in Bruges, Lübeck, Augsburg, and Venice, warehouses for assorted stocks of Amber and promoted the formation of Guilds of amber-turners. There had been a Guild of amber-turners from very early days in Bruges, followed by a similar one in Lübeck. The work was, however, limited to the making of rosaries, hence the name of paternoster makers.

In 1399 there was in Königsberg a very skilful amber-cutter, who worked for the Grand Master, making artistic reliefs for altars, etc., which were composed of precious metals and encrusted with gems. In its own country, however, the Order prevented the establishment of any independent amber works, for fear that this might facilitate the smuggling of Amber. Even at that time there was such severe friction between the Guilds and the Order that the Hanseatic League and the Duke of Burgundy had often to mediate between the producers and the buyers.

In course of time, the Order found the sale of raw Amber too troublesome, and decided, at the beginning of the sixteenth century, to place the whole of this trade into the hands of an agent—to farm it out, in fact. There were, however, so many complaints against these agents, that in 1524 the parliament in Nürnberg was obliged to interfere.

In spite of this there was no actual improvement. Not till Duke Albrecht farmed the entire raw Amber trade to a Danzig company did the buyers seem to be satisfied; but not those who had farmed it out, for we find that the successors of Duke Albrecht endeavoured for a whole century, but in vain, to annul the contract. The Great Elector, however, succeeded in getting the amber prerogative back

into his own hands, by payment of a large sum in compromise.

He moderated the severity of the amber laws by making the punishment dependent on the quantity of Amber stolen. Other regulations, however, had the effect of encouraging mutual denunciations to such an extent that family life was disintegrated and destroyed, and in consequence the coast villages became gradually demoralised and impoverished.

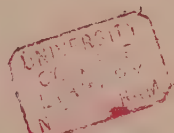
The exercise of this State prerogative remained until 1811, when, the returns having diminished steadily since the beginning of the nineteenth century, the Government decided again to place the raw Amber trade in the hands of a chief agent.

This arrangement, however, gave rise to so many complaints and petitions to the Government on the part of the buyers, that the former decided to accede to them.

The year 1837 was a turning-point in the history of the amber trade. The State farmed out the mining of Amber along the shore to the adjacent communities. In consequence the Samland shore villages began to prosper, and rose from the most miserable condition to be flourishing communities. This prosperity went on increasing year by year, and the revenues of the State increased at the same time.

In the year 1860 the amber trade received a great impetus through the enterprise of skilful merchants, Stantien and Becker.¹ In partnership they went to work with such energy and perspicuity as to get the amber trade as a practical monopoly into their hands. Again, however, the complaints of the manufacturers against the firm of Stantien and Becker became so urgent that the State decided to purchase the whole stock-in-trade of the firm. Thus, on April 1, 1899, the amber prerogative passed again into the hands of the Prussian State.

¹ Hereafter referred to. See pp. 115, etc.



In dealing thus generally with the industry, we must not overlook the history of certain amber Corporations as Dr. Klebs sets them out.

THE BRUGES CORPORATION.

The earliest records, he says, of the Bruges Corporation date from the year 1302, the title of the Corporation being "Makers of Pater Nosters." The Lübeck Corporation went by the same name, the chief manufacture being that of beads from Amber for making rosaries. Likewise in records of the Bruges Corporation the Makers of Pater Nosters are mentioned in the years 1328, 1361, 1381.

The Bruges Corporation had an appointed church for the holding of Divine Service. In 1420 there were 70 masters and 400 persons in all, including the one or two apprentices and three journeymen that the masters were each allowed. Quite a considerable export trade was done; the combined works of Lübeck and Bruges supplying the whole of Christendom with rosaries. The correspondence with the German Order of Knights during the fifteenth century concerning the raw material is very stirring; all kinds of complaints were made through powerful advocates to the Duke of Burgundy and to the Hanseatic League.

THE LÜBECK CORPORATION.

The oldest amber Corporation on the Baltic Sea coast was that of Lübeck. The patron of this Society was St. Adalbert, the first apostle in the amber country. The Makers of Pater Nosters were mentioned in the Burghers' Register from the year 1317 to 1355. The oldest scroll of the Corporation is dated 1360; they were completed by the Town Council on February 27, 1365, and September 21, 1385. In 1400, on November 25, a decision was made in regard to the purchase of Amber, in 1470 it was extended, and finally, on

September 25, 1510, the Makers of Pater Nosters assumed an entirely new position.

From this time there is not very much known of the fate of the Lübeck Corporation. It was manifestly in decline from the time that the further eastern Corporations flourished. But the Lübeck Corporation certainly lasted until the nineteenth century.

In the records of the Guild of Lübeck, under the date 1692, Pelka found an allusion to two eminent masters of the Guild, by name Johann Segebad and Niklas Steding. They are stated to have died previous to this year 1692, but they had left behind them two fine crucifixes, which were regarded as worthy of special mention.

There was also a Guild for Amber-workers at Wismar, but there is no information available concerning the history of the Guild, merely that there are mentions of paternoster makers, in the same way as these particular workers are alluded to in the Guilds at Bruges and Lübeck.

THE POMERANIAN CORPORATION.

Among the towns near the Pomeranian coast those of Kolberg, Köslin, and Stolp possessed an amber Corporation. In regard to the first two, unfortunately, little is known, because documents in connection with them no longer exist. From a deed we learn of the existence of the Kolberg Corporation in 1584, and a seal which it received bears the figures for the year 1702. The deeds connected with Stolp mention that the Kolberg Corporation ceased to exist in 1808.

Only one mention of the Köslin Corporation has been found by Pelka in a search he made concerning the Princes of Pomerania, circa 1555. In it reference is made in Old German to "united, dutiful, time-honoured Guild Masters and mutual brothers of the Amber-working district of Stolp, Kolberg, and Köslin." From these it would appear that

the Kolberg and Köslin Corporation founded a local Guild, having its headquarters at Stolp.

It is not known in what year the Stolp Corporation was founded. It is at all events older than the Danzig Society, for in the years 1480-82 the Order of Knights, wishing to prevent the establishment of the Danzig Society, pointed out to the inhabitants of Danzig that the Pomeranian towns, and particularly Stolp, already possessed an amber Corporation. In 1534 the amber-workers of Stolp received through an Edict of the Duke Barnim the Elder the right of a brewery, and this was a proof that already at that time the organisation must have attained a position of affluence.

Afterwards they attained a position above other craftsmen, and the Duke Johannes Friedrich confirmed their rights by two Edicts, of May 20, 1574, and March 24, 1575. In these it was determined that the amber-workers were not to be considered merely as ordinary workers, but to be considered as a body of merchants and to have social intercourse with other persons trading as merchants, and to deal with other merchants, and they received in addition several other privileges. The Council of Stolp imposed a heavy fine upon anyone who refused to grant the privileges of these Edicts. The Stolp amber-workers then adopted the title of "Merchants and Amber Trading Corporation of Stolp." These rights were confirmed by succeeding Pomeranian Dukes until the time when Stolp came under Brandenburg-Prussian rule, when the Hohenzollerns repeated the recognition of the Amber Trading Corporation of Stolp, on January 18, 1654.

The Corporation of Stolp was in earlier times closely associated with Danzig, and in 1583 and 1584 a Union was formed between the four Societies of Kolberg, Stolp, Danzig and Elbing, and Danzig was made the central meeting-place.

When, later, Stolp came into the Prussian State an agreement was made with the Königsberg Corporation to

endeavour to obtain Amber at a cheaper rate from the authorities, and on November 3, 1702, the two Corporations amalgamated. This pact of friendship of 1702 was not altogether untroubled; up to the time of the Seven Years' War on one occasion, and twice at the end of the eighteenth century, the Königsberg Corporation tried to obtain the total supply from the Königsberg Chamber of Amber for themselves only, against which Friedrich II. and Friedrich Wilhelm II. issued Edicts to uphold the rights of Stolp. The Stolp Corporation finally dissolved in 1883.

THE DANZIG CORPORATION.

The amber-working Corporation of the Hanseatic town of Danzig appears to have been for a long time the most important among all the eastern Corporations. From papers and documents which have been left fairly complete, we can obtain a good idea of its condition.

The Danzig Society was founded in 1477. In 1466 the Order of Knights had to conclude the second disastrous Peace of Thorn with Poland by which Danzig was lost to the German Order and came under Polish sovereignty. The industry in the town began at once to thrive. The Order tried in vain to prevail upon the King of Poland to prevent the settling of amber-workers in Danzig. In 1477 the number of amber-workers in Danzig was large enough to form a Society to which the Council granted a charter. This contains the regulations that were adopted between 1522 and 1616. In the Danzig documents appear many allusions to the efforts of aggressive Capitalists to give Craftsmanship the lowest possible reward for its labour and to bring in certain restrictions. The fight between Capital and Craftsmanship began early enough in Danzig, shortly before the middle of the sixteenth century.

As one merchant lessee, Paul Jaski, in 1533 had concluded a lease-contract in regard to Prussian Amber with Duke

Albrecht, he had next to enter into an agreement with the Danzig Corporation, according to which he pledged himself to supply it at a reasonable price. Although little is known of the matter, a Petition supplies the information that some of the masters being dissatisfied with the terms, complained to the Council of the town, and that Paul Jaski as a result refused to supply the Amber. Quite at a loss thereby, the Society begged the Council of the town to reconcile them with Jaski, as they engaged to keep to the old terms. They further declared they would take disciplinary measures against the complainants. Now as Paul Jaski and his partners had a market for the best Amber, it was to their interest to dispose of the inferior Amber to the willing buyers of the Corporation, but the merchants also had a desire to trade with finished Amber. The masters who drew up the Petition of 1538 promised to abide by Jaski's conditions. This was a weapon in Jaski's hands. He concluded a new agreement in 1546-48 in which he promised to sell the Amber, but stipulated that the Corporation should only be allowed to sell the finished goods to himself. The masters promised to be answerable to one another for payments, and to exercise inspection over one another to guard against anyone selling anything on their own account. Through this contract Jaski had the Corporation completely in his power, for he had not promised, as the Lübeck merchants had promised the amber-workers, to buy a fixed quantity. Very soon the Corporation saw in what an unfavourable position they had placed themselves. They complained to the Council of the town that they were as severely oppressed by Paul Jaski as the Children of Israel had been by King Pharaoh. The Council pleaded with Duke Albrecht that he should sell one-third of his Amber direct to the Danzig amber-turners, but this was in vain, for Duke Albrecht wished to remain at peace with his lessee. At last, in 1552 and 1555, the people of Danzig complained to Duke Albrecht in

person. Jaski remained victorious. It is true he lost his contract with the amber-turners, but he sold no Amber to them, and they were in great distress. No further information is to be had as to what took place in regard to these affairs.

In the year 1636, Wladislaus IV., King of Poland, however, commanded Israel Jaski to sell Amber to the Corporation at the same price at which he sold it abroad.

In the Danzig Guild there were constant quarrels between certain outside workers in Amber who had not been admitted to the Guild of Amber-workers, and who, the Guild said, were doing great damage to its members. Every possible effort was made to prevent these unauthorised carvers from doing their work. Unfortunately for the Guild, some of these men were admirable sculptors, and far better workers in Amber than the members of the Guilds themselves. There was one particularly mentioned, so Pelka discovered—Christoph Maucher, who was related to an artist in ivory named Johann Michal Maucher, and this man Maucher had made such a name with his carved Amber that the Council of the town of Danzig itself gave him orders for his work, although, as a record of 1705 clearly shows, he was neither a master-man in the Guild, nor even a burgher, but his work was of such importance that those who were most determined to prevent him from succeeding were obliged to regard him in a different light from that in which they regarded the members of the Guild, and to give him instructions for his masterpieces of artistic work. Unfortunately, although there are many allusions to Maucher's work in the documents, there is nothing that can now be definitely attributed to him.

THE AMBER CORPORATIONS OF ELBING AND KÖNIGSBERG.

The oldest Charter of the Elbing Corporation dates from the year 1539. In 1546 it was extended, and in 1699 a New Charter was received from the Town Council.

When the Elbing Corporation was dissolved, if at all, is unknown. In the year 1690 the amber-turners certainly requested the Council to approve the closing of the Society, and also asked them to make binding some privileges of some marriage customs of the masters. This, however, met with a refusal.

Judging from local conditions, the trade seems to have come to an end in the eighteenth century.

In Königsberg, in conformity with mercantile ideas which influenced statesmanship and finance at that time, the Great Electors were the first to permit with great readiness the formation of an amber-turners' Corporation.

In the Königsberg Guild papers there is an allusion, Pelka tells us, to the test that was given to an apprentice to see whether he was able to work Amber in satisfactory fashion before he could be received as a fully accomplished workman. It is dated 1745, and it says that he must be able to produce a quarter of a pound of perfectly round beads, without the aid of a compass, but by the eye only, and that they must have the holes bored through them straight and equal.

An important member of the Königsberg Guild who is particularly mentioned in the archives, says Pelka, is Christian Porschin. He is stated to have invented, in 1691, an amber burning-glass, which, according to the document, was much quicker in action than were the glass lenses, and he had conceived the idea of preparing eye-glasses for spectacles from Amber, "such as had never been seen before," inasmuch as he seems to have possessed some special method by which he could render Amber transparent.

This Guild, which opened in 1641 with only two members, had increased by the year 1755 to sixty-eight members (these figures refer to masters only). It was therefore the strength of that of Bruges in 1420.

By 1790, however, the number of workers in Amber who

were deserving of any record had come down to few persons. There are only two men worthy of mention in the Guild of this time whose names Pelka records—Christian Benjamin Döhring and his stepson, Christoph Döhring. Both of these were regarded as able craftsmen, but the decline of fine craftsmanship in the amber trade was rapidly setting in, and when the craft was deprived of the support of the Elector, it appears to have gone to pieces.

The Königsberg Corporation was dissolved in 1811 for the same reason as that of Stolp.

There is little inducement, says Otto Pelka, who has so closely investigated the records of these Amber-working Guilds, to go more deeply into the story of their development. Their history, says he, is that of many similar Guilds—petty jealousies, eternal envyings, ceaseless bickerings, and an openly acknowledged intermarriage of the members of the Guild, in order to keep out strangers. The records are full of such allusions, and all these disagreements brought about the end of the Trade Guilds. They had an entire lack of will, and were unable to advance with the times. Gradually, Capital ceased to take an interest in their work, and they slowly died in Prussia, the last of all to perish being the Guild of Stolp.

The earliest author to deal in anything like satisfactory fashion with the origin of Succinite was Philip James Hartmann, who in 1677 published a tract entitled "*Succini Prussici Historia Physica et Civilis.*" He was a man who took infinite pains to obtain satisfactory information respecting Amber, and several times he visited portions of the coast of Prussia, where it was found, and many places on the shores of the Baltic Sea. He paid his two notable visits in 1641 and 1663, and he appears to have spent a very considerable time in the neighbourhood, gathering up all the information available concerning what to him was a very mysterious substance, and in his Latin tract, he sets forth, first of all, the informa-

tion that other people had written about Amber, and then his own theory, coming to the conclusion that it undoubtedly was a petrified vegetable juice.

His treatise was the subject of a series of Discourses to the Royal Society in 1697, delivered by the celebrated Dr. Robert Hooke (1635-1703), who was eventually Secretary to the Royal Society, but Hooke's Discourses on Hartmann's book were not published until after Hooke's death. His papers were placed in the hands of Richard Waller, F.R.S., who edited from them in 1705 a folio volume of works, and prefixed to it a Life of the author, which was to a certain extent, we are told, autobiographical. Waller, however, died before the second volume could appear, and some of the Royal Society's remaining Lectures were issued by W. Derham, F.R.S., as "The Philosophical Experiments and Observations of the late eminent Dr. Robert Hooke, 1726." There, on pages 315 onwards, we find Hooke's Discourses concerning Amber, founded upon Hartmann's book, and also upon an important work by Thomas Bartholine, published in Copenhagen in 1673, and called "Acta Hasniensia." Bartholine was one of the many authors who insisted that jet was a form of Amber, and called it black Amber. He was also evidently of opinion that ambergris had the same origin as yellow Amber, even though it had been declared to be from the sperm of a whale or the semen of an elephant, or the dung of certain plants, or as a kind of bitumen, oozing out of the bottom of the ocean, because Bartholine states that some specimens of it had been found in Prussia in exactly the same places as Succinite was found, and he also believed that there were trees to be found in the New World yielding odoriferous gums, from which Amber was produced.

Hartmann describes for us the ancient procedure, the scooping up of the Amber or *Schöppen* by means of the net (*Käscher*) fastened at the end of a pole some twenty feet long.

He alludes to the cold in Samland and to its intense severity in November and December, the most productive months; speaks of the leathern cuirasses with their deep pockets in which the fishermen put any Amber they may discover, and describes how they become frozen in the icy waters, and have to be thawed before they can be taken to their huts or put on again to the work, and how, for this reason, big fires are kept up on the shore.

He speaks of fishermen swept away by the sea, of some connected with each other by ropes for protection, and of others who had to use their long poles dug deep into the sand to protect themselves against the force of the waters. Even so, the returns were often quite small, and the risks of obtaining the Amber were very great, yet, two hundred years ago, these were the *only* courses adopted for gleaning the Amber from the sea, and such rude attempts had been in force from what the fishermen called "time immemorial." There were variations when the sea was clear, because sometimes the Amber could be seen in the depths and loosened by spears or poles, and then caught in the net. Such plans were adopted by those who could go out on the sea and come near to the Amber reef with their flat-bottomed boats, but this was still more precarious and uncertain work, and attended by a great risk.

Moreover, it was only on the very occasional times when the water was clear and more or less tranquil that this loosening could be adopted, and these times occurred very seldom, and were also of very short duration.

It was left for Stantien and Becker to introduce modern appliances, such as dredgers, and also to start systematic mining in Samland for the precious deposit.

This is not to say that mining was unknown in Samland before the days of this enterprising firm.

Casually and occasionally, the greensand had been pene-

trated and the *Bläue Erde* or Blue Earth,¹ the great source of Amber, examined, but the work had not been carried out with any system or to any serious extent prior to the advent of Stantien and Becker.

Even where mines had been excavated to some depth, the workings were often flooded and all the labour of the miners utterly lost; and even when the Blue Earth was reached, the Amber was not properly gathered, the smaller pieces hidden amongst the debris of fossil wood and remains of prehistoric saurians being often overlooked, and, in consequence, the result of the labour was far less important than it should have been. Stantien and Becker altered all this. They used pumps to pump out the water, they supplied the workmen with suitable tools for their work, and they appointed inspectors and overseers so that all the precious gum should be obtained, and none of it lost.

Dr. Felix Dahn, in one of his books on the Bernstein industry, gives an interesting description of the Amber mines:

“ At Palmnicken,” he says, “ we visited the diggings in which, about thirty paces from the domain of the waves, the sea-gold is sought. It is an amazing sight! In the downs, shafts and galleries are made. The fresh water is pumped out. Forty feet under the sea-level the pits are dug, and the perpendicular boring reaches a depth of fifty feet. The workmen stand in three parallel rows, knocking to pieces every clod of the Blue Earth, the stratum in which Amber is usually found. A group of six or eight men is placed under each overseer. While he stands watching, that which is found is thrown into a vessel of water. The men grouped nearest the sea, when they have examined the

¹ In my own collection I possess—

Blue Earth from Oligocene deposits of East Prussia, discoloured by the Mineral Glauconite.

Striped Sands of the Miocene Formation of Palmnicken Prussia.

Blue Earth, throw it with large shovels from the lowest floor of the pit to the higher platform, which is reached by long, narrow ladders. Here the refuse material is taken in charge by a group of men and women, and flung from shovels to the third or uppermost platform, whence it is carted away. All the operations accord with the rhythm of a slow and monotonous melody which the overseers sing. This regularity of movement is intended partly to prevent pilfering, which, however, cannot be altogether prevented, although the miners are carefully searched before leaving the pit after the day's work. It is not astonishing that in the whole range of diggings not less than twenty hundred-weights are raised on many a day. Men, women and children, in all imaginable costumes, in the oddest of attires, shielding themselves against the sharp, whistling winds, digging vigorously or swinging their shovels to the languid strain of the sombre melody—what a singular spectacle is this !”

All the original methods in use in the lagoons of Samland for obtaining Amber were described by Hartmann in 1677 in his book, and he gave a curious illustration of two fishermen with their nets going forth in search of the precious resin. They carried with them, bound about their bodies, capacious bags into which they threw the Amber, and they waded out into the sea, often to a great distance, sweeping the shore with their nets, drawing up the seaweed, and disentangling from it the lumps of Amber. This illustration is reproduced in these pages.

Amber so obtained was called by a local word that may be translated as “scoopstones”—stones scooped up from the sea.

With the fishermen were associated men on horseback called Amber-riders, who in the more marshy districts were able to ride out at low tide far into the water, and carry on a similar search. Lastly there were the divers, who descended to considerable depths where there were sandbanks in which the fossil gum might be found, and they sometimes carried wooden spades by which they could loosen the sand.

Effective storms were welcomed by all these Amber fishers, because they tore up great masses of seaweed from the depths and loosened this plaything of the sea, which, having a specific gravity little less than that of sea water, was carried along on the crest of the wave and often eventually thrown up on shore. After such a storm men would dash into the surf, obtaining in their nets large quantities of the weed, which would be tossed to the shore to be picked over by women and children for fear that the Amber might slip from the entangling seaweed and be washed again away out of reach. In quite a few homes after a November storm, Amber to the value of two or three hundred pounds might be found.

All such primitive methods of extracting Amber were, however, useless as soon as mining for it in the Blue Earth could be made to pay. It was Moritz Becker who struck out the new methods for procuring Amber. Instead of fishing for it, he instituted systemised diving; instead of picking over the seaweed, mining; while in the depths of the sea he attacked the stores of Amber with steam dredgers. He it was who founded the steam-dredging station at Schwarzort, the diving station at Brüsterort, and the mines at Palmnicken now carried on by the Prussian State. Great masses of Blue Earth were brought up from these workings, thoroughly washed by means of enormous volumes of water, which carry away the sand and clay through sieves and drains, and retain the Amber.

The Amber procured in this way, however, is very much weathered on the outside, making it impossible for the manufacturers to test it as regards its colour, flaws and other peculiarities, and to fix the use to which it could best be applied. The Amber which the waves in their constant motion have polished against the sharp sand, and which the heavy surf has pounded and split, is very much preferred as an article of trade. Therefore, means have to be taken to

impart similar qualities to the mined Amber. What is done by the waves on a large scale is copied at Palmnicken on a small scale. The Amber taken from the Blue Earth is placed in great revolving barrels along with sand and water; these are kept in motion until the dark surface is removed, and the Amber has assumed a similar appearance to that taken out of the sea. It is then taken to the sorting-rooms of Königsberg, where the chisel of the workman takes the place of the surf, and completes the cleaning process.

Moritz Becker, of the firm of Stantien and Becker, at first, however, found himself in some difficulties. When his brilliant idea placed Amber mining in the Blue Earth or Glauconite on a paying footing, he suddenly flooded the market with such enormous quantities of Amber, that it was impossible to get rid of it.

He therefore introduced a system of sorting the raw Amber, in order to allow all branches of the Amber industry to buy only that sort of Amber suitable to their own trade. So every manufacturer had the advantage of being able to concentrate his buying power upon the quality suitable to his own use, whereas formerly he had been forced to buy along with that other qualities he could not use for himself, but had to re-sell. This sorting system of Becker's still prevails in the amber trade of today, and has been retained and extended under State management.

The subdivisions of raw Amber for trade purposes fall under three heads—pieces suitable for the manufacture of articles connected with smoking, pieces which can be used for beads and other ornaments, and pieces which on account of their small size can only be used to make varnish. The pieces of Amber from which cigar and cigarette holders and mouthpieces for pipes are made are called *Fliesen* and *Platten*; the former are the thicker, the latter the thinner pieces. In the manufacture of ornaments and beads,

varieties which the Germans call *Grunstein*, *Bodenstein*, *Rund*, and *Knibbel* are used. To make lacquer or varnish, other sorts are used. Within these chief groups, there used to be recorded about 250 different trade sorts (now brought down to twelve), distinguished partly by their size, and partly by the colour and purity of the Amber. From these, beads were made, from the coarser ones used to export to less civilised countries to the pale yellow olive-shaped beads intended for necklaces to gleam on the throat of an English-woman or a Turkish lady. There are also the clear-cut beads intended specially for trade in France and Russia, and the beads used for rosaries by Catholics, and for those long strings of beads used in Turkey and by Mahommedans, both men and women. Other beads are sent to China to be used in the strings of beads carried in the monasteries.

What is known as root of Amber comes from this part of Prussia, and is also found in Esthonia. The Succinite has become impregnated with salts from the soil, and has entirely lost its yellow colour and its transparency. When first found, it is covered with a hard, dark crust, and resembles, except in weight, an ordinary pebble. When polished, it is found to be of a rich brown mottled appearance, almost like marble. It has scarcely any fluorescence, and would not be recognised by the ordinary observer as Amber at all, until the tests are applied to it, and the discovery is made.

Reverting to the main Amber industry in the sixteenth century, the historical researches of Dr. W. Tesdorpf have revealed much fresh and interesting information, and broadly translating from the original German what he has put into print, we obtain the following story:

In the early part of the sixteenth century, it was the Duke Albrecht who owned the royalties on Amber, and desiring very largely to increase them, tried to do it in two ways, first by reducing the cost of production, secondly by endeavouring to find more certain and paying customers,

but in reducing the cost the workers suffered greatly, as their wages were reduced almost to vanishing point, and in consequence they did no work.

Then he tried as Hochmeister to find new and better paying buyers for the Amber. In the year 1518, he concluded a contract for selling Amber with the merchants Niclus Pflaum, George Kramer of Königsberg, Edward Rogge of Danzig, and Claus Lange of Lübeck; unfortunately in this contract a fixed price was not specified. There are also evidences of a contract made in 1521 with the merchants Andreas Granden of Augsburg and Kompagnon Flock of Breslau. Owing, however, to the raising of prices of the raw material through the contracts, the "Pater Noster" Makers, who had been the chief buyers, complained to the Emperor; thereupon Hochmeister Albrecht sent a full note of justification to the Reichstag at Nürnberg.

At last, in the year 1533, Duke Albrecht concluded a contract with three Danzig merchants—Paul Jaski, Vincent Anholt, and George Borcken, who were joined in 1545 by Heinrich v. Achelen, an Antwerp trader, who agreed that his Danzig partners should make use of his trading relations to enlarge the market and increase its value. In these contracts it was determined that these merchants and their heirs should have the three kinds of inferior Amber delivered at a firm normal price. The Duke retained the best Amber for himself, as well as the pure white Amber, this being valued as a medical remedy, and not used for trade.

At this time, through the growth of the Reformation, there was a decline in the trade of rosaries to be made from Amber, and the prices of the better kinds were reduced to some extent in 1550 at the urgent request of the buyers. The agreement relative to this of December 9, 1550, is of the utmost importance because it remained in

force for nearly a century. The Jaski firm had to place 3,000 thalers as security and pay a subscription of 4,000 thalers per annum. If they received Amber over the value of 4,000 thalers they had to pay the overplus afterwards. If less than the quantity of Amber was obtained, they were compensated with material from the forests.

They then received the right of pre-emption on the chief product, and with a fall in the value they were to receive a reduction in price. Nothing was thought of in regard to any increase in value. Later on this was to prove fatal to the Prussian Lords.

The family of Jaski remained for nearly one hundred years the only buyers of Amber, and Duke Albrecht himself must have been very pleased with the profit, which in the course of this period poured a yearly average sum of 20,000 to 30,000 Prussian marks into the Ducal coffers.

Unfortunately this favourable state of affairs changed very suddenly.

With the discovery of the Peruvian silver-mines, there came a great reduction in the value of silver, which affected Political Economy in all its branches. Owing to the fall in the price of silver, the revenue no longer covered the costs of administration and production, and the successors of Duke Albrecht tried to break the contract with the Jaskis, but without any success. Indeed, Georg Friedrich, the guardian of the imbecile Duke Albrecht Friedrich, in the year 1582 retained all the Amber produced, even repudiating the contract in 1586, and tried himself to sell the Amber, but the Jaski family were not willing to give up their rights, because they had undertaken great enterprises, and had opened up extensive new markets in Turkey, Persia, and India. They complained to the King of Poland, who decided in their favour. In 1611 Johann Sigismund was obliged to renew the contract, whereby

these Danzig merchants agreed to a rise in the annual rent of the contract, and instead of paying 4,000 marks as hitherto, now paid a subscription of 10,000 marks, and this met the depreciation in the value of silver. The value of silver, however, continued to depreciate, in addition to which, from 1626 to 1636, the Prussian coast was occupied by the Swedes, so that the amber royalties during the reign of the Elector only resulted in a loss to the State coffers. In the year 1641 the Great Elector was obliged to renew once more the contract with the Jaskis, and over this a great problem had to be faced.

In the year 1642 negotiations were begun with the holders of the amber leases. Friedrich Wilhelm offered them a sum in settlement of 15,000 florins if they would withdraw from their contracts; they demanded 50,000 florins: at last they both agreed, on December 17, 1642, that the Great Elector should pay the Jaskis 40,000 florins within four years, for which he mortgaged several Prussian districts to enable the payment to be made.

Against this, all the documents relating to the contract were renounced and surrendered. The payments were rendered on February 21, 1647, and the Great Elector was freed from all the engagements he had entered into with this Danzig family of merchants.

He then directed his attention, like Duke Albrecht, first to the improvement of the administration, secondly to new sources of supply to assure the greatest possible output of Amber. Following the decrees of his predecessors, the Great Elector brought out an amber ordinance on February 20, 1644. His successors also effected, through new orders, provision for the revenue from amber royalties.

The administration gradually became stricter and more complicated. The remuneration of the officials, however, steadily decreased, and the districts under the officials were

cut down in size in order to make possible a closer superintendence of the whole coastline.

At the end of the sixteenth century there were seven districts under so-called mounted coastguardsmen; to each of whom were given several serving-men to act as subsidiary officials. Up to the year 1811, the number of mounted coastguardsmen grew to eleven, that of the serving-men to twenty-four, having thirty-five districts under them which were distributed from the coast of Polsky, on the Danzig frontier, to Nimmersatt, on what was then the Russian frontier. The districts of the Frische Nehrung and Kurische Nehrung were considerably larger because they were less productive in Amber. The most important part of the coast was divided into twenty-one districts.

The Head Superintendent was called the Amber-master, and lived in Lochstädt until 1580, but from then the place of residence was transferred to German territory. At the close of the eighteenth century the residence was in Palmnicken, and the official took the title of Strand Inspector.

The ordinances of the Great Electors instituted an amber tribunal, which consisted of six persons whose work was to determine against frauds respecting Amber. This tribunal lasted to the nineteenth century. In 1718 it was reduced to four persons.

In the separate districts the Amber produced was gathered together after the collecting, and delivered periodically to Palmnicken. Here a sorting out was undertaken three times a year, the sorted material packed in casks, and at Christmas, Shrovetide, and Midsummer (St. John's Day) taken to the authority at Königsberg who was the State representative.

The inhabitants of the coast during the time from the sixteenth to the eighteenth century were treated with the same severity as during the time of the Order and the Dukes. From 1580 to the time of the Government of Georg

Friedrich, gallows were erected along the coast, on which unauthorised collectors of Amber were strung up without much consideration.

The later Amber Ordinances introduced a scale of punishment according to the quantity stolen, which ranged from beating with rods, imprisonment, banishment, compulsory labour, to the death penalty; every adult being obliged to swear that he would not steal any Amber, and also bound to denounce anyone belonging to him who was guilty of theft.

All persons, including high officials, were obliged to take the oath every three years along the whole coast from Polsky to Nimmersatt.

The result of all this officialism was that the profits of the amber royalties became more and more trifling towards the end of the eighteenth century.

About the time of 1800 the work was run at a loss. This state of affairs led to a complete change in the system, and to a consultation on the part of the Prussian Government as to how they could redress this evil.

The wretched position of the gleaners and the demoralisation of the inhabitants of the coast were also considered, and the opinion was formed that the production of Amber should either be leased to the inhabitants of the coast themselves or to the Amber-working Guilds of Königsberg and Stolp. An examination of conditions abroad in 1802 and 1803 had brought no result. After the war of 1806-7 everything became a question of raising the finances of the State in every possible way. Therefore, the proposition to lease to the inhabitants of the coast or to the Amber-workers' Guilds found little approval in Government circles, because they appeared to be too uncertain and insufficiently solvent. It was desired in preference to lease to an association of great merchants, who would offer a certain guarantee for prompt and regular payment. However, this could not be

done very quickly because the Amber-workers' Corporations of Königsberg and Stolp maintained with great stubbornness their right to be supplied at the cheapest prices. After the Government of Königsberg had given its opinion, Berlin was at last convinced that the Guilds possessed no particular right in regard to Amber, and this was pointed out by Friedrich William III. in an Edict of July 13, 1808. By this it was decided to sell the cheap Amber in a raw condition at a high profit further afield. Against these "decrees of annihilation" the Stolp Guild protested. The members roused themselves with great strength, and deputies from Stolp journeyed at once to Königsberg, obtained an audience with Queen Luise, and on August 2 delivered a Petition to the King in which they cited their arguments.

The Guilds of Königsberg and Stolp then received an annual indemnity of 3,000 groschen to be divided among the separate masters; granted on the understanding that they would make no further trouble. It was only granted however, during the lifetime of the existing members, and not to their successors. In this way, and also through the new conditions of Prussian industry, the gradual dissolution of the Guild organisations was settled.

In 1811 a lease of the Amber royalties was at last taken up by an association consisting of the Minister of State to the Grand Duke of Frankfort, Count von Keller, Privy Councillor Friedr. Parthey of Berlin, and the merchants Johann Gottlieb Schneider, Karl Douglas,¹ and Karl Heinrich Voelsch. Count Keller and Parthey only took a nominal part, Voelsch soon left the association, Schneider died in 1820, so from that time Douglas alone remained, he who had been the guiding spirit and leading head of the whole undertaking. The period of lease was from December 1, 1811, until December 1, 1823.

¹ A German, not a Scotsman.

The payments for the years:—

1811-13	were to be annually	6,000	Rgroschen.
1813-15	” ” ”	8,000	”
1815-17	” ” ”	10,000	”
1817-19	” ” ”	12,000	”
1820-23	” ” ”	15,000	”

payable in quarterly payments. Besides this the lessees undertook the annual payment of the indemnity to the Amber Guilds, as well as the salaries of the coast officials who entered into the services of the lessees.

The compulsory collecting of Amber by the inhabitants of the coast was now brought to an end, and altered into a free working-agreement with the Amber lessees, and the demoralising Amber oath was abolished. There still remained, however, many abuses. The trading in raw Amber remained solely in the hands of the lessees, who made use of this privilege to the fullest extent in order to prevent fraud. In order to protect the Amber-workers' Guilds, the Government caused the lessees to promise that all Amber should be disposed of internally through Königsberg and Stolp or, in the event of the dissolution of the Guilds, to their successors. This met with but little success, the lessees finding other profitable openings. Furthermore, not only was the Amber leased that could be obtained from the sea, but the lessees were permitted to dig open pits for Amber on the sea-slopes. The lessees gained a great part of their production from working these open pits. However, although the Government found the new conditions profitable, the inhabitants of the coast, the coast officials, as well as the Amber Guilds, were abused, and very soon shamefully treated. Therefore, in the years 1812-18 the Guilds again made all their old complaints, and in 1822 again sent a deputation from Stolp to Berlin.

In the year 1823 the first period of the lease expired, and the Government had to provide for a further arrangement

in the matter. It was in vain that the Head President of the province of Prussia, Von Amerswald, put forward a zealous plea, like that of 1802-8, to obtain for the inhabitants of the coast a release from the Amber royalties. It was decided to allow no omission of revenue for the State coffers. Indeed, Douglas threatened not to enter into a new contract unless an abatement was made in the lease of 11,200 Rgroschen for the years 1823-29. This was owing to a fall in the market price caused through the unrest in Turkey, the principal market for Amber. Further, Douglas laid down three important matters to be contained in the new contract: (1) A more confined space for people using the shore, (2) police aid in guarding it by the State police organisation, and (3) the possession by the Douglas officials of full jurisdiction. The first point damaged the economic conditions of the inhabitants of the coast; they depended to a great extent on visitors, who came for the purpose of bathing; the State, in 1816, had itself built a bathing-place at Kranz, so these regulations caused great suffering to the inhabitants of the coast.

At the expiration of the time of this lease a new contract was entered into with Douglas for the years 1829-35, but with a yearly abatement that reduced the amount to 10,000 Rgroschen. During this time the idea of a lease with the inhabitants of the coast gained favour more and more in Government circles, and King Friedrich Wilhelm III. on many occasions requested the Königsberg Government to examine the question closely and to send a judgment on it to Berlin.

After 1834 the question was again closely examined as to whether the inhabitants of the coast could pay for so large a contract as Douglas was enforcing.

This was decided in favour of the inhabitants of the coast, and attention was then given to the method of preventing any damage to the State coffers.

The judgment which the Government received in the matter was in favour of a full abolition of the royalties, and the result was an order of Friedrich Wilhelm III. on May 7, 1836, greeted with unbounded rejoicings, by which the preparation of a lease to the inhabitants of the coast was commanded. The whole coast was now divided into fifty-eight districts. Single lessees were mostly the proprietors of the larger properties adjacent to the coast. The inhabitants of the fishing villages who only possessed small pieces of ground, entered into unions that were recognised by the Government.

The Government had at heart in their new course the best interests of their subjects. Of course, the trading of a number of lessees in place of a single group of general lessees brought an increase of difficulties and with them an increase of working charges which did not really improve the revenue for the State coffers. The prosperity of the inhabitants, however, was increased, and their demoralisation passed away. The clientele visiting the medical waters ran into thousands a year, and a considerable income was derived from these visitors to the baths. What came to pass in the Amber trade with the ending of the monopoly showed that the joy was warranted with which the Reform of 1837 had been greeted. The only time in which the general well-being was marred was when digging for Amber on the sea-slopes was undertaken. The inhabitants, in order to pay for the requirements of such an undertaking, depended on their fishing, which was insufficient. They therefore obtained the help of merchants from the towns, who, taking advantage of their ignorance, took the lion's share of the production. As a result of this kind of robbery, conditions of labour became bad, and a lawless rabble streamed into the neighbourhood of the pits, and threatened the whole region. This reached the ears of the Government, which through police intervention sought to change the state of affairs.

In the disturbances that occurred towards the end of the last period, the police regulations failing to be sufficiently effective, the Government made provisions in the new leasing contracts of 1867 regarding a new method of production—*i.e.*, the digging of pits on the hills of the coast—by excluding it from the contracts, and considered how conditions could be made which, when granted in the contracts, would remove the evil of plundering and bad working.

The rent of the lease for gathering, scooping, and cutting amounted for the period 1867-79 to about 27,000 marks. But now other methods of production were developing, which rapidly increased the annual State revenue. This brilliant result was brought about, as already stated, by the enterprising mercantile firm of Stantien and Becker¹ of Königsberg.

The earliest undertaking of Stantien and Becker was amber dredging in the Kurische Haff. The Harbour Works Inspector at Memel (now Kliepada) pointed out in 1855 that in the course of dredging for widening the ferry in the Kurische Haff, a considerable quantity of Amber had been found in the earth that had been thrown up. The same observation had been made in 1860-61. While dredging, an extremity of the so-called Blue Earth had been struck in which were enclosed large layers of Amber. In 1861, Stantien and Becker made the Government the proposal—involving expenses of 4,000 marks per annum—to undertake on their own account a considerable amount of dredging in the Kurische Haff, even offering to pay 30 marks per day for the dredgers, if they could in return take the Amber thrown up by the dredging. As a result of negotiations the dredging at Schwarzort was given up to Stantien and Becker for the purpose of Amber production from May 1, 1862, until May 1, 1868. They were allowed 6 dredgers, and had to pay 30 marks and work at least

¹ Stantien was a banker, Becker was the partner responsible for the ideas and for their success.

30 days, from May to September, and pay a minimum indemnity of 900 marks. In 1864, Stantien and Becker were allowed 12 dredgers, and the payment was fixed at 75 marks per working day. From this time the working area was from time to time increased in size, and the dredgers and charges increased, until 1882, when a further contract was signed for the years 1882-1900, and the sum of compensation abated to 200,000 marks. The system of daily payment for dredgers had been abolished in 1874, when the sum of compensation was fixed at 213,000 marks per annum. From 1890 the firm received the right to give one year's notice for terminating the contract. In Schwarzort a large dredging colony developed and all kinds of improvements were made for carrying on the work, the number of workers employed being about 1,000, mostly married men. The output of Amber by dredging in Schwarzort amounted in 1883 to 75,546 kilogrammes.

The second method by which Stantien and Becker attempted to obtain Amber was by digging in open pits on the shore-slopes of the coast. Until the year 1860 the only way in which this was done was by a kind of raking (or scraping). In earlier times this was done in a most primitive fashion, and mounted coastguardsmen had to be appointed to oversee the diggers. A geological examination of the Samland coast threw a light upon the conditions of the strata of the seashore, and it was recognised that the position of Amber was peculiar to the Blue Earth strata. Just after 1860 plans were made for operating by means of pits on the coast.

As, after 1867, the State had excluded from the leases the right to dig, it sold this right to certain landowners of the district.

But in 1870 another contract was concluded with Stantien and Becker. They received the right to dig for Amber on the coast of Warnicken from January 1, 1870, until Decem-

ber 31, 1872, for which they paid an annual sum of 15,030 marks. The State compensated the owners for giving up the ground with 20 per cent. of the sum of the lease. A similar contract was concluded with Simon Schneider of Berlin for the term 1870-75, and he was given the right of digging on the coast of Sassau for an annual payment of 36,672 marks.

The most important digging operations, however, were those opened up by Stantien and Becker on the coast of Palmnicken, the working of which was carried on from 1870 to 1876, and in which the new method of payment of so much per acre of the area to be dug was adopted. In the beginning the charge per acre was 15,000 marks per year, and from 1873 it was 18,000 marks per year. From 1867 to 1876 the State coffers received a sum of 337,874.28 marks in payment for the working or digging.

It soon became evident, however, that the digging of open pits was an unsatisfactory method for obtaining Amber, and in 1867 the opinion was formed in Government circles that better results could be obtained by mining.

Between 1873 and 1879 the Government tried experiments in sinking shafts, but owing to it being unable to master the underground flow of water, the experiments turned out a failure and were abandoned.

Stantien and Becker, however, were more successful. In 1875 they were granted permission in a contract to build a mine on property in Palmnicken which they had acquired in 1872 for approximately double its agricultural value. In the first contract a sum of 40,000 marks' annual payment was fixed, and at least $2\frac{1}{2}$ acres had to be worked. The last contract, which was to last until 1901, fixed the sum of compensation at 50,000 marks per acre, and the minimum payment altogether to be 300,000 marks. The firm employed 900 workers in Palmnicken, opened a varnish factory, and

among many other accomplishments, had a railway built with the assistance of the Government which ran from Fischhausen to Palmnicken.

The fourth and last method of production which Stantien and Becker attempted in Amber was that of diving.

An attempt in the eighteenth century to obtain Amber by diving met with just as little success as the earlier attempt at mining. In those days the art of diving had not been developed, and nowadays to carry on diving for Amber without the proper apparatus for pumping air would be regarded as foredoomed to failure.

In 1869 the Königsberg Government invited a public offer of terms for diving on the coast of Dirschkeim and Brüsterort. Stantien and Becker made the highest bid. They received the right to dive on the coast mentioned, using twenty air-pumps for a payment of 30 marks per working day, and for a minimum working period of 120 days, the sum of the indemnity to be 3,600 marks.

Rapid progress was made, and in the next contract the number of air-pumps was fifty, the sum of indemnification 507.50 marks per dozen, and the number of working days fixed at 120. The owners of property contiguous to the coast received a compensation of 20 per cent. of the State revenue, because the Amber taken through diving in the pools reduced the value of their property. All kinds of improvements were made at Brüsterort to make the conditions of the workers comfortable and the carrying out of the work efficient.

Towards the end of 1874 these sea regions were already exhausted; thereupon the firm made use of their right of giving notice of withdrawal as contained in the contract, and now acquired the right of diving on the coast of Palmnicken, as well as neighbouring districts on the west coast, for a minimum sum of 9,000 marks per annum and a payment of 15 marks for the air-pumps per dozen.

The firm of Stantien and Becker produced in the year 1883:

Through mining	88,031	kilogrammes.
Through dredging	75,546	„
Through diving	2,576	„
Total	166,153	„

Consequently there was brought on the market thirty-four times the quantity of earlier times. This gave an unusual opportunity to extend the market. Before the year 1864 Königsberg, Danzig, and Stolp, also Constantinople, and in a less important degree Vienna, were the only places in which the working up of Amber took place. The Prussian towns now took a chief part in the Amber trade.

This state of prosperity, however, did not last long for Germany. Stantien and Becker were now the only important producers of raw Amber, and so an increase in the demand became for them a matter of their existence, and it must be recognised that in all their undertakings they showed a practical spirit of commercial enterprise.

They directed their attention to Vienna, which at the present day, through their efforts, is the chief centre of the Amber trade, and now Vienna Amber goods are sent to all parts of the world—to Paris, London, Constantinople, New York, Mexico, Cairo, Calcutta, and other important cities and countries.

The Turk is, of course, the person for whom the best of the Amber mouthpieces are made. A Turk prefers to smoke a hookah or a narghile, which has a receptacle for water or rose-water, through which the smoke passes before reaching his mouth, by means of which it is cooled and purified. The Turk loves the sound of the bubbling liquid as the smoke passes through it, and he states that it lulls and soothes him like music. The pipe-stem is formed of spiral wire covered with leather, over which another wire is coiled to strengthen the tube; but it is the mouthpiece in which he specially glories.

The narghile is often placed in the centre of his apartment, his guests sit round it, and he allows them to smoke in turn, passing round the flexible tube from hand to hand, and from mouth to mouth. The Turk prefers the straw-coloured, slightly clouded Amber for his fine mouthpieces, and for a very fine one he will give a very high price, and even, at times, have it set with diamonds. Some of the very finest pieces of Amber that have ever been discovered have been used for mouthpieces for hookahs.

It now only remains to make brief reference to the alterations of the Amber trade, enabling it to become a State enterprise.

In 1910 the method of excavating was changed, and in lieu of quarrying out, large portions of the Amber-bearing land were actually cut away, and transferred to works by electric railway, and there at once washed by electric machinery. This was mainly carried out by Government agencies, but in 1926 the entire industry passed into the hands of the State, with the exception of certain leases which were still in force, and which it was arranged should continue so in force until the date of their extinction. It was stated in 1926 that in about another twelve or fourteen years all these leases would have expired.

The method adopted for dealing with the Amber-bearing land is still that of cutting off large slices of the hills, and transporting their contents to the factories, gradually forming a space which eventually will be turned into a lake, and also, at the same time, transferring into the land at the border of the sea the soil that has been washed, and from which the Amber has been obtained. A double process, therefore, is being carried out on the Samland Peninsula—the creation of an inland lake, and the formation of more productive land where at one time there was only water, according to the same method as the Dutch are employing in filling up a portion of the Zuider Zee. Even still, with all this work,

the ground bearing Amber seems to have an almost inexhaustible store, but the work is only carried on in the summer, as sufficient is yielded to enable the works to close during the winter, with the exception of those containing the pumping apparatus, and these have to continue their work throughout the winter. The actual digging for Amber itself is now only carried out during the summer months.

Although it was only a story, written by Meinhold to mystify German critics of the Strauss school, the story of the Amber Witch should be mentioned in these pages, especially as in Lady Wilde's translation it is known to many English readers. It refers to the island of Usedom, on the Prussian border of the Baltic, and concerns the pastor of the place, Schwiedler, and his daughter Mary. The village was called Coserow, and that, the story tells us, was sacked and ruined by contending armies, so much so, that the villagers had to escape into the neighbouring hills to save their lives. When all the danger was over, they returned to the village, but found themselves without homes or food, and the pastor and his flock were driven nearly to starvation. One day, the story tells us, Mary Schwiedler went up the Stockelberg to pluck some blackberries, and returned shortly afterwards almost breathless to her father, bearing with her two great pieces of Amber, each of which, the story says, were as large as a man's head. She told the pastor that near to the shore the wind had blown away the sand from a vein of amber, she had broken off these two pieces with a stick, there was an ample store still remaining, and she covered it up to conceal her secret. The sale of the Amber brought money, and the money brought food, clothing, and comfort, but Mary Schwiedler was regarded as a witch, and hence the story. It was always a very popular tale in German households, and there is no doubt that, in the island, Amber has been found, but that two lumps of such a large size have ever been found in that part of Prussia remains to be proved.

THE ZOOLOGY AND BOTANY OF AMBER

ALTHOUGH it had long been recognised that there were enshrined in Amber remains of plants and insects, it was not really until 1830 that a systematic investigation of these remains was carried out, and it is to German students that we owe not only the commencement of such study, but also its continuance and its success.

Berendt was the first able naturalist who closely investigated the plant and animal remains, recognising their characteristics, and examining for this purpose some two thousand specimens.

Göppert became associated with him in 1845, and the result of the close work of these two scholars was eminently satisfactory.

Menge was another of the chief students of Amber, and in 1853, as the result of all their work, Göppert was able, in a report to the Berlin Academy, to define 163 species of vegetable remains, divided up into 24 families and 64 genera.

Rünge, however, goes far beyond this, and says that he has been able to find—

174 different species of flies, ants, beetles, and moths;
73 different species of spiders;
And a vast number of centipedes in many different species.

Before considering any of these creatures, something must be said on the difficulties that attend any effort to determine the exact character of the Amber-bearing trees themselves. Amazingly little of their wood has been obtained. When the Amber land was submerged, the wood of the trees floated,

and was carried away by the water to great distances. Only the Amber itself and the heavier pieces of wood containing Amber sank to the bottom, and were deposited with the result that, despite every care in sifting and washing many hundred thousand cubic metres of Amber-bearing soil, and the collecting of every atom of wood, there has not yet been determined by microscopical examination of this residue whether the Amber conifers belong to the genus *Pinus* or *Picea*. One therefore adopts Göppert's designation, and calls it *Pinites succinifera* Göp., which leaves it indefinite whether it is a pine or a fir tree. No specimen of wood with leaves attached to it has yet been found,¹ no blossoms with leaves, although detached blossoms or parts of them have been found; and therefore this point, so interesting to botanists, must still be left undetermined.

When it is borne in mind how the resin would naturally have dropped out from the trees, another reason for the difficulty in determining the nature of the trees is apparent.

It would probably in its liquid state run over the bark, forming successively thin lamellæ (called by the German writer *Schlauben*). At that time little creatures might pass over it and be attracted to its sticky, and possibly sweet, surface, and small leaves, flowers or blossoms might be blown against it by the wind, and covered up by the next flow; all such creatures, and feathers of small birds and hairs of mammals, being so preserved to this day in their transparent grave. Such deposits would not naturally have attached to them anything more than fragments of the bark of the tree.

Further, it might happen that the resin did not form

¹ In my own collection I possess—

Impression of a Leaf in the Bituminous Clay of Rixhoft, Samland, West Prussia.

Leaves of *Taxodium distichum*, taken from the Miocene Formation, Rauschen, Samland.



DRAWINGS OF PINE CONES OR KERNELS FROM PREHISTORIC PINE TREES FOUND IN AMBER, FROM EXAMPLES IN THE MINERAL CABINET IN KÖNIGSBERG.

The examples include A, A, A, pieces of Amber containing cones; B, B, B, diagrams of seeds, and C, C, of separate scales; and D, two sections of kernels.

From "Organische Reste im Bernstein," by Dr. Berendt, 1845, vol. i., Plate III.

To face page 134.

lamellæ upon the bark of the trees, but flowed freely down and formed stalactites, hanging perpendicularly from branches or twigs. In continuation new flows could run over them, and therefore it is that the larger, longer pieces almost always reveal a concentric structure.

These stalactites would enclose small organic remains, especially gnats, flies, and other small insects. If the resin dropped down from the stalactites to a lower branch or to the earth, small stalagmites could arise here, corresponding to them, and gradually increase in size.¹

In general, much of the resin ran downward and mingled with dead organic remains which covered the ground of the amber forest; for instance, small particles of the destroyed woods of fallen trees, various wing-cases, and dung-pellets of insects. In such a manner there were formed upon the ground irregular pieces of succinite, which are of specially high scientific interest, but do not possess any notable value in commerce, for they are only used for preparing varnish. It is in such pieces that morsels of wood have been discovered.

Amazingly few pine needles have, however, been discovered. They belong to the very rarest enclosures in Amber, and this is a circumstance not easy to understand.

Paleobotanists claim that three pines with two needles (*Pinus silvatica*, *Pinus baltica*, and *Pinus banksianoides*), one kind with five needles (*Pinus cembrafolia*), and one fir with plain needles (*Picea Engleri*) (similar to the *Pinus ajanensis* of East Asia), have been described as occurring in succinite, but it is unknown to which of the above-mentioned the Amber-bearing tree belonged, and Göppert's name or Conwentz' improvement on it, as *Pinus succinifera*, has to be adopted.

Those Amber forests, however, did not consist of pines and firs exclusively, but also of *Thuja*, *Biota*, *Taxodium*,

¹ I have examples of all these stalactite formations.

and other conifers. Moreover, there existed a considerable number of other trees, shrubs, and herbaceous plants. There were some Monocotyledons, for example, chiefly palms; for instance, there is at Danzig an incomplete male flower of a date tree (*Phoenix Eichleri*), and a piece of Amber about 3 inches long, containing an almost perfect leaf of a fan palm. Added to these are remains of other families, such as female and male flowers of *Smilax baltica*, a little fruiting spadix of a kind of Calamus (*Acorus minor*). Moreover, many more Dicotyledons are represented in the succinite flora. Particularly, says Dr. Conwentz, do single incomplete or complete inflorescences of oaks occur, and a number of species of that genus (*Quercus*) may be distinguished; also several leaves of oaks are known. He adds that the underside of the leaves and other organs of oaks are covered with stellate hairs, which, becoming free by the friction of the leaves one against the other, must often have filled the whole atmosphere of the forests of those days. These hairs were carried against the succiniferous trees and came in contact with the resin; in consequence of which we meet them now very frequently in the pieces of succinite. Again, there are flowers of Spanish chestnuts (*Castanea*), a beech-like fruit (*Fagus succinea*), and leaves like those of *Myrica*.

Of the greatest importance, he says, are the remains of Lauraceæ, as they belong to the most characteristic plants of the succinite vegetation. One leaf of a cinnamon tree has been known for a long time (*Cinnamomum polymorphum*), and in another specimen can be seen a flower of a cinnamon tree, which shows the anthers with valvate dehiscence and other details very well (*C. prototypum*). Both now belong to the Natural History Museum of Danzig. There has also been discovered a beautiful impression of a large leaf, similar to the Magnolias (*Magnoliphyllum balticum*), and two kinds of flowers of Ternstræmiaceæ. One is a magnificent

flower of a *Stuartia*, the diameter of which is 28 mm.; the second, a group of flowers of a *Pentaphylax*, which Conwentz called *Pentaphylax Oliveri*. There have also been found flowers of holly trees (*Ilex*), two sorts of stamens like those of *Deutzia*, and flowers of other Saxifragaceæ, which cannot, however, be identified with recent genera. An impression of an Oleander-like leaf (*Apocynophyllum*) is also known, some flowers of *Sambucus* and of various Santalaceæ have been described, and last, but not least, small branches and inflorescences of Loranthaceæ, chiefly those of an *Arceuthobium*-like appearance. We may therefore conclude, says Conwentz, that some mistletoes existed in the Amber period, and probably decorated the tops of the succiniferous pines and firs. Apart from such leaves and blossoms, actual pieces of wood, by which the tree could be identified, enclosed in Amber are exceedingly rare, and those that do exist are crumbled and had probably been rotten and decayed by damp, or injured by insects when the Amber held them, and are so filled up with the golden resin that has preserved them as to make their identification very difficult, if not wholly impossible.

One piece of very unusual beauty is described by Dr. Klebs as a light brown piece of thin wood which is mixed with bright yellow Amber cementing them together. Ferruginous water, he says, had entered into a split in the wood, and had built up in it some fine crystals of iron bisulphite (*Marcasite*). The crystals glitter in all colours of the rainbow, and are seen in the substance of the wood as well as that of Amber.

It must be remembered that even in the present day, the more a tree is injured, the more readily will its sap or its resin flow, and the larger will be the quantity. It is certain that such was the case in the Amber forests. The trees were injured by the action of fungi, insects and other organisms, and by the falling down of neighbouring trees, or

by lightning and other atmospheric influences, all tending to encourage the supply of the Amber enshrining damaged or decayed wood, and not pieces of a healthy tree.

In some such way one has to explain the presence of decayed material in the Amber and the absence of important pieces of healthy and identifiable wood. Some of the splinters that have been discovered, it should also be mentioned, present an exterior looking just as though they had been damaged by fire in these forests of long ago.

The finest specimen of the wood of *Pinus succinifera* that I have ever seen is a piece of a branch more than 18 inches in length and several inches in thickness, belonging to my friend Mr. Bursey. By his kindness, I myself possess a not unimportant lump of this same fossil wood, but at present it has not yielded, under the microscope, any important information.

On one specimen of Amber attached to some wood there was the trail of a caterpillar: the animal had escaped during the cooling of the Amber, but his trail was left behind; on another, the footprints of a bird.

The following is, it is believed, a fairly complete list of the plant remains that have been found in Amber, the result of the labours of Berendt, Braun, Caspary, Conwentz, Göppert, and Menge, with some of the arrangement suggested by Professor Dr. A. Tornquist, but brought, so far as I can do so, up to present date, and in the light of the latest discoveries.¹

I. Thallophyta. *Fungi*. Fungites.

Agrimonium (1), Sporochytriæ (1), Sperotrichites (1), Gonathotryx (1), Tortula (2),
Ramularia (1), Stilbum (1).

Lichenes: Cetraria sp. (*Iceland Moss*).

¹ English equivalents are given where they are in general use.

II. Bryophyta. Hepaticæ (*Liverworts*): Phragmicoma (3), Lejeunia (3), Lophocolea (1), Jungermannia (2), Frullania (6), Madotheca (1), Radula (1).

Musci (*Mosses*): Dicranaceæ (3), Muscites (3).

III. Pteridophyta: Alethopteris (1).

IV. Phanerogamia (or Spermaphyta).

A. Gymnosperma.

1. Cycadaceæ (*Fern Palms*): Zumiphyllum (1).

2. Coniferæ: Cupressineæ (*Cypresses*):

Widdringtonites (4):

Libocedrus (*Cedar*) (1).

Thujopsidinæ (*Thujas*) (4).

Chamæcyparis (3), Cupressites (5).

Cupressinanthus (2).

Juniperinæ (*Junipers*) (2).

Taxoideæ.

Glyptostrobus (*Embossed Cypress*) (1).

Sequoia (*Big Trees*) (3).

Podocarpites (2), Araucariæ: Scia (2).

Abietineæ (*Firs*): Pinus (13) (notably Reichiana), Picea (1), Piceites (1), Larix (1).

B. Angiospermæ.

1. Monocotyledons.

Graminaceæ (*Grasses*): Zeites (1), Graminophyllum (1).

Palmaceæ (*Palms*): Phœnix (1), Sabalites (1), Bembergia (1), Palmo-phyllum (1).

Araceæ (*Flags*): Acoropsis (1).

Commelynaceæ: Commelynacites (1).

Liliaceæ: Smilax (*Sarsaparilla*) (1).

DICOTYLEDONS

SUB-CLASS MONOCHLAMYDEÆ.

Urticaceæ (*Nettles*): Forskohleanthium (1).

Ulmaceæ (*Elms*): Ulmacites (1).

Fagaceæ (*Beeches and Oaks*): Fagus (2), Castanea (4), Quercus (*Piligera*) (15).

- Myricaceæ (*Myrtles*): Myrica (1), Myriciphyllum (1).
 Salicaceæ (*Willows*): Saliciphyllum (1).
 Proteaceæ (*Proteas*): Persvonia (1), Lomatites (2), Dyandra (1).
 Santalaceæ (*Sandal Woods*): Thesianthium (1), Osyris (1).
 Loranthaceæ (*Mistletoes*): Loranthacites (1), Patzea (2).

SUB-CLASS POLYPETALÆ.

- Magnoliaceæ (*Magnolias*): Magnolilepis (1), Magnoliphyllum (1).
 Lauraceæ (*Laurels*): Tranthera (1), Cinnamomum (Polymorphum) (2).
 Polygonaceæ (*Knotweeds*): Polygonum (1).
 Comaraceæ (*Cinquefoils*): Comaracanthium (1).
 Cistaceæ (*Rockroses*): Cistinocarpum (1).
 Papilionaceæ (*Beans*): Dalbergia (1), Leguminosites (1).
 Geraniaceæ (*Geranium*): Geranium (1), Erodium (1).
 Linaceæ (*Toadflax*): Linum (1).
 Ternstrœmiaceæ (*Camellia, Tea-plant*) (1).

SUB-CLASS DISCIFLORÆ.

- Oxalidaceæ (*Sorrels*): Oxalidites (1).
 Aceraceæ (*Maples*): Acer (5).
 Celastraceæ (*Staff Trees*): Celastrinanthium (1).
 Aquifoliaceæ (*Ilexes*): Ilex (3).
 Thymeleaceæ (*Thymes*): Eudaphniphyllum (4).
 Rhamnaceæ (*Privets*): Rhamnus (1).
 Euphorbiaceæ (*Spurges*): Antidesma (1).

SUB-CLASS CALYCIFLORÆ.

- Umbelliferæ: Chærophyllum (1).
 Onagraceæ: Ximenia (1).
 Rosaceæ (*Roses*): Mengea (1).
 Saxifragaceæ (*Saxifrages*): Stephanostemon (2), Dentzia (2), Adenanthemum (1).
 Pittosporaceæ (*White Laurels*): Billardierites (1).
 Hamamelidaceæ (*Hazels*): Hamamelidanthium (1).
 Dilleniaceæ: Hibbertia (3).
 Pentaphylacaceæ: Pentaphylax (1), Stuartia (1).

SUB-CLASS GAMOPETALÆ.

- Apocynaceæ (*Dogsbane*): Apocynophyllum Jentzschii (1).
 Oleaceæ (*Olives*): Oleiphyllum (1).
 Myrsinaceæ: Myrsinopsis (1), Berendtia (2).
 Ericaceæ (*Heaths*): Orphanidesites (1), Andromeda (6),
 Ericiphyllum (1), Clethra (1).
 Campanulaceæ (*Bellflowers*): Carpolithus (1).
 Rubiaceæ (*Brambles*): Sendelia (1), Enantioblastos (1).
 Caprifoliaceæ (*Honeysuckle*): Sambucus (2).

In regard to the specimens of Amber which contain insect enclosures and of their order in the animal kingdom, Dr. Richard Klebs in 1911 gave a careful list. He had himself collected for forty years, and then the large Becker Collection was brought to the Geological Institute of Königsberg University. Owing to the fine experience which he thus acquired, and the great quantity of raw Amber that he was able to inspect, he was able to give a fairly exact survey of the Amber and its animal enclosures. His proportion of creatures found is as follows:

Diptera	..	..	..	..	50·9	per cent.
Hymenoptera	..	..	..	..	5·1	„
Neuroptera (Mayfly)	..	..	..	..	5·6	„
Microlepidoptera (Little Moths)	..	..	..	..	0·1	„
Coleoptera (Beetles)	..	..	..	..	4·5	„
Pseudoneuroptera	..	..	..	..	10·7	„
Rhynchota	..	..	..	..	7·1	„
Orthoptera	..	..	..	..	0·5	„
Arachnoidea	..	..	..	..	4·5	„
Various	..	..	..	..	11·0	„
					100	„

It must, however, be remembered that although it is stated millions of tons of Amber have been found, less than two thousand pieces have been discovered containing complete animal forms.

Of insects the species of which can only thrive at the present time in warm zones, and are found in Amber, the following should be mentioned: The Termiten family, of ants, the species *Paussus*, which today appear in Sicily and Greece; the species *Macromischa*, now in Africa; of Neuropteren, the species *Chauliodes*, appearing nowadays in North America; of flies, *Diopsis*, now in Africa and India.

The kinds of insects that have been best preserved are the Diptera and Coleoptera, and these are the most numerous of the insects found in Amber.

In the Danzig Museum is a collection of more than one thousand pieces in which Diptera are lodged.

The insects that are found enclosed in Amber belong to the ten principal Orders: Hymenoptera, Coleoptera, Neuroptera, Orthoptera, Pseudoneuroptera, Lepidoptera, Diptera, Rhynchota, Myriopoda, and Arachnoidea. They comprise, therefore, sawflies, gall wasps, ichneumon wasps, ants, bees, burnished wasps and larvæ wasps; a large variety of beetles, including scarabs, soldier beetles, pine beetles, weevils, longicorns, spider beetles, whirligigs and ladybirds; in Neuroptera, scorpion flies and caddis; in Orthoptera, earwigs, cockroaches, locusts, grasshoppers, praying mantic, stick insects and crickets; in Pseudoneuroptera, mayflies, thrips, springtails, termites, and dragon-flies; in Lepidoptera, the very small species known as Microlepidoptera; in Diptera, sandflies, forest flies, daddy-longlegs and fleas, also plant lice, cicadas and bugs, centipedes and millipedes, many kinds of spiders, scorpions both true and false, mites and harvest spiders. The list of the insects represented in the Königsberg Museum as compiled by Dr. Klebs reads as follows:¹

¹ English equivalents are given where they are in general use.

I. HYMENOPTERA.

Tenthredinidæ (Sawflies).	Formicæ (Ants). (By far the
Uroceridæ.	commonest creatures in the
Cynipidæ (Gall Wasps).	Order.)
Pteromalidæ (Parasites).	Chrysididæ (Burnished
Braconidæ (Parasites).	Wasps).
Ichneumonidæ (Larvæ	Heterogyna.
Wasps).	Fossoria.
Evaniadæ (Hymenoptera	Vespidæ (Paper Wasp).
Parasites).	Apidæ (Bees).

Occasionally pieces of Amber are found that contain a large swarm of flies in them, representing many different varieties of these creatures. In one example, I counted nearly a hundred flies. They had evidently settled upon the sweet, sticky resin, and were suddenly overwhelmed and embedded in it.

II. COLEOPTERA (BEETLES).

Cicindelidæ (Tigers).	Nitidulidæ (Flower and
Carabidæ (Carnivorous).	Wood).
Dytiscidæ (Water).	Trogostidæ.
Gyrinidæ (Whirligigs).	Colydiidæ.
Hydrophilidæ (Water).	Rhyssodidæ.
Paussidæ (Ants' Nest).	Cucujidæ.
Staphylinidæ (Rove).	Cryptophagidæ.
Pselaphidæ. ¹	Lathridiidæ.
Clavigerinæ (Ants' Nest).	Mycetophagidæ.
Scydmanidæ.	Thorictidæ.
Silphidæ (Burying).	Dermestidæ (Fur and Skin).
Anisotomidæ.	Throscidæ.
Sphæriidæ.	Byrrhidæ.
Trichopterygidæ (Hairy-	Georyssidæ.
winged).	Parnidæ.
Scaphidiidæ.	Heteroceridæ.
Histeridæ.	Lucanidæ (Stag).
Phalacridæ.	Scarabæidæ (Burrowing).

¹ Many varieties: see a separate work on this family by Dr. L. W. Schaufuss, published in German at The Hague (Nijhoff) in 1890.

Aphodidæ (Shard Horn).	Melandryidæ.
Buprestidæ (Serrated).	Lagriidæ.
Elateridæ (Click). (This is the most common.)	Pyrochroidæ (Fire).
Eucnemidæ.	Anthicidæ.
Cebrionidæ.	Mordellidæ.
Atopidæ (Dascyllidæ).	Rhipiphoridæ.
Cyphonidæ.	Meloidæ (Oil).
Telephoridæ (Soldiers).	Ædemeridæ.
Cantharidæ (Cantharis).	Salpingidæ.
Lampyridæ (Luminous).	Bruchidæ (Vegetable).
Melyridæ.	Anthribidæ (Weevils).
Cleridæ (Pine-hunting).	Curculionidæ (Weevils).
Ptinidæ.	Bostrychidæ.
Anobiidæ (Death-watch).	Cerambycidæ (Longicorns).
Cioidæ.	Chrysomelidæ (Plant).
Lymexylonidæ.	Halticinæ.
Pimeliidæ.	Hispinæ.
Diaperidæ.	Cryptocephalidæ.
Tenebrionidæ (Meal).	Corylophidæ.
Helopidæ.	Endomychidæ.
Cistèlidæ.	Coccinellidæ (Ladybirds).
	Malocodermatæ.

III. NEUROPTERA.

The number of species of the Neuroptera in Amber is enormous. Living species also have their representatives in Amber. By far the oftenest are the Phryganidæ (Caddis). In about eight hundred Phryganidæ there is but one representative of the other two families.

Hemerobidæ (Lace-wing Flies).
Panorpidæ (Scorpion Flies).
Phryganidæ (Caddis).

IV. ORTHOPTERA.

Campididæ.	Mantidæ (Praying).
Poduridæ (Forked Tail). (These are the most com- mon.)	Phasmatidæ (Stick and Leaf).
Lepismidæ (Stone).	Acrididæ (Grasshopper).
Forficulidæ (Earwig).	Locustidæ (Locust).
Blattidæ (Cockroaches).	Gryllidæ (Crickets).
	Pseudoperlidæ.

V. PSEUDONEUROPTERA.

Living species of the class of the Pseudoneuroptera are also to be found fossil. Although all of them are to be found relatively seldom in Amber, a considerable number of species, especially of Termites and Ephemera, are well known.

Thripsidæ (Thrips).
Psocidæ (Book Lice).
Termitidæ (Termites).
Embidæ.

Perlaridæ.
Ephemeridæ (Mayflies).
Libellulidæ (Dragon-flies).

VI. LEPIDOPTERA.

With the exception of one species of a Macrolepidopteron, all of Amber belonging to this group are Microlepidoptera, which are to be found in large numbers of different kinds and species.

Microlepidoptera.
Macrolepidoptera.

VII. DIPTERA.

(Enormous variety of kinds and species.)

Pupipara (Forest Flies).
Brachycera.
Leptiola.
Tipula (Daddy-longlegs).
Dolichopoda.
Mycetophilida.
Nematocera (Cattle Flies).

Aphaniptera (Fleas).
Empidæ (Robber Flies).
Chironomida (Midges).
Sciarina (Army Worm Flies).
Phoridæ.
Psychodidæ.

VIII. RHYNCHOTA.

(Number of species very great.)

Corridæ (Bugs).
Coccidæ (Scale).
Aphidæ (Gnats).

Homoptera (Cicadas).
Pediculinæ (Lice).
Hemiptera.

IX. MYRIOPODA.

Chilopoda (Jointed).	Lithobidæ (Centipedes).
Scolopendridæ (Centipedes).	Julidæ.
Chilognata (Millipedes).	

X. ARACHNOIDEA.

Acarinæ (Mites).	Scorpionidæ (Scorpions).
Araneidæ (Web Spiders).	Solifugæ (False Spiders).
Phalangiida (Harvest Spiders).	Pseudoscorpionidæ (False Scorpions).
Pedipalpi (Whip Scorpions).	

Spiders are often found in Amber; well-preserved specimens, however, whose eyes and all other parts are to be seen distinctly, are rare.

Oftenest the mites occur, yet the examination of them in the Amber is almost impossible on account of their being so small. Numerous are the Araneidea, a little rarer the Phalangiida and Pseudoscorpionidæ.

True scorpions are represented only by one specimen.

VERMES.

Two specimens only are known to exist.

Snail-shells are among the greatest rarities found in Amber. Dr. Otto Helm possesses an unusually fine specimen. It is embedded, says he, in bright yellow Amber, and it is quite well preserved up to the orifice. The conical spherical shell is 2 mm. wide and 1.8 mm. high, has five rings, a yellow-brown bright silky colour, and of webbed ribbed-striped structure. He submitted this delicate piece to Dr. Schumann, who said:

“The snail is one of the *Helix* genera still living to this day, ‘*Acanthinula lamellata*’ Jeffreys, ‘*sen Helix scarabugensis*’ A. Müller (Rossmasler Icon., Fig. 533. Clessin, deutsche Excursions—Mollusken—Fauna, Fig. 44).”



ENLARGED PHOTOGRAPH OF AMBER CONTAINING A SWARM OF FLIES AND OTHER INSECTS OVERWHELMED BY THE AMBER RESIN WHEN FLOWING IN LIQUID FORM.

In the swarm are insects of the order of *Thysanura*, perhaps a *Podura*, a *Deseria*, and a *Petrobius*.

From a very rare specimen ($2\frac{1}{4}'' \times 1\frac{3}{8}''$) in the possession of Mr. M. W. Bursey.

To face page 146.

The specimen is very finely preserved, and in clear Amber. Only in the neighbourhood of the navel a slight disturbance is to be seen, which, however, leaves the form of it recognisable. According to Clessin, this species is found only in dense forests under dead leaves. It is to be found in England and in the northern countries of Europe. In Germany it is only found in the northern parts near the sea-coast—namely, near Kiel, in Rugen, and near Wallin.

Dr. Klebs had in his collection a small piece of Amber in which 32 flies are to be found; another piece contains 42 midges and several leaf-lice; a third, 50 ants; a fourth contains 17 Diptera, 6 Coleoptera, 3 Hymenoptera, 3 Arachniden; a fifth, 2 Phryganidæ, 6 Diptera, 2 Coleoptera; a sixth, 10 flies, 4 midges, 2 gnats, 3 beetles, 2 spiders, 1 wasp, 1 ant.

These animals appear to the surprised eye of the observer wonderfully fresh and well preserved, as they swarmed in the Amber forests hundreds of thousands of years ago. They are magically introduced into the golden material, only the warm breath of life is wanting in order to awaken the lively fellows to new restless activity—yet they remain motionless; and it must suffice for us to labour and, by being equipped with all the means of knowledge, watch for the secrets they know, which they carry from the past.

It may be well to mention, with respect to insects that are found enclosed in Amber, that many are incomplete, plainly showing that they had struggled hard for their liberty, and, in some cases, had left limbs behind them in the attempt to escape. There are specimens in which wings and legs are found, but no other part of the creature. It no doubt became entangled in the soft and viscid matter, and escaped at the expense of leaving part of itself behind. In some instances, especially amongst the Coleoptera, creatures are found wanting one and perhaps two of their

legs, and it has been possible to find the missing limbs in Amber quite close to where the piece was found that contains the body, but, in most instances, this has not been the case, and in any collection of insects enclosed in Amber there are sure to be quite a number of specimens incomplete, and also a number of examples of legs and wings that have become separated from their original possessors.

Dr. V. Galippe, of the French Académie des Sciences, once declared that he had been able to free from their prison certain of the micro-organisms in Amber, and that after cultivation they developed great activity, but his statement has lacked later confirmation, and can hardly be accepted even by the most credulous. It seems to me to be absolutely incredible, so I describe it in his own words.

His statement is set out in the following terms :

RECHERCHES SUR LA RÉSISTANCE DES MICROZYMAS À L'ACTION
DU TEMPS ET SUR LEUR SURVIVANCE DANS L'AMBRE.

L'ambre est une résine fossile provenant de différentes espèces de Conifères. Cette résine ayant été un produit de sécrétion physiologique, il était intéressant de rechercher si les éléments vivants normaux ou accidentels qu'elle avait renfermés au moment de sa formation, avaient pu traverser une longue série de siècles sans perdre leur vitalité.

Grâce à la bienveillance de M. A. Lacroix, nous avons pu étudier un certain nombre de spécimens d'ambre de la collection minéralogique du Muséum dont, pour la majorité, l'origine était connue.

La technique que nous avons suivie est la suivante: D'une façon générale l'ambre est partiellement soluble dans l'éther, mais ce fait n'est pas constant. Nous avons mis cette propriété à profit; mais avant de soumettre l'ambre à l'action de ce dissolvant, nous l'avons débarrassé soigneusement par l'émondage mécanique et des lavages prolongés dans l'eau distillée stérilisée des impuretés qui pouvaient souiller sa surface. Enfin les morceaux d'ambre, après avoir été séchés entre des feuilles de papier-filtre stérilisé, ont été mis en contact avec de l'eau distillée

stérilisée et sursaturée d'éther pendant vingt-quatre heures et fréquemment agités. Au sortir de cette solution étherée, les fragments d'ambre étaient essuyés entre des feuilles de papier stérilisé et finalement placés dans l'éther pur.

La durée du traitement par l'éther a varié suivant les spécimens. Il en est qui se sont montrés absolument réfractaires à l'action de ce dissolvant et qui ont dû être pulvérisés par des moyens mécaniques avec toutes les précautions antiseptiques requises. La plupart, au contraire, se gonflaient, se ramollissaient au contact de l'éther et se laissaient facilement diviser à l'aide d'un instrument stérilisé.

D'une façon générale les morceaux d'ambre sont restés, au minimum, quarante-huit heures dans l'éther, mais souvent ce contact a dû être prolongé pendant quatre ou cinq jours. A l'aide d'une aiguille stérilisée, on s'assurait du degré de résistance des fragments d'ambre plongés dans l'éther. Le résultat recherché étant obtenu, les fragments d'ambre, après avoir été placés entre des feuilles de papier-filtre stérilisé, étaient aseptiquement divisés en parcelles aussi fines que possible et ensemencés sur des milieux de culture solides ou liquides.

Chaque fois que cela nous a été possible, nous avons pratiqué l'examen microscopique direct des parcelles d'ambre et presque toujours, malgré les difficultés de cet examen, nous avons pu y constater la présence de microzymas, de bacilles ovoïdes et, plus rarement, de bâtonnets fortement incurvés.

La majorité de nos ensemencements ont donné des résultats positifs après quarante-huit heures de séjour à l'étuve, mais un certain nombre ont été beaucoup plus tardifs.

D'une façon générale, la flore de l'ambre ne s'est pas montrée très variée. Sans entrer dans des détails qui trouveront place ailleurs, nous nous contenterons de dire que dans nos cultures nous avons toujours trouvé des microzymas, des bacilles ovoïdes, ainsi que des bâtonnets. Ces microorganismes étaient habituellement doués de mouvements très vifs. Examinés à la lumière polarisée, les bacilles ovoïdes ne fixant pas la matière colorante se sont montrés biréfringents.

SPÉCIMENS D'AMBRE AYANT DONNÉ DES RÉSULTATS
POSITIFS.

Origine inconnue : quatre. *Baltique* (Königsberg, Danzig, etc.); *île d'Enet, près l'île d'Aix* (Crétacé, Cénomanién); *Ambre de Villers-en-Prayer* (Aisne) (Tertiaire, Éocène). *Saint-Lon* (Landes) (Cénomanién, deux spécimens). *Scanello* (près Bologne). *Meudon* (Seine-et-Oise) (Éocène, dans argile plastique). *Briollay* (Maine-et-Loire, Cénomanién). *Allinges* (près Thonon, Miocène). *Andard* (Maine-et-Loire, Cénomanién). *Brion* (Maine-et-Loire, Cénomanién). *Berland* (Charente, Cénomanién). Résine subfossile, *Rives du Congo*. *Catina* (Roumanie). *Sainte-Suzanne* (Basses-Pyrénées, Crétacé inférieur). *Rives de la Sarthe* (près Precigne, Cénomanién). *Maisons-Laffitte* (Éocène); *Rives du Dnieper* (environs de Kiev).¹

Dr. Galippe adds to his statement that there were three specimens of Amber which gave a negative result—a piece from France, a piece from Finland, and a piece from the Congo, the latter, in all probability, not Amber at all. He was, however, of opinion that even in these pieces there had been living organisms that had remained alive until a recent period. He said that he carried out his experiments with the collaboration of Madame G. Souffland.

Professor Doris L. Mackinnon, D.Sc., of King's College, to whom I have submitted Dr. Galippe's statement, considers it "highly improbable that bacteria imbedded in Amber could possibly retain their viability over so long a period," and feels sure that "the utmost caution would have to be taken to ensure no contamination of the medium and apparatus used in the observation." Dr. Mackinnon is definitely of opinion that the whole matter would "require confirmation by a scrupulously exact bacteriologist before it could even be taken seriously."

¹ Académie des Sciences au 6 avril 1920, Tome 170, No. 14.

AMBER IN ART

IN dealing with Amber from an artistic point of view, Amber as an Art material, it is very difficult to draw any line between what should be described in this particular chapter and what more strictly belongs to the section of Anthropology, inasmuch as it is clear that two of the very earliest pieces of Amber were undoubtedly artistic representations of existing creatures, and therefore, despite the fact that they have been alluded to in the chapter on Anthropology, it is desirable to make some reference to them here. They are the figures of the bear and the elk, one in the Museum at Stettin and the other in the Natural History Museum at Berlin, the former found at Stolp in Pomerania, and the latter at Woldenberg.

There is a pendant in the Municipal Museum at Weimar which came from a tomb at Hassleben, in Saxe-Weimar, that is clearly an artistic production, and must have been made for an ornament to be worn by some aristocratic woman, the wife perhaps of a chieftain, who, to judge by the other contents of the grave, was buried in this place. It is a very unusual ornament in shape, somewhat resembling a pear, but the rounded ends are carved as heads facing each other, with very primitive features. The object is decorated in patterns with parallel cuttings, and it is attached to a silver wire ring, with a rosette by which it must have been suspended. It cannot very well be attributed to a later period than the fourth century.

I have already alluded to the decoration in the palace of King Menelaus that Homer says was carried out in gold and Amber, and which certainly must be the very earliest example of artistic work in this material that has been recorded, but we learn from Pausanias that there was actually

once made a statue of Augustus entirely of Amber. It was certainly quite a small figure. It was also stated that a human figure with a crown, sceptre, and book, wrought in Amber, was discovered in a grave in Pomerania in 1820, and it may have represented a deity, possibly Astarte, but I have not been able to find out where this object is at the present moment.

To the special and very wonderful pieces of carved Amber in the British Museum allusion has already been made in the chapter on Anthropology, but these pieces must be just mentioned again in this chapter because of their extreme beauty and the wonderful way in which they are carved.

In an ancient list of the possessions of Charles V. of France, dated 1380, there is an allusion to a statue of John the Baptist in Amber; and the Duc de Berry, in 1416, owned a figure of the Virgin with the Child, enthroned beneath a baldachino with four pillars, carved out of a lump of Amber.

In a list of the treasures belonging to the City of Paris, dated 1418, there is a reference to a crucifix of Amber.

Charlotte of Savoy, in 1483, owned a small box or casket of carved Amber; and Anne of Brittany, in 1498, is said to have possessed a relief carving of Amber representing St. Veronica, and set in a silver-gilt frame. Neither of these objects can, however, now be traced.

The carving in relief of a man's figure (*Gelehrten*) was exhibited in the Berlin Exhibition in 1899, and Dr. Bode declared that it must have been executed in about 1525, and with it were exhibited two other medallions of about the same period, belonging to an important collector in Holstein, but the only important dated piece of that period is an ivory chessboard inlaid with Amber, which is now in the museum at Cassell, and is dated 1594.

An exceedingly fine carving in Amber, that must undoubtedly belong to the early part of the sixteenth century,

was, when I saw it, in the English Palace, near St. Petersburg. It represented the binding of Our Lord, prior to the scourging, and was full of wonderful dignity and grace, clearly the work of a notable but anonymous sculptor, and executed from a spirit of great devotion. It was one of the very finest carvings in Amber I have ever seen.

Monsieur Balise de Vigenère, an eminent French savant living between 1523 and 1596, refers in his writings to the contents of a Roman urn which belonged to Cardinal Farnese, and which, in 1565, had been found in a little garden belonging to the Church of St. Blasius at the foot of St. Peter ad Vincula. Amongst the contents of this urn were, he says, "a Cupid of yellow Amber, a sleeping Cupid of the same material, a figure of Silence holding a finger from his chin to his nose, and a small elephant," but it is not known where these particular pieces are at the present time.

The special importance of Amber wrought for artistic purposes did not arise, however, till the fourteenth and fifteenth centuries, and but few examples of those periods now remain.

There is certainly a miniature crucifix in existence that was once in the possession of the Polish Sovereigns, and is attributed to about 1400. It passed by the gift of King Stanislaus to the ancestors of the Count of Bolanga in return for certain martial favours, and although some doubt must be cast upon its actual age, it is a fine example of the use of Amber in that form.

What is probably the finest Amber crucifix in existence is one of much later date which belonged to Louis XVI. and to Queen Marie Antoinette. It was brought by the Duke of Angoulême to England in 1830, and was for a while at Lulworth, where the Royal Family resided, and then later transferred to Holyrood Castle. After a while Major François Louis de Queyriaux, who had been attached to the

household of the Duke of Angoulême, left the royal exiles and returned to France, entrusted with a mission. Before his departure, Her Royal Highness Princesse Marie Thérèse of France, Duchess of Angoulême, desirous of showing her gratitude to him, and as a reward for his devotion to her person and to the Royal cause, presented to him, as a precious souvenir, this crucifix, which had belonged to her father, the murdered King Louis XVI., with the injunction that it should be always transmitted to the chief of his family.

It passed by descent into the hands of Colonel Franck de Queyriaux, who, in 1870, rescued the city of Orléans from the hands of the Prussians. He died in 1913, and it is now the property of his only son, Baron Fernand de Queyriaux, and at Château de la Tour, near Eymontiers.

This crucifix is said to have been the work of Carolus Marutus. It is on a base or pedestal, the central door of which opens and reveals a carved figure of a monk in prayer. The pedestal is also decorated with seven plaques of carved ivory, and with two ivory columns. Above it rises a further pedestal of two tiers, also decorated with ivory plaques, and from which rises the cross of Amber, on which there are also a series of seven small ivory plaques, representing emblems and signs of the Passion. The figure of the Christ is formed in a single piece of ivory, and remarkable for the fineness of the features and the beauty of its face. The whole crucifix is about 19 inches high, and constitutes the finest piece of amber mounting for a crucifix that I have ever seen.

In the possession of the Duke of Norfolk, preserved at Arundel Castle, is a very fine amber crucifix, with an unusually long shaft, from which is suspended the figure of Our Lord, carved in ivory. At the foot of the shaft, in the Amber, are carved the initials I.H.S., surrounded by rays of light. Below is a pedestal, forming a kind of shrine, and on the front of it is an ivory plaque representing the

Agnus Dei. Below is a skull in Amber, and below that an ivory plaque composed of the three sacred initials with rays of light.

The candlesticks to correspond with the crucifix are of unusual form, being triangular. The Amber forming the candlesticks themselves is exceedingly carefully and delicately carved, the pedestals are inlaid with plaques of Amber and ornamented with edges of ivory, and at the foot with plaques of carved ivory.

In the possession of Miss Christie, at Cowden Castle, Dollar, Scotland, there is a very important pair of amber candlesticks, and it is stated that there was at one time a crucifix which belonged to them, which is not now in the same owner's possession. They are dignified and plain, and the bases are ornamented with ivory plaques.

In the possession of Miss Gouldfar, of Dover Street, London, is an amber crucifix, unusual in character because the pedestal from which it rises represents the Cave of the Resurrection. Above it are two figures of Apostles, carved in Amber, and a skull, and it is also ornamented with carvings in ivory. The pedestal is mounted on a larger pedestal, with four ball feet, richly decorated in various colours of Amber.

Messrs. Sac Frères, of Bond Street, had in their possession some little time ago one of the finest sets of carved amber chessmen that has ever come to this country. It is probably seventeenth-century German work, but it might be even earlier than that, as some of the figures, especially the knights, appear to belong to an earlier period than the seventeenth century. The chessboard on which the game is played is also of Amber, very richly inlaid with plaques of various colours, and has a drawer to contain the men.

Poland has always had great treasures in Amber, and a great Polish family recently sent to London for sale another famous set of chessmen made for some Eastern potentate

from Baltic Amber. The pieces are a curious mixture of Oriental and European design. There are Asiatic elephants and stately European Bishops wearing mitres. The pawns are footmen, eight wearing cocked hats and eight with turbans, and the board on which the game is played is inlaid with Amber, alternate squares of contrasting hues. This is probably mediæval and of great rarity.

In the French Court, Amber received as much admiration as it did in its own place of origin. Louis XIII., in 1613, received a present of amber chessmen from a nobleman who desired particular favour. Louis XIV. bought a great many pieces of Amber, which he used as presents. In 1687, to his Court there came two ambassadors from Siam, and to them Louis presented several caskets and two mirrors with amber frames, which the *Mercurè de France* reports in April, 1687, were decorated with figures and relief carving, and ornamented with ivory and precious stones. Louis XIV. himself possessed a great vase of Amber mounted in gold, and another one in the shape of a gondola formed of orange-coloured Amber, with two dolphins carved on the inside. He had yet a third, which was declared to represent a ship, and had upon it a group in ivory, representing Neptune with three sea-horses, and the Amber was carved with representations of flowers and fruit. None of these pieces can be traced at the present time; probably all the Amber that Louis XIV. possessed perished at the time of the Revolution.

There is a catalogue in existence in the Royal residences at Berlin, dated 1786, and in that, the author, Nicolai, says the Elector possessed a flock of sheep in Amber, with animals and trees, and a complete farmyard of amber figures with oxen, cows, pigeons, and storks. There is also an allusion in the same book to a boat in Amber that moved by clockwork, the representation of an amber mine, and figures of the miners in Amber, both with clockwork movement; a

portable altar, on which was carved a representation of the Resurrection; an eagle, a water tower, a tall cup, and very many other extraordinary pieces of Amber, including frames for mirrors, handles for sticks or for knives and forks. All these appear to have come from the Guilds at Lübeck or at Königsberg, but none of them are known at the present day, or at least they cannot be identified.

Of Renaissance objects in Amber in this country, the chief is probably the cylindrical tankard in the Waddesdon Collection in the British Museum. This is Swedish, of about 1660, and came from the collection of Count Nostitz of Prague. It originally belonged either to the Queen of Gustavus II. (Adolphus) or to Queen Christina. The whole is of transparent reddish Amber, the sides formed of nine slabs, each having carved upon it a figure emblematic of a vice, as, for example, a woman with a peacock to symbolise Pride—another eating and drinking for Gluttony, etc. It has a domed lid with busts and scrolls, and in the centre an ivory disc upon which are the arms of Sweden. On the reverse is a woman with a cup and ewer. The handle is in the form of a female terminal figure. The foot has scrolls and mounts and studs that are slightly enamelled.

On the base is a sun with rays surrounded by scrolls. It is $8\frac{1}{2}$ inches high¹ (229).

A very similar tankard of North German work belongs to the Vicar and Churchwardens of North Mimms, Herts, and is at present on loan in the British Museum. It is dated 1659. It was given to the parish in 1751.

In the Victoria and Albert Museum there are some twenty objects in Amber, the majority belonging to the seventeenth century, and of German work. They include a large altar-piece, crucifixes, caskets, and a backgammon board, etc., and there are also two reliefs, which may possibly be the work of Gottfried Leygebe.

¹ See Catalogue of 1902, p. 108.

There is a watch in the Garnier Collection now preserved in the Louvre (the whole collection having been bequeathed by Monsieur Garnier to the Louvre) in which the case is of Amber. The movement is a French one; the case has been hollowed out from a large lump of Amber to contain the movement, but the watch has no special intrinsic importance, save that the case is formed of Amber.

In the important collection of watches belonging to Mr. C. A. Ilbert, there is a seventeenth-century one that has in its mounting two pieces of Amber. The watch is a pendant-shaped one, somewhat resembling a bud or flower, and the metal ornamentation enclosing the Amber on either side is engraved with floral devices. The Amber itself has upon it a series of parallel grooves. The watch is clearly seventeenth-century work, because it has a worm setting-up gear for regulating by the mainspring instead of a ratchet. Very possibly it is early in the century, because it has never had a hairspring, and the hand is driven off the fuzee arbor. The period of this kind of watch is roughly about 1650-60, but this one would seem to be earlier than usual, perhaps belonging to about 1635, and it is quite possible that the trefoil ornamentation in metal that partially overlays the Amber may have been added at a later date, in order to protect the Amber, which it appears had fractured. The dial is silver, and elegantly engraved with a representation of a castle and a stream. The metal-work surrounding it is engraved with foliage and flowers.

A watch containing Amber or mounted in Amber is exceedingly rare, and this is a very pleasing example.

There is at Mentmore, in the possession of Lord Rosebery, an amber chandelier that Baron Meyer de Rothschild purchased many years ago in Königsberg. It belonged to some important Prussian Prince, and is dated 1640.

There is also in the same house a splendid set of amber



AMBER PLAQUE CARVED IN HIGH RELIEF BY THE
CELEBRATED AMBER CARVER, CHARLES MARUTUS, 1621, AND
REPRESENTING THE JUDGMENT OF PARIS.

It is $5\frac{1}{4}$ inches high, $4\frac{3}{4}$ inches wide, and was purchased in 1925
from the Wynham-Cook Collection. It is signed and dated.

(Victoria and Albert Museum.)

To face page 158.

chessmen, and some other fine examples of carved work in Amber—caskets, plaques, etc.

The Empress Marie Louise had a famous amber necklace, sold in June, 1921, to Tiffany's of New York for a sum that has been quoted at 90,000 dollars.

A King of Prussia is said to have possessed a burning mirror of clear Amber of great size, and also a microscope in which the lenses were made of the same transparent material. The Margrave of Brandenburg is said to have had a chair made of Amber which, later on, it is stated, was presented to the "Czar of Muscovy."

In England we have one relief of the highest importance, a mass of Amber, $5\frac{1}{4}$ inches high and $4\frac{3}{4}$ inches wide, that came from the Wyndham-Cook Collection and was purchased in 1925. It is a group of five figures—a man, three women, and a child, the latter holding a dog, and may perhaps be intended to represent the Judgment of Paris.

On the back is incised the inscription: CARROLVS (*sic*) MARVTI EXT 1621,¹ the maker of the Royal French crucifix already mentioned.

In the Wallace Collection there is a strange silver reliquary decorated with translucent enamels, French work of the fifteenth century (Gallery III., Case G, 295).

The head of Christ in the centre is of Amber. It reproduces in design a consecrated type of a much more archaic character.

The most famous collections of objects in wrought Amber are, however, those in the Green Vaults in Dresden and in Florence.

In Dresden there are two or three pieces that are attributed to the sixteenth century.

One² is a large round dish with various coloured examples of Amber set in silver-gilt. Among the transparent fragments toward the border, some are carved with scenes in

¹ A 61, 1925.

² iii. 76, pp. 36-37.

the style of the Little Masters, and between them are smaller panels, on two of which are the arms of the Margravine of Brandenburg. The dish is believed to have belonged to Magdalene Sybil, Margravine of Brandenburg, wife of the Great Elector John George I. of Saxony, and she is stated to have brought it to Dresden. She died in 1659. The silver work is by Andreas Meyer of Nürnberg, and bears his initials.

Another early piece is the octagonal rose-water bowl,¹ composed of small pieces of Amber mounted in silver. Many of the panels are richly carved, and the central one sets out a classical scene of warfare and the presentation of the victorious general to a monarch. This is attributed to 1680.

Of seventeenth-century work there are many splendid specimens in Dresden.

Two tall six-cornered boxes are very notable.² They have somewhat the resemblance of tea-caddies, and are richly carved and engraved, decorated also, as is most of the amber work of that period, with panels of engraved ivory. They have lids of Amber to each of them. There are three fine covered cups or jugs formed entirely of Amber mounted in gold or silver. One of them³ is identical in every respect with a jug in the possession of the Grand Duke of Hesse in Darmstadt, and this has on its base a plate engraved: GEORGIUS SCRIBA BORVSSVS CIVIS ET INCOLA REGIO MONTI BORVSSORVM HOC FECIT 1617. This Dresden jug is evidently the work of the celebrated carver, George Scriba of Königsberg.

By the same notable carver are a smaller jug⁴ mounted in gold, with its handle richly decorated with enamel and pearls, and a splendid cup⁵ in the form of a ship mounted in silver-gilt, carved with mythological scenes. Then there

¹ iii. 86.

² iii. 97, 98.

³ iii. 77.

⁴ iii. 79.

⁵ iii. 82, p. 46.

is a wonderful pot or drinking-cup¹ that at one time belonged to Scriba himself, and was very probably his own work, and done for his especial pleasure. In this the base, brim, lid, and handle are all of gold, and adorned with representations of fruit and flowers in transparent enamel, those on the handle being set in diamonds. The carvings represent the Greek gods.

Another covered tankard attributed to Scriba came up for sale on the Continent a few years ago, and belonged to one of the Prussian Drinking Clubs. It was surmounted by the figure of a man seated on a barrel, and was richly mounted in silver-gilt, with a handle of the same metal, on which was a finely executed recumbent figure. It passed into an American collection, but cannot now be traced. There are also in the Green Vaults two amazing cabinets of amber mosaic. One² was presented as a gift by King Frederick William I. of Prussia to Augustus the Strong on the occasion of his visit to Dresden in 1728. It is overlaid front, back, and sides with Amber, and its interior contains eighteen drawers, the front of each of them being of amber mosaic surrounding an open shrine with Amber and looking-glass panels, and containing within it a fine crucifix of Amber and ivory. Even the stand of this cabinet and the cross stretcher rail are covered with Amber, and as it is over 6 feet high, it is certainly the largest example of a mosaic cabinet in existence.

Another somewhat smaller one³ on three ball feet is also covered on all sides with Amber. This has sixteen drawers and a central shrine, the latter containing a vase for flowers of the same precious material.

Of cabinets or caskets, the Green Vaults Collection has three fine examples,⁴ all very similar, and formed of wood covered over with panels of Amber. One of them has also

¹ iii. 78.

² iii. 88.

³ iii. 248.

⁴ iii. 96, p. 35.

some finely carved panels of ivory, and another some examples of agate and other semi-precious stones used as part of its adornment. We have, however, in England four cabinets of this type as fine as the Dresden one, although smaller, all in the collection of the Hon. H. D. McLaren, and exhibited at the Burlington Fine Arts Club in 1925. They also have carved bone or ivory ornamentation and cleverly contrasted examples of Amber, some of which is richly carved. One of them has two doors enclosing drawers, another a group of kneeling figures on its summit, and all are in triple form, resembling three caskets on the top of one another. They are sumptuous in colour, and particularly good examples of their kind.

The Green Vaults have, however, a larger one¹ of six tiers, crowned with a fine carved group of a man and his wife and children. This has important carvings on the base, representing the kingdoms of the world, and at its corners twisted columns of Amber surrounded by balls. It is very rich in its panels of contrasting Amber.

Another great cup at Dresden must not be overlooked. It is shell-shaped and mounted on an elaborate base. Its handle represents Neptune riding on a sea monster, and the shell of the cup is carved all over with very elaborate carvings representing the sea and its denizens—mermaids, monsters, crustaceans, and fishes.

Mr. McLaren has a pair of altar candlesticks of Amber with bone plaques, an inlaid amber backgammon board, and most noteworthy of all, as signed amber work is very rare, a gryphon figure signed GOTTFRIED TVRAN FECIT GEDANNENSIS.

The mention of Turan of Danzig leads to a consideration of the famous amber room at Tsarskoye Selo, as several of the panels in that room bear his initials upon them. Certainly the most extraordinary and important amber work that has

¹ iii. 91.

been ever carried out forms the decoration of this famous Amber Room at Tsarskoye Selo, the summer residence of the Russian Emperors near St. Petersburg (now Leningrad).

My old friend Baron A. von Foelkersam, whom I first met in 1906, and with whom I had prolonged correspondence up to the time of the Revolution in Russia, investigated the history of this important room with great assiduity, eventually discovering documents, some of which Herr Otto Pelka quoted in 1920 in his book on Amber. These made clear the origin of the room and all about it. Of some of these documents, he sent me careful copies, and but for unfortunate circumstances that happened in Russia, I should have had placed at my disposal copies of all of them. To some he particularly alluded in the issue of *старые годы* (*Starye Godye*) for November, 1912, and other later issues.

The room is the only apartment in the world panelled with Amber, and, moreover, it contains a number of cabinets and vases of the same beautiful material.

The beginning of its existence, however, goes back to far earlier days than the actual room, because gifts of Amber to the Tsar of Muscovy from the various Electors in Brandenburg and Germany were important and extensive, and especially from the beginning of the seventeenth century, when the Great Elector, taking, as has already been pointed out, more than ordinary interest in the revival of the amber trade, regarded Amber as one of the costliest and most beautiful materials in existence, and therefore suitable for presentation to other monarchs.

Baron von Foelkersam discovered the lists that are still preserved at Moscow of gifts that were made by the Elector of Brandenburg in the year 1649, and there is in them a special reference to six confectionery bowls "and other smaller pieces of pretty articles worked in Amber." These Otto Pelka alludes to in his book (see pp. 45 and 46).

When I visited the Treasury of the Kremlin at Moscow,

I saw there four small bowls and one somewhat larger, the larger being about 30 centimetres high, and these were decorated at the upper edge with delicate tracery in silver-gilt and in part inlaid with silver and pale blue enamel. These pieces formed part of this seventeenth-century gift, and with them also was a great presentation cup ornamented with arabesques, and standing upon a silver foot, in which there were eight oval pieces of Amber carved with flowers. There was also a mug (or cup) in silver-gilt, richly ornamented with Amber, and carved with reproductions of flowers and fruit. This probably also formed part of the same gift. They were sent to the Emperor from the Elector through his agent in Russia, Hintze Reiff, so Baron von Foelkersam told me, and by Reiff vast purchases of corn were made in Russia at the time that this presentation took place.

In 1655 a second embassy left the Elector of Brandenburg for Russia, and carried with it what Baron Foelkersam styled a splendid piece of Amber, but the list does not enter into any further details concerning it.

Then there were two other embassies, Pelka says, in 1673 and 1675. At the former, there were presented "a large amber centre-piece with eight branches, set in silver; a great bowl with artistic figures in Amber, set in gold; a costly, handsomely worked casket with many drawers and plaques of ivory in it; two tall lamps of Amber; and as a personal gift from the Ambassador himself, ten small pieces of Amber." It has not been possible to identify any of these with absolute certainty amongst the pieces that are still preserved at Moscow, but there is no question about their having been presented, and there are so many pieces of Amber in the Treasury that it is not easy to differentiate between them.

In 1675, Pelka states, a still further presentation took place, and then there was given to the Emperor a large mirror handsomely inlaid with Amber. This, as we shall see presently, is still in existence.

In 1688, on the accession of Frederick III., there were gifts taken by the special ambassador named Johann Reger, and there is still in existence, in Berlin, the bill for these particular things.¹ There was a casket, a box, a chessboard with its companion pieces, and a chandelier. They were all made by a man at Danzig, Michal Redlin, but it is somewhat curious, says Pelka, that amongst the records of the workers in Amber this man does not appear, and it is concluded that he was a special artificer, not belonging to the Guild of the amber-workers, but selected to carry out this particular work. His own signature is at the foot of the bill. For the casket he received 1,150 florins, for the candelabra 600 florins, and for the chessboard 500 florins,² but none of these important works can now be discovered in Moscow; they are all believed to have been burned in 1737 in a fire that took place in the Museum of Arms, in which at the time these pieces are said to have been exhibited. The maker's own description of the three important pieces runs as follows: He says that the cabinet was architecturally constructed of choice, rare, and variously coloured pieces of Amber, including some that were pale green in colour. He says that on the transparently cut plates he represented landscapes and scenes from classical fables, which were carefully cut by him, and between them he placed carved ivory representations of flowers, foliage, and fruit. The cabinet was a double one, the smaller part being on the top of the larger. It had eight drawers.

Of the chessboard he gives a very detailed description, which need not be mentioned here, but he speaks of it as being very massive and important, and he says that the chessboard pieces and also the squares were made of the finest transparent Amber contrasted with dark-coloured pieces.

It was of the chandelier that he was particularly proud.

¹ State archives, Berlin, quoted by Pelka.

² See Pelka, p. 48.

He says it had twelve arms, six in the first tier and six beneath. They were formed of ivory and were six-sided, richly decorated with panels of Amber delicately cut. In the places where the candles were to go he had represented portraits of Roman and of German Emperors engraved in gold, and beneath them transparent clear Amber, so as to set out the engraving to the best importance, and he declares that he worked for almost two years on this particular chandelier, and is prepared, if need be, to make a solemn declaration to that effect, in order that it may be understood what an enormous amount of work he has put into it. His own drawings for the stem and the branches of the chandelier are still in existence in the State archives of Berlin, dated 1688, and exceedingly full of delicate, beautiful work.

The same collection holds the drawing for the cabinet, and shows us that, in addition to the two cabinets standing one upon the other, there was a broad base, and a pediment top surmounted by the representation of a growing tree, and that the whole thing was very beautifully modelled (see Pelka, Figs. 87 and 88).

There is a cabinet in a private collection in Berlin which has a resemblance to this one by Redlin, but it is evidently not as fine as was his work.

In 1701, Pelka discovered that Frederick IV. of Denmark seems to have recommended, by a letter dated April 2, addressed to the Danish sculptor Gottfried Wolffram, that it would be a suitable thing to have an amber chamber in his castle. Wolffram set to work to prepare, first of all, drawings for the pieces, and then to carve a number of pieces of Amber for the purpose; but after proceeding for some little time, he had a quarrel with a rather well-known man called Eosander von Gothe, and the work was taken out of Wolffram's hands. The completion of it was then placed in the hands of two masters of the Danzig Guild, Gottfried Turan and Ernst Schacht, and they were instructed by a

contract dated January 27, 1702, to carry out the work. They appear to have worked at it until about 1711, but then, it is clear, the plan of a single room was given up and the completed portions found their way to Berlin, Frederick William I. having the desire to have a room in one of his palaces decorated with Amber. Peter the Great came on a visit to Frederick William I. in 1713, and Pelka tells us he was much attracted by the amber work then in a corner room in the third story of the castle, and appears to have made a request, which could not very well be declined, that Frederick William should present the Amber to him, that he should transfer it to Russia, and put it up in one of his palaces.

In the Moscow archives, so I was informed by Baron Foelkersam, there is preserved a list or inventory of the pieces that were sent. Some of the pieces cannot now be identified, but they included two large wall panels, in each of which was a mirror in a frame, two smaller ones, four smaller still, and two doors, and all these, the inventory says, were of one height. Then there were ten other panel pieces of different widths, and a large quantity of smaller items, such as shields, rosettes, pieces decorated with shells and snails, pediments, turned corners, and one particular door panel made up of 107 small pieces.

All this was at first erected in the Winter Palace. Later on, the Emperor Peter transferred it to the New Palace, but in 1755 the Empress Elizabeth had the entire room transferred to where it is at the present moment, Tsarskoye Selo, and she was able to add to the previous gift of Amber many more specimens that had been given to her ten years previously by Frederick the Great. The list of these is also still in existence in the Moscow archives, and it especially relates to the frame for a wall mirror, which had on the upper part of it the Imperial Russian crown, held up by two armed men, and below it the sceptre and sword on a cushion,

all carved in Amber. At the sides there were representations, on one side of the Goddess of War, and on the other the Goddess of Peace, together with emblems of War and Victory, intended to refer to the then recent war in Finland and the peace that had been accomplished. Beneath these two figures were represented on one side Neptune drawing out a dolphin from the sea and crushing it, and on the other side a siren, also struggling with a dolphin, both intended to represent Russian power at sea; and at the foot of the mirror there were representations of armour, arms, and armorial provision, together with two slaves lying near to them, to typify the strength of Russia on land. In addition to all these important figures, there were carvings of snails and shells, and branches of fruit and foliage around the mirror.

This great gift¹ now hangs on the left of the room at Tsarskoye Selo, but the crown that was on the top of it, according to the description, has been removed, and has found a place on one of the other frames. The room has three windows on one side which reach down to the floor; the opposite wall is divided into two by a folding door, and so are the two side-walls. These are all richly ornamented with carved gilded wood in rococo style, and on each of the walls is a mirror in gilded bronze frame, with brackets for candles of the same material. Such portion of the doors and panels as is not covered by these bronze mirrors is decorated with Amber in very rich mosaic form, and with panels of carved Amber. Eight of the panels are oval and are carved with representations of the gods of classical history, and others show figures of Minerva and Pomona.

One panel in the middle on the left has four great reliefs depicting scenes from the Old Testament, and two of the walls are decorated with large amber frames for mirrors, somewhat similar to the one that has been described as the

¹ See Pelka, p. 62.

gift of the Empress Elizabeth, while above one of them appears the Imperial crown that was at one time on the largest mirror, and then sustained by two warriors. There is also an extraordinarily fine panel representing three sea-horses, and another showing the figure of Love. Two of the mosaic panels which represent Taste and Hearing, Pelka is convinced, did not come from Germany, but from Spain, and in spite of the strange mingling of the work of different artists at different periods and from different countries, the effect of the room is exceedingly impressive, especially when the sun shines upon it and lights up the golden luminosity of the Amber.

The ceiling is decorated with allegorical subjects by two artists, Giuseppi Valeriani of Rome and Antonio Peresinotti of Bologna, who were both working in St. Petersburg at the time of the erection of the room, and who carried out this work.

The floor of the room is an amazing piece of fine parquet work, and the room contains some very special pieces of Oriental porcelain, and in the centre a bronze figure representing one of the Emperors on horseback, and there is Amber also on the stand which supports this figure.

A few pieces in the room are signed by the well-known Amber-worker Gottfried Turan, and he has added to his signature "Fecit Gedannensis," as on Mr. McLaren's figure already mentioned.

When I visited the room many years ago, I was much impressed by its magnificent colour, by the extreme skill with which contrasting Ambers had been applied in the decoration, and also with the extremely clever carving, at times in very high relief, of some of the figures. I was promised by the Emperor, who gave me the catalogue of his silver in two fine volumes, a full set of photographs of the room, but unfortunately they all miscarried in the post, and I could not get them repeated.

As an exhibition of barbaric splendour in Amber, the room is certainly very wonderful. It is sumptuous and rather overpowering. Some of the carving is comparatively coarse, especially pieces that are high up near to the ceiling, but other pieces bear the very closest investigation.

Its actual erection in its present place, so Baron Foelkersam found out, was completed in 1760,¹ under the instructions of the Imperial architect Carlo Rastrelli the Younger, and the sculptor who was responsible for the arrangement, and for carving such Amber as was necessary to make the room complete, was Alessandro Martelli. There are several places where his signature appears with the date 1760, but there are two places, Pelka states, where the date 1709 can be noticed, and this of course refers to the work of the Danzig men. Even by 1760 the work was not regarded as complete, and several men from Königsberg were called in to finish it. Their names, according to the archives still preserved in Moscow, were Friedrich and Johann Roggenbuch, Klemens and Heinrich William Friede—two pairs of brothers in one document termed twins—and Johann Welpendorf. They appear to have been the last persons to have had anything to do with the carving of the room, which, since their time, has not been much altered. At one time many of the pieces that had been presented to the Emperor by the different Electors were put in this room. Some of them are still there, but the majority have been transferred a long time ago to Moscow.

In Florence in the Pitti Palace there is the most varied and extraordinary show of amber vessels, cabinets, and figures in existence. In one case there are six large drinking-cups on tall stems; in another, seven open bowls or *tazze*, three of which have covers. There is a wonderful open bowl with two handles richly ornamented, and there are three large tankards with covers, and two tall vases for

¹ See Pelka, p. 67.

flowers, all composed of Amber in mounts of silver-gilt. Of altar candlesticks there are eight, all mounted in precious metal and adorned with ivory or bone carving, and above all in marvel there is a table fountain of various tiers, with cherubs and scallop shells and dolphin supports, while in the bowl below are fishes of Amber that are so fastened as to appear to disport themselves when the fountain is in use. This is a very wonderful piece, suitable only for a royal or princely table.

Of crosses and crucifixes there are no less than ten, and some of them superb. One of the grandest in its conception is the very simplest, because it represents a natural tree with two extending branches and a rough base as though it was a mound of earth. On the tree is the Crucified One, and above His head, loosely fastened, is the inscription written on what would be a piece of rough board, and at the foot of the tree is a skull. In its monumental simplicity this is the only amber crucifix that I have ever seen in which deep solemnity with monumental grandeur have been attempted, and to a considerable extent the artist has succeeded in his aim.

In one of the others, a very large and tall one, standing up in an elaborate rococo shrine, the two attendant figures, those of Our Lady and St. John the Divine, are well wrought, and are expressive of feeling, but the others are elaborate, rich, and costly, rather than effective as Sacred Art. On one very elaborate crucifix, overwhelmingly rich in carving, there are figures of very many saints, apostles, and angels, as well as those of Our Lady and St. John, all grouped about a shrine enclosing a tabernacle.

Another has a fine carved *pietà* below the crucifix, and below that an elaborate achievement of the Papal arms in the same material. One surmounts a *prie-dieu* on three steps, all covered with Amber, and has as its base a shrine in which is a representation in carved ivory of the Annunciation

and attendant angels. This one has its own pair of fine candlesticks with similar decoration. Two are quite small, and one of these has the lances and the sponges supporting the crucifix, both on spears. The figure of St. John is missing from this one.

Very much like it, but of large size, is another tall crucifix rising from a triple shrine raised on two steps. This is a particularly elaborate piece of carving, but unsympathetic and somewhat coarse in execution.

Of the two remaining ones, a tall thin cross, on which is no figure, rises from a series of five ornamental bases, and the last is really a tall cross resembling a crucifix and representing one on its reverse, but bearing aloft a figure of Our Lady with two attendant Bishops.

There are several cabinets, of which the most notable is the Medici Casket, made to the order of one of the Dukes, and adorned with the Medici arms under a coronet and with fine carved figures of two Archbishops bearing pastoral crooks. On its summit is a warrior on horseback.

The other seven cabinets are of the usual type, one casket above the other; in one case three, in others two, richly ornamented with Amber in contrasting colours and adorned with carvings in ivory or bone. One is surmounted by a greyhound, another by the figure of Our Lady, and others by carved groups.

Besides all these, there are in this same collection very many carved figures, the most notable three representing the Blessed Virgin upon the moon, and others male and female saints.

There is also a prie-dieu with a shrine enclosing fine ivory carvings, and mounted on three steps; a very fine bust of a Roman Emperor; a kind of small font and some smaller pieces—cups, chessmen, bottle, tablets, boxes, etc., altogether forming the most effective and remarkable exhibit of amber objects next to that in Dresden that any museum possesses.

Quite a notable amber shrine used to belong to Sir E. Naylor-Leyland, Bart., and was sold at Hyde Park House on June 11, 1923, to the Spanish Art Gallery for a large sum. This was a very elaborate one, as upon it there were ivory figures of Christ and His twelve Apostles, plaques representing the Baptism, the Agony in the Garden, the Crucifixion, and the Ascension, and surrounding a central panel the signs of the Zodiac. It stood 47 inches high.

From very remote periods in China, Amber has been carved into grotesque shapes for ornaments or for use. Messrs. Spink & Co. had quite recently in their possession an important group of animals, forming an ornament or letter-weight, and belonging to the Ming period. They had also many smaller carvings, representing, for example, two finger citrons, a figure of a seated sage, a standing figure, and a bearded Immortal, all of Kien Lung period (1736-93). There are often carved snuff bottles in their possession made of Amber, and occasionally those strange representations of mountain landscape with monkeys and trees that the Chinese are so clever in carving from hard stones or Amber, and which belong to the Kien Lung times.

Amber has been used at times for the handles of knives or forks, and in the Victoria and Albert Museum there are a pair of finely carved amber handles.

In the Pierpont Morgan Collection is a wonderful cup composed of Amber. The cup itself is a shell-shaped piece of Amber, carved at the head of the shell with a group of flowers, and in the centre is a carved figure of an *amorino* asleep, the figure itself being represented in the opaque Amber, and the draperies in the clearer gum. The stem of the cup is of wrought gold, richly enamelled, and represents the tree of the knowledge of good and evil, fastened upon a rough base of clear Amber. The tree is enamelled brown, and about it twines the serpent in green enamel, with eyes of red and open mouth of gold. The two figures of

Adam and Eve are wholly of white enamel, their hair being left in the gold. Eve holds an apple of red enamel with two leaves of green, which she is offering to Adam, who rests one foot on the branch of the tree, around which the snake has twined his tail. The lump of clear Amber on which the figures rest is set in a gold mount, decorated with a border of strap-work, alternated with vases of flowers, the flowers being represented in natural colours, and the strap-work in black, white, and red. Height, $3\frac{1}{2}$ inches; width, $3\frac{1}{8}$ inches; width at the base, $2\frac{1}{4}$ inches.

This cup at one time belonged either to Cardinal Alessandro Farnese (1519-89) or to his brother, Cardinal Ranuccio Farnese—it is not certain which. It is believed, however, to have formed a part of the famous collection of the great Bishop of Parma who completed the Farnese Palace, and was Papal Legate to Germany, France, and the Netherlands. It was certainly at one time in the Farnese Collection, and is, we are informed, described in an inventory of that collection in the Naples Library. It was not, however, in the collection when, early in the eighteenth century, the treasures were removed to Naples after the division of the family estates according to the arrangement set forth in the Treaty of Aix-la-Chapelle, but there are some precious objects in Amber which formed part of the same collection still in the Mediæval Room of the Naples Museum. In the interval it is believed that a large sum of money was obtained for this amber cup, which then disappeared from the Farnese Collection. (See "Catalogue," 1910, pp. 136, 92.)

Occasionally the Chinese use clear Amber for netsukes, but amber netsukes are rare; ivory was very much preferred by the Chinese workers. Wood and metal were also used, but very rarely Amber. I have seen but three amber netsukes, and the finest of them is in my own collection.

I have also in my own collection three beautiful examples of Amber carved in relief, declared to belong to the late

fifteenth century, but very possibly early sixteenth. They are believed to have come from the pedestal on which stood a great crucifix that belonged to a Polish Prince, and perhaps were brought a hundred years ago from Danzig, where the crucifix was sold and dismantled. The two side panels represent cherubs with wings, the centre panel is believed to represent St. John the Baptist nearly nude, and holding a jug in his hands. The tradition, however, can hardly be supported, because the figure is presented with wings. The wings of the two cherubs are exceedingly beautifully engraved, the feathers being very carefully rendered, and the hair on the head is also rendered with great care and some distinction.

Two of the panels are of very light Amber in colour, the third a rich deep Amber, and amongst the various examples that I have seen of Amber at the bases of different crucifixes, none, to my mind, have exceeded in beauty the three pieces that I myself possess.

It will be well, perhaps, to refer in brief fashion to some of the more important pieces of carved Amber that are in other museums than those that have already been noted.

At Darmstadt there is a tall tankard mounted in silver, dated 1617; another flagon with cover, having various panels of Amber upon it; and a flat-sided canister with cover of Amber, richly carved.

In the Museum at Gotha is a fine cup and cover, and a remarkable small flask, carved in grotesque figures, and, furthermore, a somewhat squat mug on three feet with cover richly carved.

The Berlin Museum, amongst other things, contains a very important cup on a foot composed of panels of Amber and ivory, and with a somewhat notable group of figures of sea-horses, forming part of its handle. There is also a covered cup well engraved, and a splendid dish, the centre of which represents a group of fruit and flowers, and in

many characteristics is like a dish in the Green Vaults at Dresden.

In the Museum at Cassel there are several pieces, but perhaps the most notable is the chandelier, the work of J. Dobbermann. One of the most curious is of two reclining figures in a large leaf-shaped ornament which has been ascribed by Pelka to an Amber-worker named Labhard. There is also a covered cup that is notable and important.

Reference has already been made to the various things in the museums of the Hermitage and Moscow—cups, tazzas, covered cups, presentation cups, and candlesticks, some of the latter being of unusually large size.

Stuttgart, amongst other treasures, has an important plaque, with carving in high relief, Vienna a very notable group, Hamburg the handle of what appears to be a kind of dagger, and various smaller pieces. A kind of box with a cover on which is carving in high relief is another of the treasures at Gotha, and a somewhat similar box, but larger in size, is at Danzig.

One must not forget also to mention that there are handles of swords, walking-sticks, and canes in Russia, cigar-holders and cigarette-holders, and handles for knives and forks.

It must be borne in mind that the beauty of most of these pieces consists almost exclusively in the colouring, sometimes contrasting and often resplendent, of the material used, and not in the carving that has been executed upon the Amber.

It is therefore practically impossible to illustrate, with any degree of success, objects that represent the use of Amber in Art, because of the secondary position of the carving and general artistic work, and the absolute inability of illustrations, whether coloured or otherwise, to represent the gleaming beauty of the Amber itself.

The metal-work in all these objects, whether silver or gold, and whether plain or chased, is only used in a sub-

ordinate manner to show off the beauty of the Amber. It is the Amber that is so remarkable in colour, and it is this colour that constitutes the charm of these objects.

Somewhere in China there are probably two Amber vases of an extraordinary character.

There was a man named James Cox, who is first mentioned in the clockmaking records in 1760, and who died in 1788. He was an exceedingly clever mechanic, and responsible for a large number of automata. By trade he was a jeweller and watchmaker, residing at 103, Shoe Lane, Holborn, but his interest was very largely in making automata, and he produced a large number of clever mechanical devices, which he endeavoured to sell, but with very little success. He exhibited the things at Spring Gardens, Charing Cross, and attached to the principal mechanical device a certificate from James Ferguson the astronomer and mechanic (1710-76), who wrote from Bolt Court, Fleet Street, on January 28, 1774, stating that the clock to which he referred was the most ingenious piece of mechanism he had ever seen. Cox was unable to dispose of his great collection of mechanical devices and automata, which he valued at £197,500, and in 1772 he obtained a private Act of Parliament authorising him to dispose of all these things, which formed his museum, by means of a lottery at the Guildhall on May 1, 1775. His exhibition was open to the public, first of all at a charge of half a guinea each for admission, and later on at a charge of a quarter of a guinea for each admission. A catalogue of thirty-two pages was issued to visitors.

It has been stated that most of the things went to China, as they were regarded as unsuitable for the European market. Cox appears to have desired to sell them to Oriental clients, and he was responsible for an elaborate watch suitable for the Oriental market, which is now in the British Museum.

His chief mechanic was one Joseph Merlin, an eminent mechanical genius (1735-1803), a native of Liége.

Cox is believed to have had a son who settled in Canton, and there certainly was a firm named James Cox & Sons, of Canton, who were in business from 1783 to 1790. Their successors were Cox & Beale, whose name occurs in 1790. Two years later the firm appears to have been styled Beale & Félix Laurent. No further information appears to be available later than 1792.

The two pieces of Amber were the ninth and eleventh pieces in the catalogue. The amber vases, which were embellished with many ornaments of gold and stones of various colours, contained a bunch of flowers in jewellery with butterflies and other insects upon it. The catalogue states that the "flowers unfolded" and the "butterflies waved their wings" "in imitation of Nature." The vases stood on the backs of four turtles, "animated like Nature" and placed at the top of a pedestal, "raised upon columns of crystal and beautifully adorned with gilt shells amongst lively cascades of artificial water and other pleasing ornaments, with which the pot is also filled." The catalogue states (see page 22) that the piece was 10 feet high. This probably refers to the extreme height of the whole thing—pedestal, columns, turtles, and vase. The vases themselves were, in all probability, not very large.¹

Of amber jewellery I imagine that no person can have a larger collection than that possessed by a lady in London who desires to remain anonymous. She has an unrivalled collection of necklaces, representing almost every type of Amber. Perhaps her chief treasure is a necklace which, it is said, was worn by Mary Queen of Scots, composed of dark, wine-coloured beads, each of them simply and

¹ See "Old Clocks," F. J. Britten, 5th ed., p. 401; C. H. Baillie, "Clock and Watch Makers of the World"; and E. J. Wood, "Curiosities of Clocks," 1866, pp. 150-155

plainly carved. She has also a necklace which is said to have belonged to Marie Antoinette, adorned with a remarkable Eastern tassel, ornamented with silk-covered cardwork and beads.

In the same collection is an unusual lump of Amber, greyish-yellow, carved to the figure of an old man seated with a child near by, evidently Chinese. There is also a fine Chinese snuff-bottle of Amber, rather larger, flatter, and thinner than usual, of rich dark red material.

Of Sicilian Amber there is an extraordinary collection. One necklace has a large lump of deep wine-coloured Sime-tite as a pendant, having upon it a glorious bloom of blue. The necklace itself is composed of beads, not perforated, but united with gold chains between each; some are blue, others pale, carrot-like colour, others deep ruby.

Then, also of Sime-tite, there is a necklace of very large lumps, every one of them showing signs of volcanic action, gloriously blue in places, with wonderful flashes of ruby. United with these is a piece of Gedanite of unusually large size, of the ordinary plain deep yellow appearance.

There are necklaces of osseous Amber, there are some of the ordinary golden tint, others very deep in colour, and some that have been treated by the Chinese under the action of some strong acid, and altered in tone and made uniform in appearance. These are decorative and interesting, and exhibit the ability of the Chinese, almost uncanny in its power, to manipulate the colour of Amber.

There is an exceedingly beautiful piece of Succinite, partly osseous and partly clear, somewhat resembling a clenched hand or a bone, a little like the hands of jet made and sold at Santiago de Compostella. This is mounted in a gold filigree handle, evidently Persian.

Another necklace is of big rosy-tinted pieces of Sime-tite, resembling great plums.

Rumanite is also well represented in the collection, as

there is one big blob of rich dark brown and rosy Rumanite, unusually important in colouring.

Burmite is represented by two superb blobs very deep red in colour, and one, I am pretty sure, formed part of the exhibit at the Burmese Pavilion at Wembley, and was a piece that I myself tried to obtain, but was informed it was already sold. It forms a very decorative pendant.

Another necklace is of pieces of Succinite, in every one of which is some insect represented, and this collection possesses a large flat tablet of Succinite, from the district near Königsberg, in which there is a well-preserved beetle.

Moreover, the collection includes at least three necklaces of carved beads: in one the beads are very elaborately carved; in another, not so elaborately; and in the third, quite simply.

It is, in fact, difficult to find any type of Amber necklace that is not well represented in this extraordinarily fine casket of jewels.

In regard to the necklace which tradition associates with Mary Queen of Scots, just a few words are necessary. It is never, in my opinion, advisable to neglect a tradition entirely. There has generally been some foundation in fact for it, and, inasmuch as the name of the ill-fated Queen of Scotland has been associated with this necklace, it seemed desirable to consult with some detail the lists that are available concerning the jewels that she possessed. There have been two volumes issued with regard to Mary Queen of Scots' possessions,¹ and both these have been examined. The Queen's jewels consist, for the most part, of ornaments set with diamonds, emeralds, rubies, turquoises, sapphires, and, above all, with pearls, but there are others in which allusion is made to garnets, agates, rock-crystal, carnelian,

¹ "Inventories and other Records of the Royal Wardrobes," by Thomas Thomson, 1815; "Les Inventaires de la Royne d'Écosse," Joseph Robertson, 1863.

and jasp or jasper, but, so far as I have been able to discover, there is no mention in any of the jewels of settings of Amber. The Queen appears to have possessed vast quantities of buttons of different kinds, in some cases they are mentioned in connection with gowns, in others separately, evidently that they might be used for different gowns. Many of these were set with pearls, rubies, diamonds, and emeralds; others were of wrought gold, some of filigree gold, and very many enamel; while of others, the material of which they are composed is not mentioned. There are some agate and some jasper amongst the number, but there appears to be no set of buttons expressly said to be of Amber. There are two paternosters of Amber mentioned in the lists, and there is apparently a carving representing a man's head.

It has been suggested that possibly the beads in the necklace belonging to the lady in question may have been beads for a rosary, and this idea must not be wholly set aside; but, inasmuch as the beads are graduated, as if intended for a necklace, and are many more in number than would be needed in a rosary, it is not very likely that this suggestion will fit the case. All, therefore, that can be said is that, so far as the inventories of jewels belonging to Mary Queen of Scots are available, there is no definite evidence to support the tradition.

It may be well in this chapter to add a few words of precaution with regard to Amber, in view of examples being purchased. Let it be said at the outset that, in an amber necklace, if the beads are all of exactly the same colour or tone of colour, it is almost certain that the Amber has been "treated." The Chinese are exceedingly expert in "treating" Amber, exposing it to different degrees of temperature and to the influence of different gases. They have, moreover, methods of driving colour into the Amber by hydraulic pressure, and they appear to have some method, the exact process of which is unknown, of giving

to Amber certain unusual colours by a solution perchance of an acid. It may be taken as certain that there is no Amber that resembles a morello cherry, but amber necklaces are frequently to be found in which the beads are of a cherry colour, not perhaps transparent, but having very much the appearance of the fruit of a cherry. It may also be taken for granted that the Amber that resembles a plum has been treated. It is possible to drive out a certain amount of colour from the Burmese Amber, Burmite, and to render it rather more transparent. It is possible, on the other hand, to drive in a certain amount of red colouring to yellow Amber, and the Chinese do it, with the result that plum colour or a deep red colour, or bright green, is so obtained.

The naturally pale yellow Amber has often also been treated. To cut from Esthonian or from Danish Amber a necklace of which the beads will be almost exactly the same colour would be a costly procedure. In consequence, beads are cut similar to a certain extent in colour to one another, and then the whole necklace is exposed to extreme heat, carefully moderated so as to bring the amber beads all up to the same effect of colour. This is not exclusively a Chinese process; it is carried out in Northern Germany, and with some success.

The Chinese attach a very special value to a dull, greenish-yellow Amber, slightly resembling a poor quality of jade. They believe that this Amber has a certain magical quality, and sometimes they attach one bead of this Amber to a much larger necklace with intention, but occasionally the stringers of necklaces, not being aware of the special value of this jadeish-coloured Amber, use beads that may come into their possession in a necklace, with the result that certain beads in the necklace are worth a great deal more than the other beads. In one large necklace at Messrs. Liberty's, of beads of Chinese osseous Amber, I found one

of these Vladivostok jade-like beads put in by mistake. This jade-like Amber is so exceedingly rare and occurs in such very small pieces, that the Chinese consider it intrinsically of high value, apart from its magical quality, and when found, a bead of that character should be regarded as of special importance.

Amber is almost necessarily variable in colour and in tone; the effort of the maker of necklaces is to obtain a uniform result. By so doing, he spoils the character of the Amber, having to resort to some kind of treatment, and the result is by no means really satisfactory to the purchaser. Uneven colour in a necklace is greatly to be preferred by real lovers of Amber to a uniform effect which is always due to a chemical action of some kind or other.

I have recently seen an important collection of Chinese snuff-bottles, in which were several made of Amber. One was of especial interest, as it contained what was evidently an incomplete fruit of the walnut, and the whole interior of the fruit had been cut away in order to afford the necessary space for the snuff. It was comparatively easy, by means of Dr. Berendt's "*Organische Reste im Bernstein*,"¹ to recognise that the fruit belonged to *Juglans nigra jagenianus* Göppert, but I had never before seen such an excellent example of the fruit. The lump of Amber containing it had been left in its natural smooth condition. Mr. Preston, the owner of the collection, has several other notable snuff-bottles of Amber.

¹ Berlin, 1845, Plate V., Fig. 31.

THE LOCALITY IN WHICH AMBER IS FOUND

AMBER is to be found all over the world, and in places very distant from one another.

By far the chief supply of Amber, however, is from Eastern Prussia, Lithuania and Latvia, and in comparison with the Amber that comes from the shores of the Baltic Sea all other sources are insignificant.

The home of the true Amber or Succinite is in that district, but notwithstanding this assertion, it must be stated with equal truth that true Amber can be found in many other places, and also that there are certain varieties of Amber distinguished as a rule by separate names, to be obtained from distinctive places, such, for example, as Sicily and Burmah (see under Simitite and Rumanite in separate chapters).

Amber is in great demand in the East. It is brought into China from the Behring Sea. It is said to be mined at Vladivostok, and it is highly cherished by the Chinese, especially in amulet form, as it is believed to insure to its wearer a long and happy life.

It has been found in Siam and in Cochin-China; in Manchuria and Japan, in Siberia and Saghalien, in Greenland and in Mexico, but in all these latter-named places in but small quantities.

In Siberia it occurs in connection with beds of lignite, and there are splendid specimens of it that I have seen and handled in the Museum of Science in St. Petersburg (now Leningrad).

They came from a place called Turnukhansk, and also from Kaniss Island. Amber is also found in Siberia close to Lake Baikal, and this I have seen. It is not important

commercially, as it is fragile and will crumble if not carefully handled. It is deep orange in colour.

There is true Amber to be found in the United States. It has been discovered in the Magothy River near Cape Sable, and in the Anne Arundel district of Maryland, always in connection with beds of lignite.

Further afield, in the island of San Domingo, it is to be found in far larger pieces, especially in the valley of the brook Acague, washed away from its deposit in the surrounding hills.

This information came from Señor Don Jaime Alemany Rodriguez in December, 1927, and by the courtesy of my friend Mr. Burse, of the Amber Trading Company, I have come into possession of two pieces of it. They are of a rich dark brown colour, with a sort of marbled appearance, and resemble to a marked extent the black Rumanite that is found in Roumania. They take a very high polish, they are fluorescent, and the specific gravity is 1.048.

In exceedingly small quantities it occurs in the greensand of New Jersey, and in some parts of Virginia it has been discovered.

In Greenland it was discovered by Whympers in Hare Island, North Greenland, but what he found has never been, I understand, submitted to chemical analysis, and it may therefore be a fossil resin of a different character to Amber.

There is a greenish-yellow gum resembling Amber to be found in Brazil.

In New Zealand many specimens of what is more properly Retinite rather than Succinite have been discovered, and in various colours, from the palest yellow, through red, to the deepest brown; but actual Amber is rare in New Zealand, and the examples found have no very high value, and are not specially important from either a chemical or a mineralogical point of view.

The fossil resinous substances frequently found in peat

and sometimes lying loose in the ground, near to peat-beds, have been called by the collective name "Retinite." The absence of amber acid distinguishes them from true Amber or Succinite. They are of very slight industrial value.

In British Columbia, at a place called Coalmont, there is to be found a glossy black bituminous coal in which is enclosed a considerable amount of fossil resin.

Some such resin had already been reported in various cretaceous coals in Western Canada, and especially has the resin been noticed in a large deposit of ligneous coal at Cedar Lake, Saskatchewan.

Differing as they do from Succinite or true Amber, such fossil resins were named by Dana, Retinite, but Dr. Bernard Harrington gave the specific name of Chemawinite to the fossil resin at Cedar Lake, which has also been called Cedarite. In order to arrive at definite information regarding the composition of such resin, experiments were made at the Ore Dressing and Metallurgical Laboratories at Coalmont by Dr. Carnochan. His procedure was to feed the crushed coal into the centre of an agitator containing a solution of chloride of sodium or chloride of calcium, density 1.15 to 1.17, with a spray of the solution to wet the fine particles of the coal, and cause them to sink in the solution.

The coal was then drawn out in a thick pulp, and the resin floated to the surface, to be afterwards washed, dried, and weighed. About 2 per cent. of the original feed was resin, and it was in pieces about the size of peas, fairly brittle, and with no marked cleavage lines.

In colour it was as a rule pale lemon, but it varied in tint from that to a deep brown, almost black, and some pieces, says Dr. Elworthy, from whose report and from that of Dr. Carnochan these facts are obtained, showed a green fluorescence.¹

¹ See "Canadian Institute of Mining Report," 1927.

Some pieces that were the subject of very special investigation were plucked from the coal by hand. When specially tested, the Coalmont Amber was found to resemble Prussian Succinite in certain characteristics, but not by any means to be identical with it.

Its specific gravity was from 1.031 to 1.168, that of Succinite is from 1.060 to 1.096.

When heated, it softened at about 160° to 180° C., whereas Succinite softens at 150° C.

It melted at a temperature between 270° and 300° C., and Prussian Amber melts at about the same heat—say, 280° to 300° C. It yielded succinic acid practically identical with that in Prussian Amber, and to about the same extent, and its residue was soluble in linseed oil and turpentine, as is the residue of Succinite after being heated to 300° C. With other solvents, such as ether, chloroform, carbon tetrachloride, or selenium oxychloride, it behaved in similar fashion to Succinite. A varnish was made from it which closely resembled that made from true Succinite, save that in colour it was darker, and compared with other commercial products this varnish gave very satisfactory results, drying hard in the usual time, and resulting in lustrous and hard surface.

It was certainly harder and better in results than that obtained from Kauri gum scrapings, or from rosin, but it cannot compete with the better varnishes made from Manila, Congo, or Zanzibar gums by reason of the very small output and the difficulty in separating from the coal, even though, when tested by results, it was actually better and harder than were such varnishes.

The clear oil obtained from it is almost identical with that from Succinite, but, unlike that, it darkens on exposure to light and air.

It is a particularly interesting *Retinite*, but at present insufficient quantity has been obtained to make it a market-

able product. It is quite possible, however, that further exploration will reveal it in larger blocks.

A very interesting and informative report concerning the Amber of Vancouver was prepared by Mr. S. E. Oliver in November, 1921. He had studied Amber all over the world, and was convinced that as a by-product in Canadian coal, the Amber that could be extracted would have high commercial value. He said it would be possible to treat a thousand tons of coal a day, and to obtain many high-grade products—sulphate of ammonia, creosote oil, anthranilic products, benzol products, Amber, Amberoid, and clear oil. Difficulties, however, with regard to capital and sound commercial results have prevented his most interesting product having the full attention it deserved.

A discovery of Amber was reported from Madagascar and another from Uruguay, but both these, on testing them, were proved not to be Succinite, but a resin more resembling that of copal or animi.

From the Guinea Coast of Africa a large collection of specimens were obtained by a wealthy collector in the fond hope that all were Amber. Pieces containing leaves and insects were pointed out in proof of the statement, and certainly in colour, in electrical power, in a slight fluorescence, and in general appearance, the material had a somewhat close resemblance to Amber.

To the fingers, however, there was revealed some doubt, and it fell to my lot to test the examples by specific gravity, and by their appearance with ether and by other tests, and then to have to convey to the unfortunate owner the sad fact that fraud had been at work, and that not one single specimen out of over thirty was of Amber, despite all the statements to the contrary that had been made by the unscrupulous dealer concerned. In this case, very large sums had been paid for the specimens, some of which were of rare beauty, but it was eventually proved that all had

come from near to Sierra Leone, and that careful polishing and a plausible tongue had inveigled the collector into the purchase of rubbish.

Sir Thomas Browne, in his book of "Vulgar Errors," speaks about a letter that he had received from Lord Yarmouth, describing some beautiful specimens of Amber found in the Baltic Provinces, but he went on to state in this letter that "a Mr. Henshaw confesseth he was like to have been cheated by a merchant with a piece that had somewhat included in it which he found to be rosin." Lord Yarmouth then went on to state that there was a way to counterfeit Amber, "very handsomely, and he has taught me, and if we had a workman to help us, we might do some pretty things of that nature."

The presence of Amber in Spain is thus alluded to by Townsend, in his "Journey through Spain":¹

"When I returned to Oviedo, a gentleman gave me a collection of Amber and of jet, of which there is great abundance in this province: but the two most considerable mines of it are in the territory of Beloncia, one in a valley called Las Guerrias, the other on the side of a high mountain in the village of Arenas, in the parish of Val de Soto. The former is found in slate, and looks like wood; but when broke, the nodules discovere (*sic*) a white crust, inclosing yellow Amber, bright and transparent. Jet and a species of Kennel coal, abounding with marcasites, universally accompany the Amber."

I have an important example of this Spanish Amber in my collection, found near to Santander. It is crusted with some greyish-white parasitic growths, but underneath is true Succinite.

Occasionally in Siam a particular kind of Amber can be found, which is entirely different to Burmite, especially in the amount of succinic acid which it contains. It is ex-

¹ Vol. ii., p. 56.

tremely clear, and of a golden colour, not deep red, as is Burmite, and it is called by the natives of Siam by a word meaning "luminous inside," inasmuch as it has a remarkable luminous quality of its own, almost as though a flame of light was within it. There are but few animal remains to be found inside Siamese Amber, but it is of great beauty, and appears to imprison sunlight in its intense golden, luminous quality.

Roumania yields its own special and very beautiful Amber, known as Rumanite; Burmah a glorious red Amber called Burmite; and Sicily the amazing coloured fluorescent and opalescent Amber that goes by the name of Simetite. To all these special attention will be given later on.

The true Amber or Succinite, called Prussian or Samland Amber, is divided by those concerned in mining it into many varieties, according to colour and condition. These have been alluded to where special consideration was given to the principal district from which Amber comes.

Amber is also found on the shores of the islands of Osel, Orland and Bornheim, and sometimes on the Dutch coast at Scheveningen and Rollum.

Copal is sometimes confused with Amber, but it is a very different substance from it.

True copal, called by the natives of Zanzibar *Sandarusi Inti*, is a semi-fossil gum, found embedded in the earth, mainly in Zanzibar, in places where now no single tree is visible. As a rule, it can be found at a depth of about 3 feet, never, I am assured by Dr. Spurrier of Zanzibar—who is my informant with respect to copal, and from whom I have received many specimens—at a greater depth than 4 feet. It is found, as a rule, in quite small masses, weighing some few ounces, and very occasionally much larger masses, up to 4 or 5 pounds in weight, have been discovered. It is generally collected during the rainy season, when the earth is soft and easily to be worked. When first removed

from the ground, the best kind of fossil copal shows a sort of gooseskin formed upon it by its exposure to the air, but above this there is generally a sort of reddish crust, which has to be scraped off. In appearance fossil copal closely resembles Amber, but can be readily distinguished from it by its melting-point, which is approximately 100° C.; by its inferior hardness; by its deficiency in amber acid; by its different specific gravity to that of Amber, as its specific gravity ranges from 1.04 to 1.07; and by the fact that it is not attacked by caustic soda or by acids.

In Zanzibar is also found another species of copal, frequently termed *animi* or *chakazi* (jackass), and obtained from the tree known as *Trachylobium Hornemannianum*. The tree is a very handsome one, with a tall, straight stem and white, silvery bark, resembling the birch tree. It occurs in great abundance in what is called the Giriyama district. This gum is obtained from the stems of living trees, or from the roots or cavities of dead ones.¹

Two pounds of gum is said to be the average from seven trees, and it is still obtained in Zanzibar in the most wasteful and careless manner by the natives. They have been instructed to use modern appliances, and so save good living trees, but they continue to adopt their old practices, and refuse to carry out the modern arrangements. The fresh gum is not as hard as the semi-fossil variety.

A fossil copal can also be obtained on the west coast of Africa, the product of a tree now extinct. It is similar in character with what is called Sierra Leone copal, which comes from the tree *Copaiifera Guibourthiana*, but the fossil production is not identical with that which comes from the living tree. This tree also belongs to the Cæsalpinae of the order of Leguminosæ. The fossil copal occurs in rolled

¹ See "Travels in the Coast Lands of British East Africa and the Islands of Zanzibar and Pemba," by W. A. Fitzgerald, 1893, pp. 153-154.

pebbles, so Professor Church states, with an abraded surface. The Sierra Leone copal and the fossil copal are soluble in absolute alcohol and spirits of turpentine.

Other copals are known in Angola and in Gaboon, in Brazil, in Madagascar, and in Demerara, but these are all copals that can be obtained from living trees, and are different from the tree or fossil copal which is found embedded in the earth.

It is these copals that are usually employed by dishonest dealers, who sell examples to collectors as Amber.

A conviction was obtained at the Marlborough Street Police Court in 1908, before Mr. Denman, against a Mr. Ashenfarl, for the sale of copal purporting to be Amber, and declared as such. A certain amount of sand had been put upon it to make it look like the genuine article. The man was fined £10, with five guineas costs, with an alternative of a month's imprisonment. The copal gum, it was stated, was only worth 15s. a pound. It was sold at £4 per kilo. It had been cooled under high steam pressure, and the artificial crust put upon it. It had not the feel of Amber, nor its electric quality, but was an exceedingly good imitation of the genuine article.

Sometimes dishonest dealers fake amber enclosures into pieces of copal or even into two pieces of real Amber, but such deceptions can be at once exposed by dipping the supposed Amber containing an enclosure into boiling water or spirits of wine, in which fluids the various portions will fall apart.

Another method of distinguishing Amber from copal rests in the special odour that Amber gives when it is rubbed, an odour which is entirely missing when similar treatment is given to copal.

There is a steady demand for Copal, in order to make copal varnish, and it fetches about £25 per hundredweight. Some of the specimens that come to England, closely re-

sembling Amber in appearance, contain well-preserved insects, leaves, and particles of wood, but they represent living species belonging to well-known genera, and in this way copal can sometimes be detected out of hand, without the trouble of analysis.

Amber has also been imitated in preparations of Mellite and copal, also by a blending of sulphur and gutta-percha at high temperature, etc., but Mellite is infusible by heat, burning white.

Copal catches fire and falls from the instrument on which it is heated in flat drops, whereas Amber burns with spitting and frothing, and when its liquefied particles drop they rebound from the plane on which they fall. The attracting power of all amber substitutes falls far short of that of the true substance.

Amber has been found in various places in Russia, especially in alluvial beds near Kiev, on the banks of the Dnieper. It has also been seen at Brest Litovsk in valleys near to the villages of Petrovitz, Vyshgorod, and Nizhegoria, in the provinces of Volhynia and Minsk; in the Obruchesk district of the Cherson province, near Borislaff, on the Dnieper; and at the mouths of the rivers Pechor and Mezen, in Great Russia.

In all those places it is Succinite that is discovered, but only in small pieces, generally associated with lignite, and not associated with any glauconite sand.

It has been very little exploited, as, although concessions were at one time granted to certain Belgian capitalists, comparatively little exploration was done before the War, and now, of course, all work is at an end.

In 1863 there was found in the Cambridge greensand a brownish-coloured translucent fossil resin that does not agree either in geological age or in physical or chemical characteristics with ordinary Amber, and offers a new field of investigation.

Dr. Otto Helm, of Danzig, found on analysis that 0.3 gramme of Cambridge Amber produced on dry distillation only 0.006 gramme of hydrated succinic acid, corresponding to 0.005 gramme of anhydrous succinic acid, which means 1.66 per cent. against 3 to 4 per cent. in ordinary Prussian Amber, and 8 per cent. in bony Amber from the same district.

Information has arrived, while this book is in the press, concerning Amber mines in Mexico.

The mines are situated in the Department of Simojovel, State of Chiapas.

Large blocks of red, yellow, and black Amber have, it is said, been discovered, but they have not so far been exploited, owing to the absence of Amber experts in Mexico. Their area includes the whole of a mountain at the foot of which runs the Huitapan River; the mines were discovered owing to the river washing the Amber away when swollen. That mountain is thickly covered with wood, mahogany, cedar, etc., which could also be exploited if desired.

The nearest port is Puerto Frontera, State of Tabasco, Atlantic Coast. The bar only permits the entrance of steamers less than 3,000 tons; regular services direct to Europe are available. The journey from Mexico City to Frontera takes three days (one by rail to Vera-Cruz, thence two days by sea). The journey from Puerto Frontera to the mines can be made in two days by river direct from the mines to Frontera. A regular service of river boats is available from the mines to the sea at Frontera.

Only small samples of this so-called Mexican Amber have yet reached England. No analysis has therefore at present been possible, and, moreover, the interior of Mexico is still in a very disturbed condition.

ENGLISH AMBER

THERE are many places on the east coast of England where Amber has been found, the most southern locality being Walton-on-the-Naze. On the coasts of Norfolk and Suffolk it is of constant occurrence.

It has been found at Felixstowe on the beach, and there are at least forty specimens in existence that were discovered there. It has also been found at Orford Ness, Aldeburgh, West Rocks near Ipswich, Southwold, Winterton, Happisburgh, Mundesley, Yarmouth, and above all at Cromer and Sheringham, where quite large pieces have been found on the beach, one in the author's possession weighing $3\frac{3}{4}$ ounces avoirdupois, and two or three others about 2 ounces avoirdupois each.

In addition to these, Amber has been found on the shore of three hamlets some twelve to fifteen miles to the north of Skegness, Mablethorpe, Trusthorpe, and Sutton-on-Sea, and by the kindness of the Rev. W. A. Rice, I have seen examples that were obtained by him from these various places.

It is generally the golden Amber which is so discovered, but sometimes yellow clouded specimens.

Dr. H. Conwentz, in addressing the British Association on this subject at the meeting at Ipswich in 1895, said :

“ It is very probable that the marine Tertiary deposit which contained Amber was, in the geological period, not limited to Samland, but had a much greater extension. A good deal may have been carried down by the advancing of the ice during the ice age, and then by the waves, but that alone would not account for its appearance in Finland and England, in Sweden, Poland, and Central Germany, here and there even in large quantities.”

Again, he adds:

“Some geological observations seem to indicate that the district of the amber forests once extended over a wide area from east to west. For in several localities of West Prussia and Pomerania greensands exist similar to the Blue Earth of the Samland, though succinite has not been found in them hitherto; but the large greensand deposit of Eberswalde, near Berlin, does contain succinite. Further, in Mecklenburg, Schleswig-Holstein, Denmark and Sweden, geologists assume that the succinite found there is derived from destroyed Tertiary deposits of those countries. Moreover, the succinite of England was not carried there from Samland, but was probably washed out of a diluvial or Tertiary bed, which is not preserved now or which is now covered by the North Sea. A few specimens, as I have seen at Cromer, exhibit glacial scratches, and probably they were derived from a diluvial deposit not far from the English coast. Even those pieces could not have been brought by the glacial current from the Samland, but from another locality which was situated much nearer.”

In the Newer Pliocene forest-bed of Cromer, he said, one specimen has been dug up, but it has not been possible to find another. “It belongs,” he added, “to the succinite group, and it may have been washed out of an older, perhaps underlying, deposit.” Generally the geological structure of Norfolk leads one, said he, to “assume an original continuity of the amber-bearing bed from the Prussian coast (Samland) to within a short distance of the English coast. For the eastward dip of the strata in Norfolk, and the thickness of the London Clay at Yarmouth, ought to bring Upper Eocene and Oligocene beds near to that shore.”

English Succinite bears an external flora and fauna partially different from the Prussian. Mr. Ford, in a paper hereafter alluded to, mentions a small unpolished specimen of the opaque sort “encrusted with a polyzoan”; that is to say, with a polyzoön. Dr. Conwentz said that he knew that the

shells of a kind of *Balanus* often cover the fossil resin, and Dr. Weltner, of the Zoological Museum at Berlin, has determined it to be *Balanus porcatus* da Costa. Dr. Conwentz then went on to state that Mrs. J. Fox, of Cromer, possessed a light yellow clouded piece of Succinite 75 grammes in weight, which is covered with the shells of several animals, the largest of which has a diameter of 3 to 3·3 centimetres, while other specimens have fallen off. According to Dr. Weltner, this species lives on the coasts of Japan, North-East America, Greenland, Ireland, Scotland, South England, Heligoland, and in the whole of the German Ocean, also in the Greater Belt, in the Belt of Fehmarn, and at the Stoller Ground, near Kiel. He mentioned that Amber from the shores of West and East Prussia is also often encrusted with smaller shells, which belong to another species, *Balanus improvisus* Darw. Moreover, one and the same English specimen bears on one side the fragments of the tubes of annelids, determined by Dr. Collin, of Berlin, as *Pomatoceros triqueter* (L.). There is a similarly coloured second piece belonging to Mrs. J. Fox, of Cromer, which shows more and better developed tubes. It weighs 65 grammes, and is covered with a group of well-preserved tubes and fragments of *Pomatoceros*. According to the same zoologist, this worm lives on the coasts of Iceland and Scandinavia, from Varanger Fjord to Öresund; also in the German Ocean, on the coasts of North France, England, Scotland, and North-East America. A third specimen of 135 grammes he also mentioned. It has a fine yellow cloudy colour, and is covered at one side with a group of about thirty shells of *Balanus porcatus* da Costa, of various sizes, which partly contain the dead animals. This piece is at Königsberg, and was obtained from the east coast of England. It should be noticed that neither species, *Balanus porcatus* nor *Pomatoceros triqueter*, is to be found in the Baltic Sea.

Mr. Clement Reid,¹ in his paper before the Norfolk and Norwich Naturalists' Society, in January, 1884, said that, in his opinion, a weight of some 3 to 4 pounds of Amber was found every year at Cromer, and he laid out a series of arguments, not wholly convincing, but worthy of consideration, that the bed yielding the Amber off the coast of East Prussia had its continuation towards England. In his opinion, Amber found on the East Coast, especially at Aldeborough and at Cromer, was not washed ashore from the Baltic, but was washed up from a portion of a bed which he said was continuous towards the English shore.

Another paper, in the "Proceedings" of the same Society, referred to a piece of Amber that had been found at Mundesley by Mr. A. C. Savin, in which two spiders were found, the identity of which was not easily determinable; they were certainly Theridiides, but they were not *nesticus*, although they bore a very close resemblance to that particular creature.

Again, in 1886, Mr. Clement Reid, dealing with Norfolk Amber, had pointed out that as worked Amber is found in prehistoric graves in England, it was generally supposed that those ornaments had been imported from abroad. He stated that the manufacture would only be understood in a district where the raw material was comparatively plentiful; Dr. Conwentz, however, said that he was not able to assent to this. First, it must be noticed, said he,

"that there are also some amber objects attributed to the stone age, and it is not proved that in this period any connection between the English and the Prussian coast existed. Therefore these neolithic ornaments—if they should be foreign—could only have been brought from the Danish coast or from the German shore of the North Sea, where Amber occurs a little more often; but, in general,

¹ See "The Geology of the Country near Cromer," 1882, and the "Trans. Norfolk Naturalists' Society," 1884 and 1886.

why should Englishmen have sent for the fossil from abroad when they could get it at home? Add to this, the working of Amber is quite easy, and we know of numerous articles of other countries which are fashioned very delicately by primitive instruments of bone and stone. Certainly the manufacture of Amber is not more difficult than that of jet, of which we know many beads and other articles were made in the stone age in England. The characteristic manner of perforation of the jet ornaments is like that of the Prussian amber objects of that period, which proves anew that the same uses and methods, as well as customs, may originate in different countries, without any reference to one another."

Moreover, in England, even in these days, there exists an original Amber manufacture, unchanged by foreign influence, and just in the same way the fossil could have been worked a few thousand years before.

"Of course," says Conwentz, "Amber is not abundant on the shore of England, and usually it is mixed with seaweeds, for which reason many specimens may be overlooked, but the prehistoric articles also are rare," and "the present annual yield is more than sufficient to account for all the ancient amber ornaments yet found in England."¹ Having regard to all these circumstances, it is simpler, on the whole, to trace the ornaments to English Amber rather than to foreign importation.

To the special characteristics of the flies that Mr. Clement Reid and Mr. W. H. Verrall found in specimens of English Amber, I now allude.

"The specimen in one piece of Amber is," Mr. Reid states on Dr. Verrall's opinion, "a *Platyura*, of which Loew knew sixteen Amber species. The characteristics of this one are the long antennæ with long narrow joints, the yellow wings with *hairy veins*, the upper fork of the second vein ending in the costa, not very abruptly; the thorax seems to be blackish brown, the pleuræ light brown, but considerably

¹ See "Norfolk and Norwich Naturalists' Society Transactions," vol. iv., art. xiii.

greenish above, and on sides of thorax (? through some foreign colouring matter); the abdomen seems also to have some metallic colour; both thorax and abdomen bear numerous blackish bristly hairs; the halteres, legs, and coxæ, are light brown; the femora darker beneath; the front femora bear bristles beneath, rather stronger than the other usual small bristles; the coxæ bear numerous hairy bristles; the tibiæ have one light brown spur at the tip; the tarsi are rather longer than the tibiæ, the basal joint being a little shorter than the other four together, and bearing beneath middle pair about six small well-separated bristles (? in pairs)."

"The other *Platyura*" (in the unpierced bead) "is a female, and has shorter, closer antennæ; and, I think, the disc of the thorax is yellowish brown, with the sides black; while the pleuræ seem to have a largish bright yellow spot in front, near the humeri; behind which is a smaller blackish spot; then above the coxæ is a second larger bright yellow spot, elongated above which is a second blackish rounded spot, larger than the first, and bearing short yellow hairs; also in front of the second yellow spot is a third blackish spot; the edge of the abdomen is bright yellow, and the upper side conspicuously fasciated, the basal three-fifths of each segment being dark, and the last two-thirds dull yellowish; the belly is duller yellowish brown; the knees and tips of the tibiæ are blackened, the spurs are longish and dark. The wings seem darker than the first species, and the upper fork of the second vein more abrupt."

"In the bead is a small *Xiphandrium* (?). When Loew's paper appeared this genus was included under *Rhaphium*, of which, he says, only a few little notable species occur. This one has a somewhat metallic greenish thorax, and broad frons. I think I can detect a smallish free hypopygium with some long hairs, and the long narrow antennæ with terminal arista; the anterior femora are thin and longish, and, I fancy, dark with yellowish bases; possibly the hind metatarsus is thickened in some way. The third and fourth wing-vein run parallel, and the large cross-vein is twice its own length from the edge of the wing."

"Thus all three species are fairly examinable, and are not far from existing British species."

The fauna of the Norfolk Amber now include the following species, all of which have first been recorded in the "Transactions of the Norfolk and Norwich Naturalists' Society."¹

RHYNCHOTA.	DIPTERA.	ARANEINA.
Aphis (larvæ).	Cecidomyia ? sp.	Linyphia (Bathypantes) sp.
	Chrysotus sp.	
	Leia sp.	
	Platyura, 2 sp.	
	Xiphandrium sp.	

What is probably the most interesting collection of examples of English Amber is that which in 1890 belonged to Mrs. Burwood, of Yarmouth, and was described by Mr. Alfred S. Ford, F.G.S., in the "Transactions of the Norfolk and Norwich Naturalists' Society."¹

Every piece in Mrs. Burwood's collection had been found on the East Coast, and the specimens of Amber had all been polished in order to render visible the insects which the pieces contained. As a rule, Mr. Ford stated that in colour a rich wine yellow seemed to predominate, but there were a few pieces of lemon yellow colour, more or less clouded, and a few that were more or less opaque like ivory.

He found that one piece was almost entirely occupied by a number of minute creatures, which at first sight looked like ants, but were proved underneath a microscopic examination to be beetles (*Platypus*). Another piece was tenanted by a cockroach (*Blatta Orientalis*) with a small fly for his companion. A third piece contained two bees side by side (*Apis mellifica*), and another two spiders, the exact name of which was indeterminable.

The following was the list of the insects that Mr. Ford illustrated with extreme ability on the colour plate that accompanied his article:

¹ Vol. v., p. 92.



Hymenoptera:	<i>Apis mellifica</i> .
Coleoptera:	<i>Clerus</i> .
„	<i>Platypus</i> .
„	<i>Tomicus</i> .
Orthoptera:	<i>Blattá Orientalis</i> .
„	<i>Psocus</i> .
Araneida:	2 examples that were indeterminable.

It was said by Mr. Ford in his article that Mrs. Burwood's collection had occupied many years in its formation, and that one small piece of Amber was encrusted with polyzoon, proving its marine origin without any doubt.

One specimen had a leaf in it, but it was impossible to identify it.

Since the days when Dr. Conwentz, Mr. Ford, and Mr. Clement Reid wrote upon English Amber, a theory has been proposed that some of this Amber comes from the Dogger Bank, and to test the truth of this theory, dredging has been carried out with special intention near to the Dogger Bank, with the result that certain pieces of dark-coloured Amber, bearing upon them shells of *Balanus* and other similar fossils, have been discovered. It is probable that this particular reef would merit closer investigation, but unfortunately the Amber that has been obtained already from it is exceedingly dark in colour, is almost invariably covered with different shells, and is not homogeneous, as is Prussian Amber, abounding as it does in cracks. It is therefore not commercially important, and although it is probable that on the Dogger Bank there is a considerable amount of this Amber, it is, in all probability, not worthy, from a commercial point of view, of special enterprise.

AMBER CONSIDERED FROM THE POINT OF VIEW OF MEDICINE AND FOLKLORE

IN his wonderful "Natural History," to which all students of medical lore have to refer, Pliny gives the then accepted theories as to the medical value of Amber.¹

"Amber," says he, "is not without its utility in a medicinal point of view; though it is not for this reason that the women are so pleased with it. It is beneficial for infants, attached to the body in the form of an amulet; and, according to Callistratus, it is good for any age, as a preventive of delirium and as a cure for strangury, either taken in drink or attached as an amulet to the body. This last author, too, has invented a new variety of Amber; giving the name of 'chryselectrum' to an Amber of a golden colour, and which presents the most beautiful tints in the morning." "This last kind, worn upon the neck," he says, "is a cure for fevers and other diseases, and, triturated with honey and oil of roses, it is good for maladies of the ears. Beaten up with Attic honey, it is good for dimness of sight; and the powder of it, either taken by itself or with gum mastic in water, is remedial for diseases of the stomach."

Amber has, however, been in use as a medicine since the time of Hippocrates, and in the form of the oil obtained from it by destructive distillation still is so. The properties of this oil resemble those of turpentine. It is occasionally prescribed for internal administration in asthma and whooping-cough, but more frequently as a stimulant and rubefacient in liniments for the chest. Its very extensive use from the earliest times in necklaces was as an amulet, and this use was common everywhere—in China, in Persia, and in Europe.

The principal medicinal uses of Amber are thus described in Culpeper's "Dispensatory" of 1654:

¹ Book xxxvii., chap. xi., Bohn's translation.

“Amber heats and dries, therefore prevails against most diseases of the head; it helps violent coughs, helps consumption of the lungs, spitting of blood, the whites in women . . . it stops bleeding at the nose, helps difficulty of urine: you may take ten or twenty grains at a time.”

There are references to oil of Amber in More's "Utopia" (1551), where he speaks of "Fine linnen cloth dipped in oyle of ambre"; and in Gray's "Letters," in 1737, he says:

"Not hartshorn nor spirit of amber, nor all that furnishes the closet of an apothecary's widow."

Ancient writers said that Amber eased stomach pains, cured jaundice and goitre, and acted against certain poisons. Camillus Leonardus recommended it as a cure for toothache and affections of the teeth. In the Middle Ages it was used as a charm against fits, dysentery, jaundice, scrofula, and nervous affections. Thomas Nicols, a seventeenth-century writer, says:

"Amber is esteemed the best for physic use, and is thought to be of great power and force against many diseases, as against vertigo and asthmatic paroxysmes, against catarrhes, against diseases of the stomach and to free it from sufferings and putrefactions, and against diseases of the heart, against plagues, venoms and contagions. It is used either in powder or in trochees, either in distempers of men or women, married or unmarried, or in the distempers of children."

The dose formerly administered for coughs, hysteria, etc., was from 10 to 60 grains.

Amber cut in various magical forms has been extensively used as a charm against the evil eye, witchcraft, and sorcery. Its employment as a mouthpiece for cigars and cigarettes was originally talismanic, for it was implicitly believed that Amber would not only prevent infection, but would act as a charm against it.

Francis Barrett, in his work on "Natural Magic," says

that Amber attracts all things to it but garden basil or substances smeared with oil. In China today Amber is greatly esteemed, being used in the making of certain medicines, perfumes, and as an incense which dates back for many centuries. In such esteem is Amber held in the East that the Shah of Persia is said to wear a block of Amber on his neck to protect him against assassination.

Amber has been used in medicine as an antispasmodic; it has been recommended in hysteric and hypochondriacal affections, in cases of the suppression of the monthly courses, and as a cure for gonorrhœa or fluor albus. It is so used in substance, after having been washed with hot water and reduced into fine powder by levigation. It is still made use of in the East in strengthening and resolving fumigations, by throwing it in powder on a very hot brick, and directing the fumes to the part to be fumigated. The liquid acid and salt of Amber are regarded in Egypt as cordial and antiseptic; they are administered also as powerful diuretics. The oil of Amber, which is certainly empyreumatic, is used externally and internally for the same purposes as Amber itself, but is prescribed in smaller doses on account of its greater activity. The succinated balsam of sulphur, which is given in the dose of a few drops, in proper fluids, or mixed with other substances to form pills, has been declared useful in affections of the breast. A syrup, called *syrup of Amber*, is made in China with the liquid acid of Amber and opium, and there used with advantage as a sedative, anodyne, and antispasmodic remedy. *Eau de luce*, which is prepared by pouring a few drops of oil of Amber into a bottleful of caustic ammoniac and agitating the mixture till it becomes of a white milky colour, has long been in use as a powerful stimulant in fainting fits. It is held to the nose, the nerves of which it stimulates, and by the sneezing it produces the patient is, it is said, helped to recover.

The ancients also held that Amber was a cure for insanity, fever, and other disorders when taken as a drink or worn around the neck as an amulet, and Budge's "Syriac Book of Medicines" (1913) mentions it thrice as a remedy.

An eccentric medical man wrote to *The Times* recently, stating that he had evidence of the efficacy of Amber in the cure of asthma, hay fever, croup, and various diseases of the throat, and was convinced of its beneficial action. A well-known chemist has declared, in my own hearing, that his wife had suffered from asthma all her life until five years ago, when she expressed a desire to wear a string of Amber, and since wearing this she has not experienced the slightest symptom of her former trouble. There is an amber necklet in existence the beads of which are stated to be mud-coloured and cracked, and this result, the owner declares, ensued after it had been worn for a few months by a lady suffering from hay fever. Ancient observation was probably correct that it had a certain curative influence, and the statement in some modern medical text-books that Amber had "absolutely no curative value" is difficult to follow. It is remarkable that distilled Amber yielding a pungent, acrid, but not unpleasant oil, known as Oil of Amber or Oil of Succinite, is still recognised as a potent ingredient in various embrocations.

Mr. C. W. King says:

"Repeated experiments have proved beyond doubt that the wearing of an amber necklace has been known to prevent attacks of erysipelas in a person subject to them."

He also writes of its efficacy "as a defender of the throat against chills."

With regard to the wearing of Amber, it should be pointed out that Amber has the power of almost at once taking up the temperature of the body, and retaining it for a very long time, even after the necklace has been removed from the person who is wearing it. Amber never feels chilly and

cold to the skin, like other materials that are worn as necklaces, and it seems to be quite likely that the electrical quality that it possesses may have some remote influences upon the skin and upon the body that have not hitherto been fully recognised or medically examined. Amber has always been regarded as suitable to wear as an amulet, or as a lucky stone, and there have been some Greek scholars who have tried to explain that the origin of the word "electron" is from the verb ἀλέξειν (*allexein*), meaning to ward off and to protect. This construction, however, is by no means generally accepted.

"I think," says Dr. Clements, "there must surely be some property in Amber which acts on the mucous membrane when brought into proximity with it. I have known at any rate one case where a cold in the head, which had refused to yield to any other treatment, was cured by wearing an amber necklace. It is," he adds, "an excellent palliative for hay fever, either worn as a necklace, or, as is sometimes more convenient, carried in the pocket, and held up to the nose or mouth when required."

Amber, by astrologers, has been placed under the sign Leo, the sign of the Sun, but generally to the sign of Venus (Taurus), to which it more probably belongs. Beryl and Emerald are also under Taurus. In Oriental story Amberabad (Amber City) was a city of Dinnistan (Fairy Land).

To dream of Amber in the East was said to denote a voyage, and, according to the philosophy of the Quabalah, the indication was always of some kind of movement or change.

While this book is passing through the press, I have heard that Amber is used in Germany in connection with the operation of transfusion of blood (*Thrombocyten*), but, beyond the mere statement to this effect, I have no information on the subject, and at present have not been successful in obtaining the book which is stated to have been recently issued in Germany relative to this use of Amber.

SICILIAN AMBER OR SIMETITE

THE Amber found in Sicily possesses a striking beauty of its own, inasmuch as some specimens are of glorious colour—deep ruby, garnet red, and even blue and green. It is by far the most gorgeous in colouring of any Amber, and very attractive as an ornament.

Moreover, it is often opalescent, and again, some pieces of blue Amber, notably a piece in my own collection, are as deep in colour as lapis lazuli, and almost resemble at first sight that precious mineral. Many others possess a bloom of blue or purple covering them, and giving to them a gem-like beauty. Some of the very clearest pieces of golden Simetite possess bloom and flashes of blue, and sometimes brilliant flashes of crimson indescribably lovely in effect. On some specimens there are beads or clots, almost resembling rubies in their gorgeous blood colour.

Sicilian Amber is probably so characteristically fluorescent and so brightly coloured by reason of volcanic influence, the neighbourhood where it is found being near to Etna, and, contrary to Baltic Amber, Sicilian Amber contains a large amount of organic sulphur (0.67 per cent. in the red and 2.46 per cent. in the black), which of itself indicates volcanic influence.

The hardness of Simetite is rather less than that of Succinite, its fracture similar, and in specific gravity there is little difference between the two, but Simetite contains no succinic acid, and in consequence the operation of heating it, although similar clouds of white fumes arise to those obtaining when Succinite is heated, is not unpleasant to the operator.

It derives its technical name from its discovery in the river Simeto, near to Catania, and it is from that part of

Sicily that the bulk of it comes. It is mainly to be found in the central part of the island, and especially near to the brooks and streamlets that have washed it out of the clayey soil. It has been discovered near the mouths of all the rivers of Sicily and in many parts of the island. It has been seen, so Buffum tells us, "at Leonforte, at San Filippo d'Agiro, on the shores of Terranova and Pozzalo," and in various small places, especially near to mountain rivulets. When found, it is in roughly rounded pieces, generally covered with a thin crust of a rusty iron red, proving that it has been subjected to the action of water, and rolled about on sandy surfaces.

A writer named Patrick Brydone, in some letters from Sicily, published in 1770, alludes to Amber being found at the mouth of the Giarretta, and to his obtaining many pieces in that district. At the present day there is but little Amber found at the mouth of that river.

Goethe alludes to a collection of Sicilian Amber that he saw at Catania, where, he says, the Museo Biscari was, in his time rich in examples of it. The Amber found in the northern part of Italy, especially near the river Po, in Ravenna and in Ragusa, it should be stated, is not Simetite, but is a form of Succinite.

Amber is found close up to Syracuse, in the neighbourhood of Taormina, and on almost all the volcanic land in the precincts of Etna.

It has also been discovered on the shores of Reggio and Messina, washed up by the sea, and occasionally also in the Lipari Islands, at the foot of Stromboli, where it seems possible that mining might reveal quite extensive strata containing it.

It is generally associated with lignite, and often with a black resin, softer than Simetite, and resembling it in fracture and in specific gravity, but of no commercial value or beauty.

Simetite is sometimes even found crusted over with this

resin, or with a similar one of a deep red hue, but when this is removed the true Simitite is found underneath, often iridescent and opalescent, and exceedingly lovely in appearance.

It is rather curious that the classical authorities do not refer in any way to Sicilian Amber, although Diodorus was born close to a place where it is now found in considerable quantities. It seems probable that they knew nothing about Sicilian Amber, although there has been a theory that some of the Amber found in tombs came from Sicily, but tomb Amber, when examined chemically and with regard to its specific gravity, is as a rule proved to be Succinite from the Baltic, and not Simitite from Sicily. Certainly some of the beads that have been discovered are of a colour approximating to Sicilian Amber, but it is wholly unsafe to make any decision on the ground of colour, because the clearest and most golden of Amber will change, under certain circumstances, to quite a dark red.

Whether the Phœnicians actually knew of the existence of Amber in Sicily is not at all clear. If they did, they disguised the fact, as they declared that all that district of Trinacria was full of incredible dangers, and that they alone knew the secret of penetrating the mysteries and obtaining any treasures from Sicily.

RUMANITE

CONSIDERABLE attention has in the past few years been given to the species of Amber to be found in Roumania, and to which the name of Rumanite has been given.

Dr. Istratti was one of the first scientific writers in Roumania to take up the suggestion made by Dr. Paul Dahms, and to discuss the peculiarities of Roumanian Amber. He was followed by a very able scientist, who alas ! has passed away—Dr. Murgoci, and to the labours of the last-mentioned writer we owe, to a great extent, the information we possess.

Rumanite is very similar in its structure, density, specific gravity (1.067), and exact chemical composition to Baltic Amber, but differs from it in geological age, in colour, and in certain extrinsic characteristics.

When it was first discovered in Roumania no one can tell, but archæologists have proved that the Romans established a direct line of communication from the district of Buzan, where Rumanite is found, as far as to Memel and what are now the Baltic States, which even in those early times were famous for their Amber. From researches made on the ruins in the neighbourhood of Buzëu, it is clear that the Romans frequented that part of the country, and equally clear that they knew of the existence of this fossil gum and made use of it.

Rumanite is alluded to in many books that deal with Roumania, but it did not receive any special attention until 1822, and its geological history was not investigated until 1883, when Zuicker issued his book "Die geologische Horizonte der Fossilen Kohlen" (Leipzig).

It has now been established that Rumanite is to be found in the Miocene strata, differing in that respect from Prussian Amber, which is found in abundant quantities in the Eocene strata. The field of its discovery is mainly on the banks of the river Buzëu, and it can be mined in the strata of sandstone close to that river.

It is also to be found near to the Monastery of Alunis on the banks of the Danube, in the neighbourhood of Craiova and Olan'esei, in the tar deposits of Putna, and in the petrol wells of Ocnita on the river Dimbovita, while by the banks of five other rivers—Coltii, Roscoiul, Venetisul, Frasinul, and Corbul—fragments of it have been found.

The only commercial Amber, however, is that from Buzëu.

In all the districts in which it is discovered there are Oligocene strata of two varieties alternating with each

other, one known as Kliwa Sandstone, the other of a schist called Menilithic or Bituminous Schist.

Roumanian geologists regard the Sandstone as formed of sea-sand from the dunes and beaches of the Oligocene sea, and the appearance of erosion and markings of shells and pebbles on the Amber found supports this theory.

In the Bituminous Schist are found vegetable debris and remains of algæ which covered the sand of the dunes where the Amber was deposited by currents of water.

It is almost invariably, if not embedded in the Sandstone, found with one surface in contact with it.

The Sandstone is sometimes greenish, yellowish, or white in colour; the other strata is black, and resembles coal.

Both correspond in many features with the so-called Blue Earth in which the Prussian Amber is found.

Rumanite is mined in very primitive fashion mainly by a few peasants in the neighbourhood of the river. Rain-storms bring down from the mountains trunks of trees; these tear away portions of the river-banks, exposing the strata, and when the river subsides the peasants start prospecting. In the holes that they dig they find a black lustrous carbonaceous material and blocks or lumps of Amber with it, and often embedded in it.

In appearance Rumanite differs very much from Prussian Amber, mainly because of its beautiful and varied colouring and of the presence in it of cracks and hollow spaces that give the effect of glistening scales.

Its colours Dr. Dahms described thus:

“Yellow, rose-red, dark-garnet, and smoky-gray; the last one ranging from bluish to a deep black. Deep tones predominate. Occasionally there are besides deep blue reflections or with light shining through brown-red, and falling on it greenish-brown or greenish-blue colour tones. The same pieces can be variously coloured and inter-formed; some possess dark, often reticular veins in a light mass—

or reversed—then grains and knots in a light integument—
or reversed.”

“ If the cracks present are darker than the resin-mass, the material appears to be dark-veined. In many the light will be reflected in a closed manner, similar to mother-of-pearl, with the difference that the reflection is sometimes white, yellow or red, and perfectly resembles cats' eyes.”

Dr. Murgoci says that in *lustre* it is glassy, dull, and fatty. It is often *transparent*, yellow in different shades—straw-coloured, lemon or greenish yellow, and there is usually an irregular outer crust. “ This crust is hard to the touch, brown, reddish, ruby-red, dark red, almost black, generally continued into the interior for several millimetres, but sometimes the dark colour extends throughout the whole specimen. This occurs more especially in specimens occurring near the surface of the soil.” Rumanite may also be greenish or bluish brown, coffee or chocolate colour, smoke colour, very dark brown, or even black. The very dark colours are rare and beautiful; light-coloured specimens are often fluorescent; they may be yellowish-brown or cloudy in transmitted light and greenish or bluish brown in reflected light. This is best seen in polished specimens. The dark colour is usually caused either by gases absorbed by the mass of the Amber or by inclusions, such as hydrocarbons, coal, oxides of iron, pyrites, etc., sometimes visible to the naked eye. The presence of hydrocarbons, colloidal or in drops, or nacreous, causes great fluorescence and iridescence. Brown specimens in general are full of fractures which reflect light, there being both total reflection and diffraction, and consequently a spark-like effect, like glittering spangles of gold or silver. With diffraction there is iridescence, as if there were iridescent flowers and leaves. These light effects are quite characteristic; sometimes they are on a fairly large scale, and individual sparks or spangle-like reflections can be seen; sometimes they are on a very small

scale and close together as in aventurine. When the pores are small and the cracks very fine, parallel and undulating, they reflect light like mother-of-pearl, and give a nacreous effect with grey or brown shades.

It will be realised from these delightful colour notes that the ordinary phrase of Black Amber applied by dealers to Rumanite is misleading, because its colour value is a very high one, and many examples are amongst the most lovely coloured pieces of Amber that have ever been found. Several examples in my own collection, notably those that came from the late Dr. Murgoci, are glorious in ruby, blue, green, and yellow, although those colours are often associated with the darker background from which Rumanite is called Black Amber.

In the darker species of Rumanite can sometimes be found green streaks reminiscent of emerald. In some of the yellow specimens there is a wonderful mother-of-pearl lustre in the cracks.

Rumanite is sometimes fluorescent, even to a greater extent than in Sicilian Amber. It is seldom, however, blue like the Catanian Amber.

The ivory, bone-like effects that are to be found in Prussian osseous Amber are almost entirely wanting in Rumanite.

There are, however, pieces to be found which are almost black, and one of the very finest examples of this belongs to Miss Wyndham, of Rogate Lodge—a cigarette-holder $2\frac{7}{8}$ inches long, $1\frac{3}{4}$ inches in circumference, and more than $\frac{1}{2}$ inch in diameter, and was presented to a member of her family by King Charles of Roumania. It is altogether a superb specimen of native Roumanian Amber and worthy of a museum or collector.

There are some other parts of Roumania besides those already mentioned where Rumanite may be found, but as folding and erosion are much less pronounced in Moldavia,

Bukovina, and Galicia than in Wallachia, the finds of Rumanite are far fewer in those districts than in Wallachia.

There are, however, very similar strata in Poland, and there also Rumanite has been discovered.

An effort has been made in recent years by M. Grigarescu to dig into the mother-rock for Rumanite, instead of depending upon the chance discoveries of the peasants by the river. This has been attended with some success, and fine examples of Rumanite obtained in this manner I have seen in the Mineralogical Museum at Bucharest.

Chemically the properties of Rumanite differ almost as much as its colour varies. There is always 1 to 5 per cent. of succinic acid to be found. About 6 per cent. is soluble in alcohol, 16 per cent. in ether, 10 per cent. in chloroform, and 14 per cent. in benzine, but even this varies from specimen to specimen.

In density Baltic Amber may be stated as 1.05, but Rumanite as 1.048. In melting-point the figure is 330° C. against 287° C. for Baltic Amber.

Into the details of distillation it is hardly necessary to enter. They can be obtained from Dr. Istratti's paper on Rumanite, read before the Rumanian Academy on June 30, 1895. It should, however, be stated that in Rumanite there is a far larger amount of sulphur than is found in Prussian Amber. It amounts to about 1.15 per cent., and Rumanite when heated gives off not only a peculiar aromatic odour quite *sui generis*, but a smell of hydrogen sulphide, due to the presence of this sulphur. It fuses at 300° to 310° C. without altering in proportion, and gives off fumes which cause distress to the respiratory passages of the chemist.

Its elasticity is much less than that of Prussian Amber, and its hardness (2.5 to 3) also less.

Its index of refraction measured by a prism is 1.4377; measured by immersion in liquids, it varies from 1.43 to 1.44 per cent.

Its fracture is conchoidal.

There are very rarely any enclosures in it either of insects or of vegetable remains.

There is, however, another type of Rumanian Amber which has been termed Amber of Piatra.

It was discovered by Professor Rosca near to Piatra Niamtu in the same Kliwa Sandstone as Rumanite, but the Sandstone has been so completely metamorphosed that it has become almost quartzite.

Two varieties of this Amber have been found: (1) A fluorescent variety, in colour greenish-blue, dark green, brownish-green up to black, ruby-red in transmitted light. It is poor in pseudocleavages, but rich in cracks; there are few sparks and sometimes a nacreous or agate-like structure. The hardness is greater than that of Rumanite. It is readily worked, and on working there is a characteristic smell of sulphur and bitumen. Large pieces are rare. (2) Together with this Amber in the same strata has been found a black bituminous fossil resin, with a glassy lustre and a rough porous crust. The mother-rock is also porous and has undergone an intensive diagenesis. The resin is brittle and friable, and gives a dark orange-coloured powder which is attacked by various reagents. The melting-point is lower than that of the other Amber of Piatra. Probably this is the burnt variety of Piatra Amber, but it differs very markedly from burnt Rumanite.

Professor Murgoci proposed for this Amber the name "Almashite" (from the valley and monastery "Almash" where the Amber is found), and "burnt Almashite" for the burnt variety which accompanies it. It is yet another of the series, all included under the generic name of "Rumanite."

I was able to acquire from the Murgoci Collection several important examples of Rumanite, some of which are worthy of description in detail. One piece is a native amber pebble

that has not been polished, and is yellow with cracks. It has a thin crust over it, while combined with it are sandstone and portions of bituminous coal. Other pieces have bituminous substances involved in them, and one piece is evidently burned by great volcanic action. All these three pieces came from Buzëu, and from the same district is a piece of brown-reddish Amber, of an exceedingly beautiful deep ruby colour, with a brownish-red crust, cloudy, nacreous, and fluorescent. Seldom found in the Buzëu district is the transparent yellowish-green Amber, with light, brilliant sparks of opalescent colour in it, greens and blues, and the Murgoci example enshrines some pine-needles, which are exceedingly rarely to be seen.

Then, also from Buzëu, there is a very rare light-coloured flocculent Amber, looking almost as though some wool had become hardened and enshrined within it. It is full of minute cracks, and is also highly fluorescent; the crust is impregnated with salts of copper.

From another district comes brown cloudy Amber that has pieces of rich brownish-purple in it, flashes of white and red light, and very fluorescent, while occasionally there is found the intensely deep brown and gold Amber, closely resembling that which comes from the Behring Sea, and has very high fluorescence, and cracks full of bituminous substance.

Burnt Amber acquires a fiery orange-red colour, and that has flashes of light in it. My specimen is particularly gorgeous in its colour, and of unusual excellence.

Very rarely, some is found with a tinge of blue resembling that on the Sicilian Amber, especially that from Catania. The blue can only be seen clearly by reflected light, and pieces of that colour are but seldom acquired, and are always very small.

There are also three very rare pieces, which came to me in a quite different way from a museum at Bucharest when some duplicate specimens were dispersed, and were all

found by the banks of the river Buzău. They differ entirely from one another, although they were found in close proximity to each other. One has the intensely deep blue opalescent effect, with sparks and flashes of gold; another has somewhat the appearance of a piece of woody fibre suddenly crystallised, and has a wonderful green flash in the centre, a pale yellow piece, full of cracks, into which salts have entered, giving it the iridescent and flocculent effect that it possesses; and the third is somewhat similar to the second, but is a mass of deep brown-purple colour, with the salts of copper at one end of it.

The very finest example of Rumanite that I have ever seen is now in the possession of Messrs. Liberty. Its weight is 6 ounces (avoirdupois), its extreme length 7 inches, and its extreme width $2\frac{1}{4}$ inches. It is a glowing mass of colour, with some specially beautiful spots of iridescence in it. It came from the river Buzău district, but the exact place where it was discovered does not appear to be known.

BURMITE

IN Burmah is found a deep red coloured Amber which has been called Burmite.

Varieties of it have been discovered of a pale yellow or golden colour, similar in appearance to Prussian Amber, and some of a dingy dark brown tint more closely resembling Beckerite.

Its colouring is not as a rule clear, but somewhat dense or turbid, and some specimens exhibit a bloom or opalescence of a green or blue character, such as is formed in Sicilian Amber or Simitite.

Burmite is found in a blue-grey clay belonging to the Lower Miocene divisions of the Tertiary formation.

Dr. Bauer states that the mines are situate "in a hill three miles south-west of Maingkwan in the basin of the

Hukong, the upper reach of the Chindwin river, and in latitude $20^{\circ} 15'$ N. and longitude $96^{\circ} 30'$ E. of Greenwich."

In the exhibition of Burmese objects at the Wembley Exhibition of 1924 a superb ball of Burmite of a glorious red colour was exhibited, amazingly clear and brilliant in colour.

This, it was stated, had belonged to the last King of Burmah, and was regarded as of almost sacred importance.

At the same Exhibition I acquired several fine examples of Burmite, all red in colour and very free from the cracks which, filled as a rule with calcite, too often disfigure Burmite.

I find it a degree harder than Prussian Amber, capable of sustaining a high polish, very ornamental, and in some specimens quite glorious in colour, clear and transparent, but the paler yellow Burmite examples, of which I also possess some, are not so attractive.

Their content of succinic acid is far less than is the case in Succinite. Burmite is obtained entirely by mining; it has not hitherto been obtained on the banks of a river. It is highly fluorescent (see p. 95).

The Chinese have for many centuries, since indeed the remote days of the Han dynasty, sent to Upper Burmah for examples of Burmite for the pleasure of Chinese womanhood, and to an even greater extent for the adornment of the Mandarins.

There is but little, however, that comes into the market. It is mined from the lignite and Blue Earth in which it is found in the primitive fashion by the peasants, who, from a depth that seldom exceeds 30 feet, send up the soil to the surface in bamboo baskets, and there it is picked over by the women and children in search of treasure. There is no systematic mining, and the search is a careless and indifferent one. It is said that not more than 300 pounds of Burmite is found in the course of a year.

Some of it goes to Mandalay, where, with very simple tools, it is fashioned into ornaments or the smaller pieces

turned as beads. The fish is one of the most favoured forms, typical in the mythology of Burmah as of good fortune and long life, closely connected with the mystical ceremonies of birth and marriage.

Most of it goes, however, to China.

Recently Burmite has been discovered in the Hukawng Hills in or near to the Nangotaimaw Hills, and the important pieces that have been found have been taken into Mandalay to be made into rosary beads or into ear-cylinders. It has been almost impossible for either travellers or scholars to obtain any specimens of this exceedingly dark red Burmite, but I have now in my collection one small example of it.

It is a singular fact that, although Burmah is the home of numerous species of ants, not one single example has hitherto been found enshrined in Burmite. A few leaves, and *very* occasionally indeed flies and minute coleoptera, have been discovered, but no ants. On the whole Burmite is singularly lacking in animal or plant remains.

Messrs. Liberty have in their possession two very large lumps of Burmite from their own property in Burmah, the two together being considerably larger than the size of a man's head. From these lumps they have taken slices, and have sent them to China to be carved, and one particular slice is a good example of modern Chinese carving on this somewhat difficult material. The extremely rich colour of Burmite, which resembles that of a jujube, is to a certain extent lost in these very large pieces, and can only be seen by reflected light, the general effect being a dull, even deep tone of red.

AMBERGRIS

It would be unwise, in treating of Amber, to refrain from allusion to a material that by journalists and others is often confused with it, although Ambergris, sometimes called Grey Amber and sometimes spelled Ambergrease, has

nothing whatever to do with true Amber, and is not even a mineral, but an animal product. It is curious, however, that it derives its name from the Arabic *anbar* in more direct fashion than does Succinite. True Amber was so called from a supposed resemblance to Ambergris, which actually, save perhaps in smell, it does not resemble at all.

Ambergris is a morbid secretion from the liver or intestines of the spermaceti whale, and is generally found floating in the sea.

It is also extracted by whalers from the abdomen of the whale in lumps varying in size from half an ounce up to a hundred or more pounds.

It was at one time declared to be a fossil naphtha or bitumen, exuding from depths below the sea, and hardening and floating on its surface, but it is not a bitumen at all, fossil or otherwise.

Some writers in alluding to Ambergris state that claws and beaks of birds and feathers, parts of vegetables and bones, and scales of fish are found in it, but such is not the case, and the black spots which are to be found in it have been proved under the microscope to be minute remains of the beaks of the octopus, *Sepia octopodia*.

Ambergris is the result of some mysterious illness that attacks *Physeter macrocephalus*, and is only found in whales that are torpid or sickly, and in their intestinal canal.

When first extracted it is soft, but rapidly becomes hard. It has at first a very disagreeable odour, but this passes off, and gives place to a peculiar aromatic odour, quite unmistakable.

The Ambergris found floating upon the sea is harder than that obtained from the dead whale.¹ Gradually

¹ There has been one large mass brought to light in a curious way. It was found in the stomach of a slaughtered sheep, and appeared to be composed of smaller masses which the animal must have swallowed with its food. It was a good sound lump, nevertheless, for the heat and juices of the stomach had cemented the fragments very closely.

Ambergris loses not only its unpleasant odour, but also its dull black colour, and it then becomes white, or of a dirty white or brown colour, and less ponderous.

The reason for the presence in it of remains of the beak of the octopus is that this black horny substance passes undigested and unchanged in appearance through the stomach of the whale into the intestinal canal, and it is quite possible that it is these very beaks that set up the abscess in the abdomen of the whale, and the Ambergris may be a secretion produced by the animal to assist in the cure of the irritation.

The more torpid or sickly the whale, the more Ambergris can be obtained from its body. It has been declared that Ambergris is only hardened semen or even dung from the whale, but this also is incorrect. The fæces of the whale differ entirely in constituent parts from Ambergris.

Ambergris is lighter than water, and hence floats upon its surface. Its specific gravity is from 0·780 to 0·920 maximum. It is nearly (almost wholly) soluble in alcohol or hot ether. It melts at 144° F., and is dissipated in white vapour at 212° F. It burns with a very agreeable odour, and leaves practically no ash. It consists in great part of a peculiar white crystalline substance called Ambreine, believed to be identical with Cholesterine.

On distillation, it yields 85 per cent. of Ambreine.

It is very soft, can be marked with a finger-nail, and adheres to the edge of a knife when it is cut.

It is found in larger quantities in the male than in the female whale.

Our chief sources at present for it, apart from that obtained by the whale fishers, are the Indian Ocean near to the Laccadive Islands, the coasts of the Bahama Islands, and the coasts of Africa, Brazil, China, and Japan.

It is stated that there is a vegetable production that closely resembles it, found in Guiana, and first mentioned

by Magellan. The local name is "cuma." It is whitish-brown in colour, melts and burns, as does Ambergris, and has a similar odour.

The following quotations concerning Ambergris are given in the first volume of the "Oxford National Dictionary":

1398. Trevisa, *Barth. De P. R.*, XIII. xxvi. 463: "The whale hath gret plente of sperme . . . and yf it is gaderid and dryeþ it turneþ to þe substaunce of ambra (1535 ambre)."
1477. Norton, *Ord. Alch.* in Ashm. (1652) v. 70: "Amber, Narde, and Mirrhe."
1587. Harrison, "England," I. II. xx. 330: "Induing the fruits with the savour of muske, ambre, etc."
1662. Fuller, "Worthies," I. 194: "It is called Ambragresia, That is, Gray Amber, from the Colour thereof."
1670. Cotton, "Espernum," III. IX. 447: "Some pieces of Amber-gris, (or rather black Amber, for it was of that colour)."
1693. In Blount, "Nat. Hist.," 14: "Great variety of Opinions hath there been concerning Amber. Some think it to be a Gum that distils from Trees; Others tell us, it is made of Whales Dung; or else of their Sperm or Seed, (as others will have it,) which being consolidate and harden'd by the Sea is cast upon the Shore."
1718. Lady M. Montague, "Lett.," I. xxxvii. 146: "Slaves . . . with silver censers . . . perfumed the air with amber, aloes-wood, and other scents."
1634. Habington, "Castara" (1870), 85: "A mighty showre of Amber comfits it sweete selfe did powre Vpon our heads."
1671. Milton, "Samson," 720: "An amber scent of odorous perfume."

Ambergris has from the earliest days of perfumery been used as a basis, because it not only possesses a remarkable and aromatic odour of itself, but it has the power of heightening the natural odour of other bodies, and the great secret of its use to this end is to add it so sparingly that,

while it improves the smell of that to which it is added, its own may not be discovered.

There are references to its use as early as 1190, when statutes respecting glove-making in France were passed, and perfumed gloves were regularly worn, the skins being impregnated with musk, civet and Ambergris, and so imported from Italy and Spain into France. The perfume is particularly referred to in a French MS. of the later part of the sixteenth century, referring to a pair of gloves to be made for the Sovereign.

In 1582, during the reign of Henry III., Nicholas de Montant reproved the ladies of Paris for using

“ all sorts of perfumes, cordial waters, civet, musk, Ambergris and other precious aromatics to perfume their clothes and linen, and even their whole bodies.”

In the late sixteenth century, there is a recipe in MS. for a paste used by the Duchess of Braganza and the Duchess of Parma. It is composed of Ambergris, musk, and civet, with essence of citron and rose-water.

A perfume used by the Court beauties of the time of Charles II. was composed of Ambergris, musk, and sandalwood. These were powdered, mixed together, and placed in small boxes to be worn on the person, or put amongst the clothes in the oak chests and coffers that were then in use.

In Sâdî's "Gulistân," the Persian poem in Praise of the Rose, there are the following lines:

“ ‘ Art thou, then, musk or Ambergris,’ I said;
 ‘ That by thy scent my soul is ravished ?’
 ‘ Not so,’ it answered; ‘ worthless earth was I,
 But long I kept the roses company;
 Thus near them perfect fragrance to me came,
 Else I’m but earth, the worthless and the same.’ ”

The Golden Rose, sent by the Holy See to Queens as a mark of peculiar favour, has its flowers perfumed still with Ambergris, musk, and other aromatics.

Ambergris has always been regarded as a potent drug, a cordial, an antispasmodic, and above all as an aphrodisiac, in which it was taken in doses of from 3 to 10 grammes.

Furthermore, it is used in fumigation, especially in Moslem countries, where its perfume is particularly acceptable.

Its value in 1929 was about 140s. an ounce. I have several different examples of it in my collection, varying in colour and density.

The records of Lever Brothers' associated company, the Harris Whaling and Fishing Company Limited, contain a striking story concerning Ambergris. During the 1924 whaling season, they found in a sperm whale a number of pieces of dark brown Ambergris, the largest weighing 22 pounds. Altogether there were about 44 pounds of Ambergris, and it was sold in London for £2,018, an average price of 56s. an ounce. The windfall turned a bad trading year's loss of £300 into a profit of £1,700!

About two years ago a dredging party was at work under the shadow of the Statue of Liberty when an immense greyish mass made its appearance. "Ambergris!" shouted the men, and a free fight ensued for its possession. Order was at length restored and a solemn agreement was reached. The mass was escorted to the strong-room of a New York bank, and instructions given for its sale.

The elation was short-lived, however, as an analyst's certificate showed that the "ambergris" had never had even a nodding acquaintance with a whale. Not from the ocean depths had it come, but from the cellars of an illicit "moonshine" distillery! Under cover of night the "bootleggers" had dumped the spent mash of their still into New York Harbour, and through the alchemy of wind and waves the mass had simulated the appearance of Ambergris.

In the "Secrets of Alexis" (1555) there is the recipe for a good perfume against the plague, and Ambergris is the principal item in its composition.

During the time of the Great Plague, a French quack doctor named Angier claimed to be successful in stopping the plague with a fume which he invented, and the Lord Mayor was ordered to give him all encouragement in the distribution of his medicaments, the fume consisting of sulphur, saltpetre, and, it is said, Amber, but probably this was Ambergris.¹

Those who are studying Ambergris, or endeavouring to collect samples of it, must be on their guard concerning various materials that have a resemblance to it, and have been confused with Ambergris by those who are not acquainted with the real substance.

Paraffin wax that has been found floating on the surface of the sea is often dubbed Ambergris. Decomposed soapstone from seaside beaches on the south coast of England is another material that has been confused with Ambergris, and quite constantly the spawn of the whelk found in Wales, Ireland, and Scotland has been regarded as the precious material for which many persons are seeking. Some little while ago, a well-stopped glass jar was sent to the Natural History Museum, because it contained a jelly-like substance preserved in spirit, which it was thought almost certainly was Ambergris. The result of the investigation given by Captain Totton was that the material was certainly not Ambergris, but, on the other hand, it was exceedingly interesting, because it was a portion of a very rare Medusa or jelly-fish, bearing the name *Chirodropus gorilla*. Only a single specimen of this rare Medusa had hitherto been described, and it was believed to be no longer in existence. It was therefore very interesting to the scientific investigator at the Natural History Museum that from the west coast of Africa should come this precious portion of jelly-fish, even though the correspondent had sent it in the vain hope that

¹ See "The Mystery and Lure of Perfume," by C. J. S. Thompson, pp. 122-136.

he had in his jar an example of a material far more precious intrinsically.

In the collection of Mr. J. Pierpont Morgan, in America, is a complete jewel made of Ambergris, set with gold, rubies, and enamel. It was at one time supposed to have been made of an aromatic wax, and it was judged to be a model for a pendent jewel, and to represent Charity, but it is actually a representation of Philoprogenitiveness, and wrought out of a lump of Ambergris of unusual size, to be worn by one of the Medici princes for its aphrodisiac qualities, and with a desire to found a family. It is, so far as I know, the only jewel made of Ambergris that is in existence.

GEDANITE AND PSEUDO-AMBERS

DR. CONWENTZ in 1895, in delivering an address before the British Association, then meeting at Ipswich, described Gedanite as a yellow transparent Amber without any appearance of polarisation or fluorescence. "It looks," said he, "as if it were covered with white powder, part of which can be wiped away," and this external feature is very characteristic of Gedanite. Its hardness is only 1.5 to 2. Knocking or cutting easily splits it asunder, and therefore it is not of much value for working. Its fracture is conchoidal and glassy. By heating it to between 140° and 180° C. it becomes inflated, and by heating it more it begins to melt. The plant which produced Gedanite is not known, but sometimes Gedanite encloses small fragments of a pine-like wood, possibly belonging to the trees that produced the resin. Small leaves also of other plants, the identity of which cannot be determined, and several kinds of insects, are found in the interior of this fossil resin.

Gedanite is evidently the resin from quite another tree to that which yields Succinite, a pine to which has been given the name of *Pinites stroboides*. It is known to the

miners as brittle Amber, because it is far more brittle than Amber. It shows a brighter gloss on fracture, and contains far less succinic acid than does Succinite.

Somewhat similar to it in certain qualities are two other resins, called after the names of Messrs. Stantien and Becker, who did so much in Samland to develop the Amber industry—Stantinite and Beckerite. These are both dark-coloured resins from a yet unknown plant or tree, and the latter, in the opinion of Dr. Klebs, is the fossil sap of a plant not unlike the Gutta-percha.

Gedanite has a density of 1 to 2; Succinite from 2 to $2\frac{1}{2}$.

Gedanite has a specific gravity of 1.060 to 1.066; Succinite varies widely, being from 1.050 to 1.096.

The enclosures in Gedanite are very rare. Dr. Helm only possesses one Hymenopteron (*Pteromalus*), a small spider, some Diptera, and a fine enclosed Microlepidopteron. These enclosures cannot be kept, like those of Succinite, preserved in alcohol, because with alcohol diluted ninety times with water, the Gedanite is still affected; its surface softens, whitens, and after drying up it becomes cracked.

Gedanite takes its name, suggested by Dr. Helm, from Gedania, the Latin name for Danzig.

It is generally more or less yellowish in colour, and only semi-transparent. If heated it darkens gradually, and eventually assumes a milky appearance. On analysis it is found to be composed of:

Carbon	.. 81.01 per cent.	Oxygen	.. 7.33 per cent.
Hydrogen	.. 11.41 ,,	Sulphur	.. 0.25 ,,

Beckerite is a dark brown, soft, dense, non-fusible resin, cloudy and earthy. It is found in lumpy masses, and is wholly opaque, save for a slight transparency at the thinner edges. It is so tough that it can only be reduced to powder with difficulty; the powder is a grey-brown colour, and contains 0.005 per cent. only of succinic acid. In Beckerite foliage

has been found on several occasions. In some of its characteristics it is related to gutta-percha.

Stantinite has a close resemblance to Beckerite. It is equally dark and opaque, but just at the thinner edges there is a red-brown glow. It can be reduced to a cinnamon-brown powder, much more easily than Beckerite. It is found in irregular or roundish pieces, and has a dull black surface. Its proportion of succinic acid is less than that of Beckerite, being only 0.0003 per cent. Of organic remains, only those of vegetable origin have yet been traced in it. It is found in the Blue Earth of Palmnicken in East Prussia, and in close contact with Amber. There is practically no succinic acid to be found in Stantinite.

Glessite, Dr. Conwentz describes as a gum resin from yet another tree, the identity of which cannot at present be determined. It is light brown in colour, and somewhat resembles myrrh.

It is, Conwentz says, almost opaque, without incidence of polarisation or fluorescence. Its degree of hardness is 2, its fracture conchoidal and greasy, and no remains of plant or animal have yet been found in it. It is named, of course, from Glesum, an old name for Amber (see p. 49).

Other fossil gums that should be alluded to are Kranzite, a soft, Amber-like resin that is found in the coal measures in Saxony; Allingite, a yellow resin, occasionally found in Switzerland; a substance called Amber found in the cretaceous rocks in Syria, especially near to Mount Lebanon; Ambrite, an Amber found in the lignite beds of New Zealand; and, finally, a resin that has not yet come under close analysis that is said to occur in Southern Mexico, to be yellowish or reddish in colour, and to be very fluorescent.

There is a species of Amber-like resin found in the bituminous limestone in the Savoy.

There is a yellowish-reddish substance resembling Amber found in lignite in Tasmania.

There is also something very similar to be found in the coal measures in Labuan.

Then there is the reddish mineral resin found in sandstone in Austria called Schraufite, the constituents of which closely resemble those of Amber, and may be expressed by the formula $C_{11}H_{16}O_2$; and there is also that mysterious resin called Pigotite which is found in granite, and has a far more complex composition, as it contains aluminium, and its formula is $4Al_2O_3C_{12}H_{10}O_8 + 27H_2O$. Both are found, I am informed, associated with lignite or jet.

Another resin that should be mentioned is that extraordinary material called Loban, about which very little is known. It is found near to Mecca, and is called by some chemists "Balm of Mecca." It has the appearance of a greyish crystalline mass, but is inflammable, and melts to a kind of sticky, resinous gum. It has a very pleasant smell when it is burnt—a clean, sweet-smelling vapour that possesses antiseptic properties, and round about Mecca it is frequently burned in stuffy places to purify the air. It is also used for flavouring for cigarettes and for coffees, and to coffee it gives a rich and almost alcoholic taste. Some pieces have very much the appearance of decomposed Succinite. Others resemble Ambergris.

I am not aware of any exact chemical analysis having yet been made of it. It is really only known to persons who have travelled in Central Arabia, and more especially to the Arabs who have made the pilgrimage to Mecca. They state that it is found in very few other parts of Arabia, except close to the sacred city.

What are sometimes called English Ambers are two mysterious resins of very rare occurrence, and about which very little is yet known. One is Copalite or Highgate resin. This resin is found in the London Clay, especially at Highgate, and in a few other districts, notably at Richmond.

It was first detected by a local surgeon, Mr. B. G. Snow, who sent it to Dr. Sowerby for examination.¹

It was described by Dr. William Whitaker, one of the earliest geologists to draw special attention to it, as forming "irregular pieces of a pale yellowish and dirty brown colour, resembling copal in colour, lustre, transparency and hardness, and like it equally difficult to dissolve in alcohol."

It burns easily, with a yellow smoky flame, and leaves little ash. It has a curious waxy texture. $C_{40}H_{64}O$ is its formula.

A substance very closely resembling Copalite is occasionally to be found at Prague, and is known as Valchorite. It is a very rare mineral, and is found in the cretaceous sediments at Valchov, near to Boshovice. The sediments are of alum shale alternating with coal, and Valchorite has a greasy surface resembling that of Copalite, but it is much harder. It has a conchoidal fracture, a small amount of succinic acid, and is a dense, soft material, but of no commercial value, only interesting to the mineralogist. I have one of the largest examples of it yet found in my own collection.

Another strange soapy material, resembling Amber, is what is called Hachtite, found at Savigno near Bologna, in Italy, and found also in the mines at Merthyr Tydvil. It is semi-transparent, somewhat horny in character, very dull lemon-coloured, and, on analysis, having quite a close resemblance to Copalite. It is only found very occasionally, and in thin veins, and is therefore a rare mineral, difficult to obtain. It is readily soluble in ether.

AMBER VARNISH

THE smallest pieces of Amber are used for the manufacture of varnish.

On heating Amber to 375° C., it decomposes and sets a large part of amber acid and volatile oil free, leaving behind,

¹ See *Ann. Phil.*, vol. ii., 1813; also *Phil. Mag.*, xiv., 1839.

in the form of a brownish substance, a residue which can be dissolved in various ingredients, which are taken into consideration in the production of oil varnish. This so-called Amber colophony or Amber pitch is considerably harder, has greater lustre and durability than copal, damara, and other gums used in the varnish industry; it mixes well with all colours used in trade, and is therefore of importance wherever these properties are required.

To prepare what is known as soluble Amber, the process usually adopted is this: The Amber is heated very cautiously in an iron pot, over a clear fire, until it becomes soft or semi-liquid; then pale boiled linseed oil, heated very hot, is added, and well mixed in by stirring. The best proportions are 3 pounds of oil to 4 pounds of Amber.

In this state, on being cooled a little, it may be made into a varnish by the addition of oil of turpentine; or it may be preserved for any length of time if covered from the air, and is always ready for its purpose on being gently heated. It is sometimes used as a cement for glass and earthenware by rubbing it on the edges of the broken piece, previously heated.

To prepare actual Amber varnish, the following is the process usually adopted: To 1 pound of Amber take of pale boiled oil 10 ounces, and of turpentine 1 pint. Render the Amber, placed in an iron pot, soft or semi-liquid by heat; then add the oil hot, mix the two together very quickly, remove the mixture from the fire, and when it is cool, stir in the turpentine. The process, I would like to add, is an *extremely dangerous* one, and should never be attempted save in a properly furnished laboratory.

The resulting varnish is rather dark in colour, but remarkably tough. It is used for the same purposes as copal varnish, and is excellent for covering wood or any other substance not of a white or very pale colour. It dries well, and is exceedingly hard and durable.

For the preparation of a black varnish, take 1 pound of

Amber, boiled oil $\frac{1}{2}$ pint, powdered asphaltum 6 ounces, and turpentine 1 pint. Melt the Amber as already described, then add the asphaltum, previously mixed with the oil, cold, and afterwards heated very hot; mix them all well, remove the vessel from the fire, and when cool, add the turpentine, also previously made warm.

Each of these varnishes can be reduced to a proper consistence with more turpentine if required. The last form produces the beautiful black varnish used by coachmakers.

Some manufacturers omit the whole or part of the asphaltum, and use the same quantity of clear black rosin instead, in which case the colour is brought up by lamp-black reduced to an impalpable powder, or previously ground very fine with a little boiled oil. The varnish made in this way lacks, however, that richness, brilliancy, and depth of blackness imparted by asphaltum.

An imitation Amber can be made by dissolving shellac in an alkaline lye, and passing chlorine through the solution until the whole of the lac is precipitated. After washing this in water, it must be melted and kept over the fire until it runs clear, taking care that it does not burn; it should then be poured into moulds of the size of the pieces required. All these operations require considerable care, and are not at all easy ones to perform.

In the working of Amber for art purposes there are, it is stated, two methods practised by the workman to harden common Amber and to render it clearer:

The first is to boil the pieces of Amber in an essential oil for twenty-four hours.

The second is to surround the Amber with clean sand in an iron pot, and expose it to a gradually increasing heat for thirty or forty hours. During this process pieces must be kept in the sand at the side of the pot, for the purpose of occasional examination, lest the heat be raised too high, or be too long continued.

This process, again, requires for its success much skill and experience. It is *difficult* and even *dangerous* in many respects.

As to the use of Amber varnish on Cremona violins, Mr. C. Reade, in a letter to the *Pall Mall Gazette* of August 31, 1872, made some very important statements.¹ The letter, together with some others relative to the same subject, was reprinted by G. H. M. Muntz of Birchfield, in a little pamphlet entitled, "A Lost Art: Manufacturing Cremona Violins and Varnish," by Charles Reade. It was printed, so Mr. Heron-Allen informs me, at the Steam Press, Eastgate, Gloucester, but the edition was an exceedingly small one. Mr. Reade refers to the anxiety on the part of many violin-makers to discover the secret of the varnish used in Cremona, and to the fact that many chemists have "given days and nights of anxious study to it." He then goes on to say that the first and most important theory that has been adopted was that the basis of the varnish was Amber, "that these old Italians had the art of fusing Amber, without impairing its transparency: once fused by dry heat, it could be boiled into a varnish with oil and spirit of turpentine, and combined with transparent yet lasting colours."

"To convince me," says Mr. Reade, "they used to rub the worn part of a Cremona with their sleeves, and then put the fiddle to their noses and smell amber. Then I, burning with the love of knowledge, used to rub the fiddle very hard, and whip it to my nose, and *not* smell amber. But that might arise, in some measure, from there not being any amber there to smell." He adds: "These amber-seeking worthies never rubbed the *coloured* varnish on an old violin. Yet their theory had placed the amber there."

As to this theory, Mr. Reade writes thus: "Surely amber is too dear a gum, and too impracticable for two hundred fiddle-makers to have used it in Italy. Till fused by dry heat, it is no more soluble in varnish than quartz is, and

¹ I owe this reference entirely to Mr. E. Heron-Allen, F.R.S.

who can fuse it? Copal is inclined to melt, but amber to burn, catch fire, do anything but melt. Put the gums to a lighted candle, you will then appreciate the difference. I have tried more than one chemist in the fusing of amber; it came out of their hands a dark brown opaque substance, rather burnt than fused. When really fused, it *is a dark olive-green, as clear as crystal, yet,*" says Mr. Reade "I never knew but one man who could bring it to this, and he had special machinery invented by himself for it; in spite of which he nearly burnt down his house one day." Mr. Heron-Allen says that this man was John Lott (1830-70), one of the most talented violin-makers, and, he adds, "perhaps our best native copyist. Marvellous tales are told of his cunning in the matter of repairs. He has been compared with J. B. Vuillaume himself."

Then Mr. Reade adds: "I believe the whole amber theory comes out of an equivoue. The varnish of the Amati was called amber to mark its rich colour, and your *a priori* reasoners went off on that, forgetting that amber must be an inch thick to exhibit the colour of amber." His opinion about the amber varnish used at Cremona is that the wood is varnished with "a colourless oil varnish which sinks into and shows up the figure of the wood." There is then used "a heterogeneous spirit varnish which serves to give the glory of colour with its light and shade, which is the transcendent beauty of a Cremona violin." "This deep red varnish of Cremona," he says, "is pure dragon's blood," and adds, "not the cake, the stick, the filthy trash which in this sinful and adulterating generation is retailed under that name, but the tear of dragon's blood, little lumps, deeper in colour than a carbuncle, clear as crystal and fiery as a ruby."

AMBROID OR PRESSED AMBER

IN spite of the manifold uses of Amber, a great proportion of pieces of the middle quality, too expensive for varnish, would have been practically lost for want of a use to put them to but for the invention of a method whereby small pieces may be pressed together by hydraulic force. Amber is indissoluble either by the action of fire or of water; but at a temperature between 170° and 190° C. it softens without disintegration to about the consistency of india-rubber.

While in this state small pieces are pressed together in the following manner: The pieces of Amber, thoroughly cleansed and carefully freed by hand from their weathered crust, are placed on a very strong, deep steel tray which is closed with a perforated cover. At a temperature of 200° C. these two vessels (the tray and its cover) are pressed together, so that the Amber in its soft state is forced up through the holes of the perforated cover, and in cooling it solidifies into a mass. In this way, by hydraulic pressure of forty atmospheres, one gets Amber in the form of flat pieces which can be turned, bored, and polished like natural Amber. It is harder than the natural Amber, but is inferior to it in brilliancy and polish.

The many difficulties which present themselves in preparing Amber for pressing, and the waste which takes place, render pressed Amber (Ambroid) quite expensive, but the high price is counterbalanced by the increase in adaptability and decrease of waste in turning.

This Amber or Ambroid can be worked in a lathe, polished with whiting and water or oil, and finished off by friction with flannel. During the operation the pieces often become hot and electrical, and fly into fragments. To avoid this, they should be kept cool and only worked for a short period at a time.

The workmen polishing Amber suffer considerably from

electrical excitement, often experiencing severe nervous tremors of the hands and arms.

Pressed Amber is excellent for all cheap bulk articles, especially those used by smokers, as the use of wood, horn, bone, celluloid, etc., are avoided for hygienic reasons and a permanent good appearance is not required. It is not adapted to fine manufactures. All pressed, misty Amber, undergoes a change in a very short time after use; this is not only apparent on the surface, but through the whole mass. The even cloudy appearance seen at first becomes after a few months bony-white, rendering it uneven and disagreeable in appearance. The clear sorts retain their original quality, but cannot be compared to the genuine natural Amber in fire and lustre. Pressed Amber is also transparent, but on close observation one can see that it is not perfectly clear. It contains undulating lines and elevated portions, which reflect the light in different ways. It reminds one of two liquids of different specific gravity, for instance glycerine and water, about to combine; or of heated air when passing into cooler, often described as trembling air. This distinguishing feature is typical, and is best visible when the object to be examined is so placed that the light penetrates as large a mass of Amber as possible. It is more difficult to distinguish the misty sorts. There are convex layers of misty and clear parts in pressed Amber, caused by the manufacturing process; these have the appearance of the well-known cirrus clouds. These layers show the direction taken when pressed; if a cigar-holder is cut parallel to this, the misty layers can be seen above each other from the cigar end to the mouthpiece. If the work is done at right angles to the incidence of pressure, rows of marking can be seen side by side, across the holder. Such peculiar misty spots are not found in the genuine Amber. An experienced person can easily detect this mistiness. In misty Amber a large quantity of small bubbles have caused

the mistiness, as already mentioned. These are round, or rather oval, and are located in a bed of clear Amber. Pressed Amber can also be seen to contain a large number of flat crevice-like cavities which run in all directions or appear somewhat like moss.

Artificial Amber has been recently produced by a combination of formaldehyde and creosol. This has been given the name of Bakelite. It has a very close resemblance in appearance to Amber, feels to a certain extent like Amber, and possesses a certain amount of electric power, but when heat is applied it gives off a very strong smell of carbolic acid, and hence can be quite readily detected.

Efforts to colour an entire mass of pressed Amber have been very successful. Coloured Amber can be easily turned and polished, and the colours are durable. On account of its great durability and elegant appearance, coloured Amber is used as a substitute for several other materials and for decorative effect, where durability is required, such as for door-knobs, window-handles, and similar objects. For such purposes it can compete with ivory, so often used. Both are very valuable, do not conduct heat, and are equally durable. Ivory, however, changes its hue very quickly and becomes yellow, whereas Amber retains its colour.

Pressed Amber reveals brilliant interference colours under polarised light rays. It has similar electrical qualities, but to a minor extent, to those possessed by natural Amber. It is stated that it does not possess any so-called anti-rheumatic qualities, and as it becomes more osseous in appearance, it loses any fluorescence it may have possessed. It melts at a lower melting-point than does Succinite.

BIBLIOGRAPHY

*The books marked * refer to amber varnish.*

- ABROMEIT, J. Bericht über die Tätigkeit des Preussischen Botanischen Vereins im Jahre 1905-1906. Königsberg, 1906.
- AGRICOLA, GEORGE. De Natura fossilium. Liber iv. 1584.
- ALBERTI M. De Succino. 1750.
- ALDREVANDI. Musæum Metallicum.
- Amber, Royal Works at Königsberg. Short History of Amber. 1913.
- Amber as a Gem. Liberty & Co. 1929.
- ANCHER, P. De Succino (Danice). 1737.
- ANSTED, D. T. Natural History Rambles in Search of Minerals. London, 1880.
- *AUDA, D. Pratica di Spetiali. Venice, 1670.
- *AUDA, D. Recueil abrégé des Secrets Merveilleux. Venice, 1663.
- AURIFABER, ANDREAS. Kurzer grundlegliche Bericht woher der Agtstein oder Bernstein komme, dass er kem Baumharz sey sondern ein Geschlecht des Bergwachs, und wie man jenen in Arzenenen möge gebrauchen. Königsberg, 1551.
- AYCKE, J. C. Fragmente zur Naturgeschichte des Bernsteins. Danzig, 1835.
- BAIERUS, J. J. De Ambra. Jenæ, 1698.
- BARTHOLINE, THOMAS. Acta Hasniensia. Copenhagen, 1673.
- BAUER, DR. MAX, tr. by DR. SPENCER. Precious Stones. London, 1904.
- BAUMER, J. De Succino. Halæ, 1750.
- BERENDT, G. C. Die Insekten im Bernstein. Danzig, 1830.
- BERENDT, G. C. Organische Reste im Bernstein. 2 vols. Berlin, 1845-56.
- BERENDT, G., und JENTZSCH A. Neuere Tiefbohrungen in Ost- und Westpreussen östl. der Weichsel. Berlin, 1883.
- BERENDT, G. Vorarbeiten zum Bernsteinbergbau im Samlande. 1872.
- BERENDT, G. Erläuterungen zur geologischen Karte des West-Samlandes. 1866.
- BERENDT, G. Die Bernsteinablagerungen und ihre Gewinnung. 1866.
- BERTUCH, G. De succini solutione ferme radicali. Halae Magdeb., 1739.
- BERZELIUS, I. I. Traité de Chimie. 1839.
- BESSELL, W. Ueber Pytheas von Massilien und dessen Einfluss auf die Kenntniss der Alten vom Norden Europa's insbesondere Deutschlands. Göttingen, 1858.
- BEYRICH, E. Kenntnis des tertiären Bodens der Mark Brandenburg. Berlin, 1848.

- BEYRICH, E. Ueber den Zusammenhang der norddeutschen Tertiärbildungen, zur Erläuterung einer Geologischen Uebersichtskarte. Berlin, 1856.
- BLACK, G. F. Amber and its Origin. 1919.
- BLIND, KARL. An Old Greek Explorer of Britain and the Teutonic North. Fortnightly Review, September, 1891.
- BOCK, F. S. Naturgeschichte des preussischen Bernsteins. Königsberg, 1767.
- BOCK, F. S. Naturgeschichte von dem Königreich ost- und Westpreussen. 1783.
- *BONANNI, F. Trattato sopra la Vernice detta Cinese. Rome, 1702.
- *BONANNI, F. Traité des Vernis. Rome, 1713.
- BOSWELL, JOHN. De Ambra. Lugduni Batavorum, 1736.
- BRAUN. Pflanzenreste im Bernstein. Zeitschr. d. Deutsch, 1861.
- BRISCHKE, D. Die Hymenopteren des Bernsteins. Danzig, 1886.
- BRITISH MUSEUM. An Introduction to the Study of Minerals. London, 1924.
- BRITISH MUSEUM. A Guide to the Mineral Gallery. London, 1921.
- BRITISH MUSEUM. The Student's Index to the Collection of Minerals. London, 1922.
- BROWNE, SIR THOMAS. Pseudodoxia Epidemica, or Enquiries into Vulgar and Common Errors. 1646.
- BUCHBERG, MIKISCH-, VON. Der Bernstein. 1882.
- BUFFUM, W. A. The Tears of the Heliades, or Amber as a Gem. London, 1898.
- CARDAN. Re rerum Varietate. Basle, 1556.
- CASPARY, RUD. Die Flora des Bernsteins und anderer fossiler Harze des ostpreussischen Tertiärs. Bd. I. Nach dem Nachlasse des Verstorbenen bearbeitet von R. Klebs. Berlin, 1906.
- CASPARY, RUD. Neue fossile Pflanzen der blauen Erde usw. Königsberg, 1882.
- Chambers's Journal, January 18, 1851, and November 29, 1873.
- CHURCH, SIR A. H. Precious Stones. London, 1924.
- COCKERELL. Descriptions of Hymenoptera from Baltic Amber. Königsberg, 1909.
- Congrès International d'Anthropologie et d'Archéologie Pré-historiques. Compte-Rendu. Sessions 1874 and 1876. Budapest and Stockholm.
- CONWENTZ, H. Die verschiedene Bildungsweise einiger Handelssorten des baltischen Bernsteins. 1889.
- CONWENTZ, H. Monographie der Baltischen Bernsteinbäume. Danzig, 1890. [B.M. 7202 g 7.]
- CONWENTZ, H. Ueber die Verbreitung des Succinits, besonders in Schweden und Dänemark. Danzig, 1890.
- CONWENTZ, H. On English Amber, and Amber Generally. Nat. Science, ix. 54 and 55, 1896. [B.M. PP 1976 c.]
- COOKE, J. Natural History of Lac, Amber, and Myrrh. London, 1770.
- CRÉMER, H. Richesse minérale de la Roumanie. 1888.

- *CREUZBERG, H. Lehrbuch der Lackierkunst. Weimar, 1876 and 1884.
- CURWEN, ELIOT. The Hove Tumulus. 1918.
- DAHMS, DR. PAUL. Markasit als Begleiter des Succinit. 1892.
- DAHMS, DR. PAUL. Mineralogische Untersuchungen über Bernstein. Schrifttender Naturf. (various papers), 1893, 1896, 1898, 1901, 1906, 1907, 1912, 1914, 1919, 1921.
- DAHMS, DR. PAUL. Ueber das Vorkommen und die Verwendung des Bernsteins. Zeitschrift für praktische Geologie, 1901.
- DAHMS, DR. PAUL. Einschlüsse in Bernstein. Danzig, 1915.
- DAHMS, DR. PAUL. Über rumänischen Bernstein. 1920.
- DAHMS, DR. PAUL. Hohlräume und Wassereinschlüsse in Bernstein. 1922.
- DAMPFE, A. Palæopsylla Klebsiana n. sp., ein fossiler Floh aus dem baltischen Bernstein. 1910.
- DANET. Du Succin employé dans la coqueluche, les convulsions et les coliques des enfants pendant la première dentition. Bulletin de l'Académie de Médecine, xxviii., Paris, 1862-63.
- DELAFOSSE, M. Nouveau cours de minéralogie. Paris, 1860.
- DERHAM, W., F.R.S. Philosophical Experiments and Observations of the late eminent Dr. Robert Hooke, S.R.S. London, 1726.
- *DEVAUX, A. A. T. Traité . . . sur l'art de faire les Vernis. Paris, 1845.
- ECKSTEIN. Tierische Haareinschlüsse im baltischen Bernstein. Danzig, 1890.
- ENGELHARD, K. Der Bernstein.
- ERMAN und HERTER. Ueber Tertiärschichten, welche die Bernsteinführende Braunkohle an der Samländischen Ostseeküste bedecken. 1850.
- EURELIUS, G. Ἠλεκτρον. Lipsiæ, 1687.
- EVANS, DR. JOAN. English Jewellery. London, 1921.
- FARRINGTON, OLIVER C. Amber, its Physical Properties and Geological Occurrence. Chicago, 1923.
- *FIEROVANTI, L. The Universal Mirror of Arts and Sciences. Bologna, 1564.
- FOELKERSAM, A VON. Articles in the Russian Magazine, старые годы (Starye Godye). November, 1912.
- FRIEND, J. NEWTON. An Introduction to the Chemistry of Paints. London, 1910.
- *FRY, G. The Varnishes of the Italian Violin-Makers. London, 1904.
- FUHR, MAXIMILIAN. Pytheas aus Massilia. Darmstadt, 1842.
- GENTHE, H. Ueber den Etruskischen Tauschhandel nach dem Norden. Frankfurt a. M., 1874.
- GERARD, A. Observations et Expériences sur la vertu de l'ambre jaune dans une maladie nerveuse de forme convulsive. Journal des Connaissances Médico-Chirurgicales, Paris, ix., part 2, 1842. Also, Annales de Médecine Belge, Bruxelles, i, 1842.

- GILBERT, DR. WILLIAM. *De Magnete*. London, 1600.
- GOEBEL, SEVERIN. *De Succino Libri duo (cum corollario C. Gesneri)*. In Gesner. C. *De omni rerum fossilium genere*. Regiomont, 1558, and Königsberg, 1565.
- GOEBEL, SEVERIN. *History and Particulars, Origin and Uses of Amber*. 1566.
- GOEPPERT und BERENDT. *Der Bernstein und die in ihm befindlichen Pflanzenreste der Vorwelt*. Berlin, 1845.
- GOEPPERT. *Die fossiler Coniferer mit stäter Berücksichtigung der Lebender*. Haarlem, 1850.
- GOEPPERT. *Beiträge zur Bernsteinflora*. Berlin, 1852.
- GOEPPERT. *Sull' ambra di Sicilia e sugli oggetti in essa rinchiusi*. Rome, 1879.
- GOEPPERT, H. R., und MENGE, A. *Die Flora des Bernsteins*. 2 vols. Danzig, 1883. [B.M. 7202 g 11.]
- GÖPPERT, H. R. *Ueber die Bernstein-Flora. Bericht über die Thätigkeit der naturwissenschaftlichen Section (der Schlesischen Gesellschaft für vaterländische Kultur) im Jahre 1853*. Breslau.
- GÖPPERT, H. R. *Über quantitative Verhältnisse des Bernsteins*. 1878.
- GRAFFENAUER, J. P. *Histoire naturelle, chimique et technique, du Succin ou Ambre jaune*. 1821.
- GRALATH, DANIEL. *Elektrische Bibliothek. Zweites Theil*, 537-539. Danzig, 1754.
- *GRIVEL, V. *Vernis des Anciens Luthiers*. Grenoble, 1866.
- GRUNOVIVS, SIMON (a Dominican Friar). See Hartmann.
- *GUIDOTTI, A. M. A. *Trattato di qualnivoglia sorte di Vernici*. Bologna, 1764.
- HADDOW, J. G. *Amber: All about It*. Liverpool, 1892.
- HAGEDORN. *Borkenkäfer des baltischen Bernsteins*. 1906.
- HAGEN. *Ueber Neuropteren der Bernsteinfauna*. Wien, 1854.
- HANNA, GENERAL W. *Brief History of Amber*. 1924.
- HARRIS, DR. RENDEL. *Treatise on Apollo*. *Journal of Hellenic Studies*, xlv., p. 229, 1925.
- HARTMANN, PHILIP JACOB. *Succini Prussici Physica et Civilis Historia*. Frankfort, 1677. (In this book is printed a tract, *Von den Börnstein und seines Ursprungs*, by Simon Grunovivus.)
- HAVARD, H. *Dictionnaire de l'ameublement*. Paris.
- HECKER, J. L. *Diss. de Succino, ejus characteribus, origine et usu*. 1794.
- HEDINGER, A. *Die Vorgeschichtlichen Bernsteinarte fakte und ihre Herkunft*. Strasburg, 1903.
- HELM, OTTO. *Chemische und physikalische Beschaffenheit des Bernsteins*. 1877.
- Ueber die mikroskopische Beschaffenheit und den Schwefelgehalt des Bernsteins. 1878.
- (Both above from E. Reichard's *Archiv der Pharmazie*. Halle.)

- HELM, OTTO. Mitteilungen über Bernstein. VIII. Ueber einige Einschlüsse im Bernstein.
- HELM, OTTO. Mitteilungen über Bernstein. XIII. Ueber die Insekten des Bernsteins. Danzig, 1886.
- HELM, OTTO. Beiträge zur Kenntniss der Insekten des Bernsteins. Danzig, 1895.
- HELM, OTTO. Mitteilungen über Bernstein. XII. Ueber die Herkunft des in den alten Königsgräbern von Mykenä gefundenen Bernsteins und über den Sauregehalt verschiedener fossiler Harze. Danzig.
- HELM, OTTO. Mitteilungen über Bernstein. X. Ueber blaugefärbten und fluorescierenden Bernstein.
- HELM, OTTO. Mitteilungen über Bernstein. XV. Ueber den Succinit und die ihm verwandten fossilen Harze. Danzig, 1891.
- HELM, OTTO. Mitteilungen über Bernstein. XVII. Ueber den Gedanit, Succinit und eine Abart des letzteren, den sogenannten mürben Bernstein. Danzig, 1895.
- HELM, OTTO. Thierische Einschlüsse im Succinit. Danzig, 1896.
- HELM, OTTO. Ueber die durch eingeschlossenes oder eingedrungenes Wasser und andere Flüssigkeiten im Succinit hervorgebrachten Erscheinungen. Danzig, 1898.
(The above are all from Schriften der Naturf. Ges. zu Danzig.)
- HELM, OTTO. See also Records of Geological Survey of India, xxxvi, 31-61, 1893.
- HERMANN, DANIEL. In Discursu Philosophici in succinis Rana reperta est et Lacerta. Cracow, 1580, and Riga, 1600.
- HERON-ALLEN, EDWARD, F.R.S. De Fidiculis Opusculum. London, 1883.
- HERON-ALLEN, EDWARD, F.R.S. Violin-Making. London, 1884.
- HEYER, J. C. H. Chemische Versuche mit Bernstein. Erfurt, 1787.
- HIRSCHBERG, J. Notiz über einen Fall von Vergiftung mit Bernsteinöl. Berliner klinische Wochenschrift, vi., 1869.
- HUMBOLT, BARON V. Cosmos. Bohn's edit. London, 1860.
- HUTH, ERNST. Sammlung naturwissenschaftlicher Vorträge. 1887.
(See Der Bernstein mit besonderer Berücksichtigung seiner Gewinnung in Ostpreussen, by R. Bonn.)
- India. Geological Survey, vol. xxxvi., 31-61, 1893. [B.M. 0710 8 d.]
- ISTRATTI, DR. C. Rumanita san Succinul din Romania. 1895.
- ISTRATTI, DR. C. De l'ozokérite (cire de Moldave) de Roumanie. 1897.
- JAMESON, ROBERT. A System of Mineralogy. 3 vols. Edinburgh, 1820.
- JENTZCH, A. Geognostische Durchforschung der Provinz Preussen. 1877.

- JENTZSCH, A. Bericht über die Verwaltung des geologischen Provinzialmuseums. 1887.
- JENTZSCH, A. Der vordiluviale Untergrund des nordostdeutschen Flachlandes. 1899.
- JENTZSCH, A. Der tiefere Untergrund Königsbergs. Berlin, 1900.
- JENTZSCH, A. Verbreitung der bernsteinführenden blauen Erde. Zeitschr. d. Deutsch. Geol., 1903.
- JOHN, J. F. Naturgeschichte des Succins, etc. Köln, 1816.
- JOHNSEN, A. Ueber den Kranz des Zipfelberges. Königsberg, 1907.
- JONAS, R. Bernsteinperlen aus einem mykenischen Kuppelgrabe und die Identifizierung ihrer Substanz mit Succinit. Schriften d. Physikal.-Oekonom. Gesellsch. zu Königsberg. Königsberg, 1909.
- KLEBS, RICHARD. Der Bernsteinschmuck der Steinzeit. Beiträge zu Naturkunde Preussens. 1882. [B.M. Ac 2337.]
- KLEBS, RICHARD. Gewinnung und Verarbeitung des Bernsteins. 1883.
- KLEBS, RICHARD. Die Handelssorten des Bernsteins. Jahrb. der Kgl. Preuss. Geol. Landesanst. u. Bergak. zu Berlin für 1882. Berlin, 1883.
- KLEBS, RICHARD. Gastropoden im Bernstein. Berlin, 1886.
- KLEBS, RICHARD. Ueber Farbe und Imitation des Bernsteins. Schriften der Physikal.-Oekonom. Ges. zu Königsberg. Königsberg, 1887.
- KLEBS, RICHARD. Aufstellung und Katalog des Bernsteinmuseums von Stantien und Becker. Königsberg. Hartungsche Buchdruckerei. 1889.
- KLEBS, RICHARD. Cedarit, ein neues bernsteinähnliches Harz Canadas und sein Vergleich mit anderen fossilen Harzen. Jahrb. der Kgl. Preuss. Geol. Landesanstalt und Bergak. für 1896. Berlin, 1897.
- KLEBS, RICHARD. Guide to Exhibit of Amber at St. Louis. 1904.
- KLEBS, RICHARD. Ueber Bernsteineinschlüsse im allgemeinen und die Coleopteren meiner Bernsteinsammlung. Schriften der Physikal.-Oekonom. Ges. Königsberg, 1910.
- KLEBS, RICHARD. Der Bernstein und seine Bedeutung für Ostpreussen. 1910.
- KLOBIUS, J. F. Ambræ Historia. Wittemberg, 1666.
- KNAPP, FRIEDRICH. Bernstein. 1898.
- KOENEN, A. v. Revision der Molluskenfauna des samländischen Tertiärs. Berlin, 1894.
- KÖHNE, B. VON. Various papers and articles. Berlin, 1882.
- KOLBE. Die Psociden des Bernsteins. 1883.
- KÖPPEN. Vorkommen des Bernsteins in Russland. 1893.
- KRAUSE, P. G. Ueber Diluvium, Tertiär. Kreide und Jura in der Heilsberger Tiefbohrung. Berlin, 1908.
- KUNZ, DR. G. F. On Gems. 1892. [B.M. 7105 h 5, and B.M. 7105 ee 14.]
- KUNZ, DR. G. F. Mineral Resources of the U.S.A. 1904.

- LAPPARENT, A. DE. Cours de minéralogie. 1890.
- LAUFER, B. Historical Jottings on Amber in Asia. See especially as to China, Russia, and Siberia.
- LIBERTY & Co. Amber as a Gem. 1929.
- LOEW, DR. H. Eine naturwissenschaftliche Abhandlung. 1850.
- LÜHE, M. Säugetierehaare im Bernstein. 1904.
- MACCALL, WILLIAM. Amber. Cope's Tobacco Plant. Liverpool, May, 1875, to January, 1881.
- MACCALL, WILLIAM, and HADDOW, J. G. Amber, and All about It. Cope's Smoke-Room Booklets, vii. 1892.
- McLINTOCK, DR. W. F. P. Guide to the Collection of Gemstones in the Museum of Practical Geology. London, 1923.
- *MAILAND, E. Découverte des Anciens Vernis Italiens. Paris, 1859 and 1874.
- MARCINOWSKI. Ueber die Lagerungsverhältnisse der bernsteinführenden Schicht am Samländischen Weststrande. 1876.
- MARTIN, TH. HENRY. Du Succin de ses noms divers et de la ses variétés suivant les anciens. Paris, 1860.
- MAURY, M. F. Physical Geography of the Sea. London, 1891.
- MAYER, K. Die Faunula des marinen Sandsteines von Kleinkuhren bei Königsberg. 1861.
- Mayerne MS. published in Beiträge zur Entwicklungsgeschichte der Maltechnik. Munich, 1901.
- MAYR. Die Ameisen des baltischen Bernsteins. 1868.
- MENGE, A. Ueber ein Rhipidoteron und einige andere im Bernstein eingeschlossene Tiere. N.D.
- MENGE, A. Ueber einen Scorpion und zwei Spinnen im Bernstein. 1860.
- MENGE, A. Lebenszeichen vorweltlicher im Bernstein eingeschlossener Thiere. 1856.
- MENGE, A. Beiträge zur Bernsteinflora. Danzig, 1858.
- MENGE, A. Einschlüsse in Bernstein. 1872.
- MEUNIER. Monographie des Cecidomyidæ, Sciaridæ, Mycetophilidæ et Chironomidæ. 1904.
- MEYER, A. B. Notiz über im Ostseebornstein eingeschlossene Vogelfedern. 1887.
- MEYER, ERICH. Ueber Störungen diluvialen Alters an der Samländischen Westküste. 1911.
- MEYER, K. Die Faunula des marinen Sandsteines von Kleinkuhren bei Königsberg. 1861.
- MÜLLENHOFF, KARL. Altertumskunde Deutsche, I, ii. 211, 224. Berlin, 1870.
- MUNSTER, SEBASTIAN. Kosmographia Universalis. 1554.
- NAVARRO, J. M. DE. Prehistoric Routes between Northern Europe and Italy defined by the Amber Trade. Geographical Journal, lxvi., No. 6, December, 1925.
- NICOL, JAMES. Manual of Mineralogy. Edinburgh, 1849.

- Norfolk Nat. Hist. Society Proceedings, vol. iii., 1884, and vol. iv., 1886. [B.M. R Ac 3028.]
- NORTLING, FRITZ. Die Fauna des samländischen Tertiärs. 1888.
- OLAUS, MAGNUS. Hist. de Gentibus Septentrionalibus. 1555.
- OLSHAUSEN, OTTO. Untersuchungen über baltischen Bernstein und andere fossile bernsteinähnliche Harze. 1904.
- OLSHAUSEN, OTTO. Der alte Bernsteinhandel der Einbrisenen Halbinsel und seine Beziehungen zu den Goldfunden. Berlin, 1890.
- *PAPPENHAUSER, A. VON. Lackierkunst.
- PELKA, OTTO. Bernstein. (Illus.) 1920.
- PELKA, OTTO. Die Meister der Bernsteinkunst. Nürnberg, 1917.
- PERRY, W. J. The Significance of the Search for Amber in Antiquity. 1918-19.
- PIERSON, WILLIAM. Elektron, oder über die Vorfahren, die Verwandtschaft, und den Namen der alten Preussen. Berlin, 1869.
- PLINY. Natural History.
- PLOUCQUET, G. G. De Vernicis Succinatæ vi eximia in sanandis Ambustionibus. 1783.
- *POMET, P. Histoire Générale des Drogues. Paris, 1694.
- POTONIÉ, H. Der Baltische Bernstein. 1891.
- RAPPOLT, K. H. De origine Succini in litore Sambienſi meditatio. 1737.
- RAUFER, G. M. Die Meerscham und Bernsteinwaaren-Fabrikation. Wien, 1876.
- *READE, C. Cremona Violins and Varnish. Gloucester, 1873.
- *REBS, A. Amleitung zum Lackieren von Streichinstrumenten. Leipzig, n.d. [1889].
- REDSLOB, D. G. M. Die Phönicischen Handelswege nach dem Norden, insbesondere nach dem Bernsteinlande. Leipzig, 1855.
- REID, CLEMENT. See Trans. Norfolk Nat. His Soc., iii., 601, 1884; iv., 247, 1886. Norwich.
- RITTER, E. VON. Bernsteinfunde aus Aquileja. Wien, 1889.
- ROMAIN, M. A. Manuel complet du Fabricant de Vernis etc. Paris, 1888.
- ROY, C. W. VAN. Ansichten über Entstehung und Vorkommen des Bernsteins. Danzig, 1840.
- RUDLER, F. W. Handbook to a Collection of the Minerals of the British Islands. London, 1905.
- RUELLIUS, JOHANNES. De Natura Stirpium. See pp. 125 and 530. Paris, 1536.
- RUNGE, WILHELM. Der Bernsteingräbereien im Samlande. Berlin, 1868.
- RUNGE, WILHELM. Der Bernstein in Ostpreussen. Berlin, 1868.
- RUTLEY, FRANK. Elements of Mineralogy. London, 1902.
- RUTLEY, FRANK. Revised by H. H. Read. 1923.
- RUTTER, OWEN. New Baltic States. 1925.

- SADOWSKI, J. N. VON. Die Handelsstrassen der Griechen und Römer durch das Flussgebiet der Oder, Weichsel, des Dniepr und Niemen an die Gestade des Baltischen Meeres. Aus dem Polnischen von Albin Kohn. Jena, 1877.
- SCHAUFUSS, DR. L. W. Preussens Bernstein-Käfer. Pselaphiden. Hague, 1890.
- SHELLWIEN, E. Geologische Bilder von der Samländischen Küste. Königsberg, 1905.
- SCHULTZ, DR. GUSTAV. Der Bernstein. Prometheus. No. 92, and later numbers. Berlin, 1891.
- SCHULZE, J. H. De Succino. 1734.
- SCHUMANN, J. Geologische Wanderungen durch Ostpreussen. 1869.
- SCHWEIGGER, A. F. Bemerkungen über den Bernstein. 1819.
- SCHWEIGGER, J. S. C. Ueber das Elektron der Alten und die praktische Bedeutung alterthümlicher Naturwissenschaft. Archiv der Mathematik und Physik. Griefswald. 1847.
- SCOTT, A. MACCULLUM. Beyond the Baltic. London, 1925.
- SENDEL, NATHANAEL. Historia Succinorum corpora aliena involventium a Nathanaele Sendelio. Lipsiæ, 1742. (This is a folio, richly illustrated.)
- SILVESTRI, F. Die Thysanuren des baltischen Bernsteins. Königsberg, 1912.
- SLAVIK, F. Anthophyllite-asbeste manganésifère de Chvaletice en Bohème. 1927.
- SMITH, G. F. HERBERT. Gem Stones. London, 1912.
- SMITH, H. CLIFFORD. Jewelry. London, 1908.
- SMITH, H. G. Minerals and the Microscope. London, 1919.
- SOKOLOV, N. Die untertären Ablagerungen Südrusslands. St. Petersburg, 1893.
- SORBY, H. C., and BUTLER, P. J. The Microscopical Structure of Amber. Monthly Microscopical Journal, November, 1876. London.
- SPENCER, L. J., F.R.S. Fluorescence of Willemite and Other Zinc Minerals in Ultra-Violet Rays. 1927.
- SPLIETH, DR. W. Die Bernsteinengewinnung an der Schleswig-Holsteinischen Küste. 1900.
- STEFANESCU, G. Cours elementar de geologie. Bucharest, 1890.
- STOCKAR DE NEUFORN, J. G. De succino in genere et specialim de succino fossili Wisholzensi. Leyden, 1760.
Also in Sandifort, Diss. I.; and in French epitomised in Journal de Médecine, Paris, t. xiv, 1761.
- STREETER, E. Precious Stones and Gems. London, 1898.
- TESDORPF, DR. W. Gewinnung, Verarbeitung und Handel des Bernsteins in Preussen. Jena, 1887.
- THILO, I. De Succino Borussorum prima nomina, descriptionem et materiam ejus exhibens. Lipsiæ, 1663.
- *TINGRY, P. F. Traité . . . sur l'art de faire et d'appliquer les Vernis. 1803.

- TOMASEK, J. N. Die Pfeifen-Industrie, oder die Fabrikation der Cigarrenspitzen und Pfeifenmundstücke aus Bernstein Weimar. 1878.
- TORNQUIST, DR. A. Der Baltische Bernstein. 1910.
- TORNQUIST, DR. A. Geologie von Ostpreussen. Berlin, 1910.
- TORNQUIST, DR. A. Die in der Kgl. Universitäts-Bernsteinsammlung eingeführte Konservierungsmethode für Bernstein-einschlüsse. Königsberg, 1910.
- TRUPIER-DEVAUX, A. M. Traité théorique et pratique sur l'Art de faire les Vernis. Paris, 1845.
- ULE, O. Der Bernstein. Zeitschrift für Natur und Heilkunde in Ungarn, Oedenburg, x, 1859.
- ULMER, GEORG. Die Trichopteren des baltischen Bernsteins. Leipzig, 1911.
- VON MIKISCH-BUCHBERG. Der Bernstein. Vortrag gehalten in der Altertumsgesellschaft in Insterburg. 1882.
- VON OLFERS. Flügellose Arthropoden des Bernsteins in ihren Beziehungen zur Deszendenztheorie. Königsberg, 1905.
- VON OLFERS. Die Urinsekten im Bernstein. Königsberg, 1907.
- WALDMANN, F. Der Bernstein in Altertum. 1883.
- WALLERAUT. Traité de minéralogie. 1890.
- WATERS, LE SIEUR. L'Art du Peintre, Doreur, Vernisseur etc. Liège, 1774.
- WICHENDORFF, H. HESS VON. Ein neues Vorkommen von Phosphorit führender unteroligocäner Bernsteinformation bei Steinitten im Samlande und seine Natur als Diluvialscholle. 1911.
- WIGAND, JOHANN. Vera Historia de Succino Borussico, per Johannem Wigandum (written in 1584). Jenæ, 1590.
- WODISKA, JULIUS. A Book of Precious Stones. New York, 1909.
- WOODWARK, T. H. The Rise and Fall of the Whitby Jet Trade. Whitby, 1922.
- WUTZKE, J. C. Bemerkungen über die Gewässer, die Ostseeküste und die Beschaffenheit des Bodens im Königreich Preussen. 1829.
- YU HUAN. *Wei lio* in Chinese, circa A.D. 260.
- ZADDACH, E. G. Ueber die Bernstein- und Braunkohlenlager des Samlands. 1860.
- ZADDACH, E. G. Das Tertiärgebirge des Samlands. 1868.
- *ZAHN, J. Oculus artificialis. Nuremberg, 1685 and 1707.
- ZIEGLER, A. Die Reise des Pytheas nach Thule (Shetland-Inseln). Dresden, 1861.
- ZINCKEN. Die geologischen Horizonte der Fossilen Kohlen. 1883.

APPENDIX

IN my own collection I possess—

- Amber from the Blue Earth of Palmnicken. (See p. 20.)
- Amber from the Diluvium of East Prussia, with a red belt near the heart of it. (See p. 20.)
- Sea-worn Amber out of the Baltic Sea. (See p. 19.)
- Amber encrusted with pyrites, owing its origin to organic remains. (See p. 25.)
- Amber exuded in regular drop form. (See p. 22.)
- A large amber bead or drop. (See p. 22.)
- An amber bead that has been pressed flat. (See p. 22.)
- A conglomerate of amber beads. (See p. 22.)
- Amber exuded in knotted, roundish form.
- Flat, or plate-shaped Amber. (See p. 22.)
- Amber showing the impression made upon it by the wood of the tree. (See p. 135.)
- Flat, knotted piece of Amber, upon which the curvature of the ground can be recognised. (See p. 24.)
- Long stalactites of Amber enclosed in Amber of a subsequent flow, and also containing insects. (See p. 23.)
- Amber that has hung free and formed long scaly stalactites. (See p. 23.)
- Scaly Amber.
- Bony Amber.
- Variegated bony Amber, the watery contents of the cells mixed with clear resin. (See p. 21.)
- Bastard Amber.
- Dark Bastard Amber.
- Cloudy Bastard Amber.
- Commercial so-called Blue Amber, bright and opaque. (See p. 23.)
- So-called Blue Amber. (See p. 23.)
- Greenish Amber, partly clear and partly dull.
- Light oily, cloudy Amber. (See p. 24.)
- Dark oily, cloudy Amber.
- An insect enclosed in Amber enveloped in dull, emulsion-like sheet. (See p. 134.)
- Ice-coloured clear Amber, bleached by light, found, not in Blue soil, but in Miocene diluvium. (See p. 24.)

- Clear Falernian-coloured Amber of Brunswick. (See p. 39.)
- Clear golden Amber. (See p. 95.)
- Scaly Amber with bony fluxes laid over one another.
(See p. 135.)
- Clear Amber, discoloured by wood dust. (See p. 24.)
- Dull Amber, discoloured by wood dust. (See p. 24.)
- Bony Amber, discoloured by wood dust. (See p. 24.)
- Scale Amber with encrustations of pyrites. (See p. 21.)
- Frothy Amber, encrusted with pyrites. (See p. 21.)
- Crude Succinic Acid. (See p. 91.)
- Purified Succinic Acid. (See p. 91.)
- Pressed clear Amber. (See p. 236.)
- Pressed dull Amber. (See p. 236.)
- Example of clear Gedanite or fossil resin, known as
Brittle Amber. (See p. 227.)
- Example of dull Gedanite. (See p. 227.)
- Example of Beckerite, non-fusible fossil resin. (See p. 228.)
- Example of Stantinite, black fossil resin. (See p. 229.)
- Teeth or vertebræ of sharks out of the Blue Earth.
- Very many examples of Simitite, both in the rough and
polished, including many blue pieces and pieces that
are opalescent, ruby, emerald, and brown. (See
p. 208.)
- Specimen of Amber from Santander. (See p. 189.)
- Specimen of Amber from Syria. (See p. 58.)
- Specimens of Copalite and Valchorite. (See p. 231.)
- Specimens of Hachettite. (See p. 236.)
- Specimens of Root of Amber (so called). (See p. 116.)
- Several specimens of Siamese Amber (so-called
"luminous"). (See p. 190.)
- Many specimens of Amber from Esthonia. (See p. 97.)
- Many specimens of Amber from Lithuania. (See p. 97.)
- Many specimens of Amber from Latvia. (See p. 97.)
- Many specimens of Amber from Northern Germany, both
in the rough and polished.
- Specimens found in Klaipoda. (See p. 97.)
- Specimens found in Denmark. (See p. 99.)
- Specimens found in England. (See p. 195.)
- Osseous Amber from Zanzibar. (See p. 190.)
- Osseous Amber from Omdurman. (See p. 95.)
- Very many choice examples of Rumanite in various
colourings, some exceptionally rare. (See p. 210.)

- Several specimens of Burmite. (See p. 218.)
 Several specimens of Ambergris. (See p. 221.)
 Specimen of Retinite. (See p. 186.)
 A rare example of green Amber from Sicily. (See p. 208.)
 Several examples of Amber from Behring Sea and China.
 (See p. 184.)

I have also in my own collection examples of all the following:

- Fossil wood of *Pinites succinifer*, impregnated and infiltrated with Amber. (See p. 137.)
 Bark of the amber tree. (See p. 134.)
 Splint of wood enclosed in Amber. (See p. 137.)
 Fossil wood from tree ant-bored. (See p. 137.)
 Jet-like coal or gagate, from the Blue Earth of Palmnicken.
 (See p. 253.)
 Specimen of a lichen, *Lichenes hepaticæ* Jungermania.
 (See p. 139.)
 Specimen of scale-like leaves from a plant of the Pine order. (See p. 135.)
 Specimen of pine-needles from a similar tree. (See p. 135.)
 Specimen of a seed-vessel of a cedar tree or Thuja tree.
 (See p. 135.)
 A portion of a Widdringtonia. (See p. 139.)
 Hair from an oak, *Quercites Meyerianus*. (See p. 139.)
 Pollen-bearing anthers or lobes.
 Leaf base. (See p. 136.)
 Oak blossoms. (See p. 136.)
 Scale Amber, showing numerous insects. (See p. 24.)
 Examples of Diptera. (See p. 145.)
 Examples of Nematocera. (See p. 145.)
 Example of Brachytera (or Flies). (See p. 145.)
 Feelers of Chironomidæ (or Midges). (See p. 145.)
 Examples of Sciara (or Gall-flies). (See p. 145.)
 Examples of Mycetophagidæ. (See p. 143.)
 Examples of Tipulidæ (or Daddy-longlegs). (See p. 145.)
 Example of Dolichopidæ (or Metallic Flies). (See p. 145.)
 Example of Coleoptera (or Beetles). (See p. 143.)
 Example of Elateridæ (or Skippers). (See p. 144.)
 Example of Cyphonidæ. (See p. 144.)
 Example of Hymenoptera. (See p. 143.)
 Example of Formicidæ (or Ants). (See p. 143.)

- Examples of Phryganidæ (or Caddis). (See p. 144.)
 Example of Blattariæ (or Cockroaches). (See p. 144.)
 Example of the Larvæ of the same. (See p. 144.)
 Example of Gryllidæ (or Grasshoppers). (See p. 144.)
 Example of Pediculinæ (or Lice). (See p. 145.)
 Example of Termitidæ (or Termites). (See p. 145.)
 Example of Microlepidoptera. (See p. 145.)
 Example of Lepisma (Bristletail or Springtail). (See p. 144.)
 Example of Podura (or Water Springtail). (See p. 144.)
 Example of Homoptera (or Aphides). (See p. 145.)
 Larvæ of the Cicada. (See p. 145.)
 Example of Hemiptera (or Sucking Insects). (See p. 145.)
 Example of Aphides. (See p. 145.)
 Example of Winged Aphides. (See p. 145.)
 Various examples of Spiders. (See p. 146.)
 Example of Mites. (See p. 146.)
 Larvæ of Anthropodæ.
 An entire example of one of the Curculionidæ almost exactly resembling the diamond beetle of South America, *Entimus imperialis*, and at present a weevil unidentified. (See p. 144.)

OTHER RARE MINERAL HYDROCARBONS

INASMUCH as Amber is only one of the hydrocarbons in the group of non-metallic minerals, and as its companions Copalite, Gedanite, Hachettite, Valchorite have already been alluded to, it may be fitting in an appendix to mention, however briefly, certain other substances closely allied to Amber, and forming part of the same group.

To Coal one need not give much attention beyond a statement that it, like Amber, is the fossil remains of decayed vegetation in many forms—plants, trees, rushes, etc.—now forming a stone-like material.

Peat, again, is a mass of vegetable substance, chiefly mosses and bog plants, compressed into a compact homogeneous substance. Lignite or Brown Coal may perhaps represent a further stage beyond that of Peat in the way in which a vegetable deposit becomes a hard material. Of Lignite a remarkable form is known as Jet, but about its origin there are two distinct theories, one arguing that it is wood “in a high state of bituminisation” and supporting

its accuracy by the strong bituminous smell it throws off when burned, the other saying that its ligneous origin can neither be supported by chemical analysis nor by microscopical investigation, and insisting that it has nothing to do with wood at all, and is only an "aggregation of bituminous matter."

Jet has been known from very remote times. Pliny says it was obtained from Gagás, in Asia Minor, and its German name *Gagat* is derived from that place.

"Jet" in English is from the Old French word *jaiet*, itself probably a corruption of *Gagat*. The Venerable Bede alludes to its presence in Britain. The Abbey rolls of Whitby of 1394 speak of it and of the jet-workers or jeators. Camden in the sixteenth century and Drayton in the seventeenth both refer at length to Jet, while in 1730 a Portuguese merchant who came to England, Don Manoel Gonzales, gives many references to the mining of Jet and to its manufacture into ornaments.¹

It was not, however, till the first half of the nineteenth century that the trade began to be of commercial importance. The chief seat of the Jet industry is at Whitby, in Yorkshire, although Jet has always been found and worked in Spain, and, in fact, in the neighbourhood of Santiago de Compostella there have been, from the fifteenth century, Guilds of Azabacheros making amulets, figures, clenched hands, beads, images, rosaries, medallions, necklaces, and crucifixes to be purchased by the pilgrims to that famous shrine, and all known to the Spanish historians as Azabaches Compostelanos.

Of these objects, the ones representing St. James, the Virgin, and the clenched hand, were the most popular, and the industry produced some able sculptors and jet-workers, whose names have been held in high repute.

The industry continued in existence down to *circa* 1800, and then died out. Collectors are eager to acquire ancient examples of this Spanish jet work (I brought back some myself from Santiago), and an important work on these jet carvings was written by Señor C. T. de Osma.²

Asphaltum is another hydrocarbon composed of organic matter. Its chief source is the celebrated pitch lake of

¹ See Mem. Geol. Survey, 1888; and "The Geology of Yorkshire," by Tate and Blake.

² "Catalogo de Azabaches." Madrid, 1916. Limited edition.

Trinidad, but it can be mined in various places in England and in many parts of Europe.

Elaterite is a soft and flexible form of bitumen something like india-rubber, translucent at the edges, as a rule black, reddish or yellowish-brown in colour, and comes from the veins of lead ore in the mountain limestone of Derbyshire, also being found in France near to Nantes in carboniferous sandstone, and in Connecticut in a bituminous limestone.

Ozokerite somewhat resembles wax, and is generally of a dark yellow or brownish colour. It is found in Galicia and also in Moldavia. It is amorphous, but sometimes fibrous, semi-translucent, and has a pleasant aromatic odour. It is soluble in oil of turpentine. It is purified to form ceresine, which is used for candles.

Fichtelite is a white pearly substance easily soluble in ether, and obtained from a peat moss in Bavaria. Formula C_4H_3 .

Hartite is, again, a white waxy-looking substance, soluble in ether, but not flexible. It comes from the cavities of bituminous wood in the lignite of Austria, especially from Gloggnitz. Its compound is C_6H_5 .

Hartine is very similar and comes from the same place, but it is not soluble in ether, and hardly in alcohol. Its formula is $C_{20}H_{34}O_2$.

Bogbutter from Ireland and Guyaquillite from South America are similar pale yellow materials, soluble in alcohol, and having a curious bitter taste. Their compound is $C_{20}H_{26}O_3$.

Four similar materials are Scheererite, Branchite, Tekoretine, and Phylloretine. All have been found in fossil wood in Denmark and in Italy. They readily dissolve in alcohol, are greasy to the touch, have an aromatic odour, and are in colour greenish or yellowish-white, really resembling Amber in appearance.

Koulite is very similar, and comes from bituminous fossil wood near St. Gall, in Switzerland. It is white and crystalline.

Walchovite and Middletonite are both found in coal, the former in brown coal, the latter in the main coal seam at Middleton, near to Leeds. The former is yellow and brown, and very inflammable; the latter, reddish-brown, dissolves with difficulty in either alcohol, ether, or turpentine, but is entirely soluble in sulphuric acid: it burns like resin on hot coal.

The rarest of all the hydrocarbons is, I believe, Whewellite, which is really a hydrated oxalate of lime. The crystals are very small, and are found associated with crystallised calcite in Saxony and Bohemia, but not more than about half a dozen specimens have been discovered. It is very slightly fluorescent.

Honeystone is a yellow waxy substance, occasionally found in brown coal. It gives off no odour, and is only soluble in potash or nitric acid; and Oxalite, another brown coal substance found in Czecho-Slovakia, is easily soluble in acids, but of its chemical history very little is yet known.

All these have amber characteristics in different ways.

To gum copal allusion has already been made.

After Copal, the gum that most nearly resembles Amber is the Kauri Gum of New Zealand (*Agathis australis*), and this in colour, in electrical quality (not always consistent), in a slight fluorescence, and in its surface, does offer an even closer resemblance to the fossil gum. It has been known since 1769, when Cook alludes to it in his journal, but its commercial value did not start till about 1845. The great bulk of it comes from vast Kauri peat swamps, and it is largely dug up by the Maoris. There are varieties of it, graded according, as a rule, to the depth at which it is found and its colour, white being worth 500s., deep yellow 410s., and other varieties 336s. and 260s. It can also be bled from living trees, but the finest is swamp found. An oil can be extracted from it. In specific gravity (1.05) and in composition it differs from Amber, and it is much softer than Amber (melting at 360° to 450° F.), but the main interest of it to the Amber student is that it is in process of change, as Amber must have been at a remote age, and that, given a million years, Kauri gum may eventually approximate quite closely to Amber, although at present there is no trace in it of the characteristic succinic acid.

It is perhaps unnecessary, but it may be of some interest to the student if other gums of similar colour or characteristics are mentioned in this chapter. Some are found fossil or fossilising deep down in the soil, as, for example, two varieties of the Malay States Dammar, and the Chakazi or Milk Copal of the Congo.

Others contain an acid closely resembling succinic, as, for example, two found in British Guiana: Locust Gum,

both yellow and clouded—*Hymoncea consbaril*—and the curious black gum called Buck Gum.

Others are the same colour as Amber, and insects have been found in them, as the Manilla Copal, Pontinac Copal from Zanzibar, and a similar gum from Dongola, the latter, in fact, being so much like Amber in appearance that even clever judges of the real material have been deceived.

Then there are the aromatic gums, such as Calbanum; Gum Benjamin from Sumatra and Siam, Thus and Myrrh. These all possess, as does Amber, a characteristic odour, and in melting-point approximate to it.

A red gum that has been found as deep in colour as Burmite is that from *Calamus draco*, commonly known as Dragon's Blood, and pieces of this have been found fossilised clear and even brilliant. The small ruby blobs of it are invaluable for varnish to the violin-makers.

Of all parts of the world, however, in which gums can be found either to be obtained bled from the trees or found buried in the soil, the most prolific is Travancore. There we obtain a long series of such gums:

- Terminalia tomentosa,
- Phyllanthus embleca,
- Ailanthus malabarica,
- Shorea tatura,
- Bemba malabaricum (Cotton Tree),
- Sterculia revers,
- Canarium strictum (Black dammar or Tinnevelly resin)
- Hopea parviflora (Cinghalese pale resin),
- Buchannia latifolia,
- Pterocarpus marsupium,
- Avæcardium occidentale,
- Butea frondosa, and
- Myristica attencasta.

All these to a student of fossil gums (and I have specimens of all before me) are of interest from a chemical and also from a commercial point of view. In the latter respect I think that they deserve fuller consideration and investigation, as they can all be obtained in fairly large quantities, and should have a bright future before them when once they are known to gum and varnish merchants, and their qualities for such purposes appreciated and understood.

INDEX

- ABALUS, Isle of, 35
 Abyssinia, 56
 Achelen, Heinrich v., 117
 Achilles, 85
 Acland, Capt. J., 84
 Adriatic Sea, 37, 62
 Æschylus, 35
 Æstiers, the, 64
 Africa, 22
 Agricola, Georg, 34, 91
 Aix-la-Chapelle, Treaty of, 174
 Ajasson, —, 38 *n.*
 Aldbourne, 72
 Aldeburgh, 195, 198
 Alexander, 59
 Alexander III., Czar, 169
 Alexis, Czar, 163, 164
 Allingite, 229
 Almashite, 216
 Alps, the, 38, 77
 Alunis, Monastery of, 211
 Amarna tablets, the, 57
 Amber, classical allusions to, 26 *sqq.*
 derivation of the word, 49
 Sicilian, *see* Simetite
 True, or Succinite, home of, 96 *sqq.*
 Varieties of, classification and names of, 20 *sqq.*, 31, 37, 39, 49 *sqq.*, 90-1, 94-5, 115, 116, 179, 182-3, 190, 208, 214; summary of names, 59
 Amber, city, 25 *n.*
 Amber Corporations, the, 100, 102 *sqq.*
 Amber Divers, 113, 129
 Amber Fishermen, 110-11, 113
 Amber Forests, the, 16 *sqq.*, 133 *sqq.*, 196
 Amber-master, the, 120
 Amber Mines, 111 *sqq.*
 Amber Reef, the, 97, 111
 Amber Riders, 113
 Amber Routes, the, 42, 58, 60 *sqq.*, 73, 211
 Amber Trading Company, the, 185
 Amber Varnish, 92, 231 *sqq.*
 "Amber Witch, The" (Meinhold), 132
 Ambergris, 59, 110, 220 *sqq.*
 Ambrite, 229
 Ambroid, 236 *sqq.*
 Ambrosian Library, Milan, 68
 Amerswald, —, von, 124
 Ancona, 66, 75
 Angier, Dr., 226
 Angola, 192
 Angoulême, Duchess of, 154
 Duke of, 153, 154
 Anholt, Vincent, 117
 Anne of Brittany, 152
 Anthropology, Amber in, 70 *sqq.*
 Antinous, 28
 Antrim, 77
 Antwerp, 117
 Aphrodite, 23
 Apollo, 60
 Appendix, 249
 Aquileia, 84
 Archelaus, King, 38
 Argonauts, the, 65, 66
 Argor, 76, 77
 Aristotle, 30, 59
 Armento di Basilicata, 84, 85
 Arnold, Sir T. W., 68
 Art, Amber in, 26 *sqq.*, 39, 69, 70 *sqq.*, 151 *sqq.*

- Arundel Castle, 154
 Asarubas, 36
 Ashenfarl, —, 192
 Askme, William, 44
 Assyria, 42
 Athene, 85
 Augsburg, 100
 Augustus, 152
 Augustus Franks Collection,
 the, 86
 Augustus the Strong, King, 161
 Aurensan, Grotto of, 70
 Austeravia Island, 37
 Austria, 70, 74, 230
 Avicenna, 50
- BABYLONIA, 57
 Bacon, Miss, 65, 66
 Bacon, Sir Francis, 42
 Baikal, Lake, 184
 Bakelite, 238
 Balm of Mecca, 230
 Baltic Sea, Coasts' and Prov-
 inces (*q.v. also under*
Names), 16, 19, 26, 34,
 43, 49, 50 *n.*, 58, 62,
 66, 67, 73, 76, 80, 96,
 97, 98, 109, 132, 184,
 198, 211
 Baret, John, 43, 44
 Barlowe, Archdeacon William, 51
 Barrett, Anne, 44
 Barrett, Francis, 204
 Barrows and other Burial-
 places, 71 *sqq.*, 152, 198
 Bartholine, Thomas, 110
 Bauer, Prof. Dr., 91, 95, 218
 Bavaria, Lower, 74
 Beale & Félix Laurent, Messrs.,
 Canton, 178
 Beazley, —, 68
 Beck, Horace, 70, 73 *sqq.*, 89
 Becker Collection, the, 141
 Becker, Moritz, 114, 115
 Beckerite, 218, 228-9
 Behring Sea, 95, 184, 217
 Belgard, 99
 Beloncia, 189
 Berendt, Dr. G., 20, 96, 133,
 138, 183
- Bergères les Vertus, 77
 Berlin, 156
 Academy, 133
 Exhibition, 1899, 152
 Museums, 70, 151, 175, 197
 Bernstein Industry, the, 112
 Berry, Duc de, 152
 Berzelius, —, 89
 Bible, the, Authorized Version,
 52
 Bibliography, 239
 Birdlip, 79
 Black, Dr., 17
 Blackwell, 45
 Blue Earth, the, 18, 19, 20, 112,
 114, 115, 126, 127, 196,
 212, 229
 Bode, Dr., 152
 Bohemia, 74
 Bolanga, Count of, 153
 Bologna, 231
 Borislaff, 193
 Borken, George, 117
 Bornheim, 190
 Boshovice, 231
 Bosnia, 62, 71
 Boyle, R., 51
 Braganza, Duchess of, 224
 Brandenburg, Margraves of,
 119, 159, 160
 Brandenburg, Margravine of,
 160
 Brassavolus, 34
 Braun, —, 138
 Brazil, 185, 192
 Brest Litovsk, 193
 Brevarius, 68
 Brighton Museum, the Amber
 Cup in, 82
 Britain (*see also* England), 35,
 60 *n.*, 83
 British Association, the, 195,
 227
 British Museum, the, 55, 71,
 72, 76, 84, 86, 152,
 157, 177
 Brno, 61
 Bronze Age, the, 61, 62 & *n.*,
 72, 73, 83
 Browne, Sir Thomas, 34, 43, 189

- Bruges Corporation, 100, 102, 108
 Brüsterort, 96, 114, 129
 Brydone, Patrick, 209
 Bucharest, 215, 217
 Budge, Sir E. A. W., 206
 Buffum, W. A., 209
 Bukovina, 215
 Burgundy, Dukes of, 100, 102
 Burlington Fine Arts Club, 162
 Burmah, 184, 218
 Burmite, 81, 95, 180, 182, 189, 190, 218 *sqq.*
 Burnt Almashite, 216, 217
 Bursey, M. W., 138, 185
 Burwood, Mrs., 201-2
 Bury St. Edmunds, 43, 44
 Butow, 99
 Buzan, 211
 Buzău, river, 211, 217, 218
 Byron, Lord, 45
- CALLISTRATUS, 203
 Cambridge greensand, 193-4
 Camillus Leonardus, 204
 Canadian Ambers, 186 *sqq.*
 Canusium, 84
 Cappadocia, 38
 Cardan, 34
 Carlyle, Thomas, 45
 Carmel, Mt., 57
 Carniola, 61
 Carnochan, Dr., 186
 Carnuntum, 38, 67
 Caspary, R., 138
 Cassel Museum, 152, 176
 Cassiterides, the, 30
 Castellani Collection, the, 84
 Catania, 95, 208-9, 214, 217
 Cedar Lake, 186
 Cedarite, 186
 Cephisis, Lake, 36
 Champaubert, 77
 Charles, King of Roumania, 214
 Charles II., 224
 Charles V. of France, 152
 Charlotte of Savoy, 152
 Charvais, 77
 Château de la Tour, Eymontiers, 154
- Chemawinité, 186
 Cherson Province, 193
 China, 116, 173 *sqq.*, 184, 203, 205, 220
 Chindwin, river, 219
 Christie, Miss, of Cowden Castle, 155
 Christina, Queen, 157
 Church, Prof., 192
 Clandown, 82, 83
 Classical allusions to Amber, 26 *sqq.*
 Clements, Dr., 207
 Cleopatra, 33
 Clessin, 146, 147
 Clymene of Lybia, 40, 41
 Coalmont Amber, 186 *sqq.*
 Cochín-China, 184
 Collecting of Amber, methods of, 110 *sqq.*
 Collin, Dr., 197
 Colombia, 81
 Colouring or Treating of Amber, 39, 181 *sqq.*, 238
 Coltii, river, 211
 Congo, the, 150
 Constantinople, 65, 130
 Conwentz, H., 135, 136, 137, 138, 195 *sqq.*, 202, 227 *sqq.*
 Cooke, Dr., 58 *n.*
 Copal, 190 *sqq.*
 Copalite, 230-1
 Copper, 56
 Coptic language, 56
 Corbul, river, 211
 Cornell University, 67
 Coserow, 132
 Courland, 96, 97
 Cox, James, 177-8
 Cox & Beale, Messrs., Canton, 178
 Craiova, 211
 Cremona Violins and Amber Varnish, 234-5
 Crete, 86
 Crime, the, 78
 Cromer, 195, 196, 198
 Culpepper, —, 203
 "Cuma," 223

- Cumæ, 75
 Cunnington, E., 83
 Curwen, Dr. E., 82, 83
 Cyprus, 86

 DAHMS, Dr. Paul, 89, 210, 212
 Dahn, Dr. Felix, 112
 Dalmatia, 50
 Damascus, 79
 Dana, —, 186
 Danube, the, 61, 67, 211
 Danzig and its Museums, 24,
 30, 34, 61, 96, 97, 98,
 99, 106, 117, 119, 130,
 136, 142, 175, 176, 228
 Danzig Corporation, 104, 105
 sqq., 165, 166, 170
 Darmstadt, 160, 175
 David, King, 68
 Dawkins, Prof. Boyd, 16
 Delitsch, F., 52
 Demerara, 192
 Demonstratus, 35
 Denman, Mr. Justice, 192
 Denmark, 73, 74, 79, 95
 Derham, W., 110
 Detken, —, 84
 Dieskau, 61, 74
 Dimbovita, river, 211
 Diodorus, 210
 Dioscorides, 34, 59
 Dirschkeim, 129
 Dnieper, river, 62, 193
 Dobbermann, J., 176
 Dogger Bank, the, 202
 Döhring, Christian Benjamin,
 109
 Christoph, 109
 Domitian, 32
 Dongola gum, 95
 Dorchester Museum, the Amber
 Cup in, 83, 82
 Douglas, Karl, 122, 124
 Dragendorf, —, 21
 Dragon's Blood, 235
 Dramburg, 99
 Draping, —, 88
 Dresden, Green Vaults in,
 159 *sqq.*, 172, 176
 Du Fay, —, 52

 "Dumb-bell toggles," 72
 Dutch coast, the, 190

 EARINUS, 32
Eau de luce, 92, 205
 Eberswalde, 196
 Egypt and the Egyptians,
 50 & *n.*, 64, 71, 78
 Elbing Corporation, 104, 107-8
 Electron, 26, 27, 29, 50 *sqq.*,
 207
 Electrum, 29, 35, 51, 59, 76
 Elizabeth, Empress, 167, 169
 Elton, Prof., 49
 Elworthy, Dr., 186
 England, 77, 79, 195
 English Amber, 196 *sqq.*
 English Palace, near St. Peters-
 burg, 153
 Enkomi, 86
 Eridanus, river, 30, 54 *n.*
 Esthonia, 50, 95, 96
 Etna, Mt., 208, 209
 Etruria and the Etruscans, 35,
 66, 67, 75, 84 *sqq.*
 Euripides, 35
 Europe, 16, 74, 203
 Eurymachus, 28
 Eusebius, 68
 Evans, Dr. Joan, 44
 Evans, Sir Arthur, 83
 Evans, Sir John, 83
 Ezekiel, the Prophet, 42,
 52 *sqq.*, 59

 FAKED Amber, 188-9, 192-3
 Falernian Amber, 39
 Farnese, Cardinal, 153
 Farnese, Cardinal Alessandro,
 174
 Farnese, Cardinal Ranuccio,
 174
 Farnese Collection, the, 174
 Faversham, 79
 Felixstowe, 195
 Ferguson, James, 177
 Finland, 50, 150, 168, 195
 Fischhausen, 129
 Flock, Kompagnon, 117
 Florence, 170

- Fluorescence, 93 *sqq.*, 190, 219
 Fluorspar, 93
 Foelkersam, Baron A. von, 163,
 164, 167, 170
 Ford, A. S., 196, 201, 202
 Fox, Mrs. F., 197
 France, 65, 70, 75, 98, 112, 150
 Frankfort, Grand Duke of, 122
 Frasinul, river, 211
 Frederick II., 105, 167
 Frederick III., 165
 Frederick IV. of Denmark, 166
 Frederick William I., 161, 167
 Fried, Prof. J. N., 91
 Friede, Heinrich William, 170
 Klemens, 170
 Friedrich William II., 105
 Friedrich William III., 122,
 124, 125
 Friesland, 49
 Frische Haff, the, 97
 Frische Nehrung, the, 96-7, 210

 GABOON, 192
 Gæa, 40
 Galicia, 215
 Galippe, Dr. V., and survival
 of micro-organisms in
 Amber, 148 *sqq.*
 Garnier Collection, the, 158
 Gedanite, 94, 95, 179, 227-8
 Genthe, 20
 Germanicus Cæsar, 37
 Germany (Germania), 16, 35
 sqq., 71, 73, 95, 207
 Ghazali, 68
 Giarretta, river, 209
 Gilbert, William, 51
 Glacial Epoch, the, 18-19
 Glæsaria Island, 37
 Glæsum or Glesum, 37, 49
 Glauconite, 115
 Gles, Glese, Gless, 31, 49, 59
 Glessite, 229
 Glesum, 49, 229
 Goethe, J. W. von, 209
 Golden Fleece, the, 66
 Golden Rose, the, 224
 Göppert, Prof. H. R., 17, 20, 21,
 133, 134, 135, 138

 Gotha Museum, 175, 176
 Gothe, Eosander, 166
 Gouldfar, Miss, 155
 Granden, Andreas, 117
 Gray, Thomas, 204
 Great Plague, the, 226
 Greece, 62, 78
 Greenland, 184, 185
 Griffin, B., 84
 Grigarescu, —, 215
 Guatavita, Lake, 80
 Gubiasco, 77
 Guiana, 222
 Guildown, 80
 Guilds of Amber-turners, 100,
 102 *sqq.*
 Guinea Coast, 188
 Gulf Stream, the, 18
 Guricke, Otto von, 51-2
 Gustavus II., 157

 HACHETTITE, 73, 231
 Hallé, 74
 Hallstadt, 74, 77
 Hamburg Museum, 176
 Hanseatic League, the, 100, 102
 Happsburgh, 195
 Harrington, Dr. Bernard, 186
 Harris, Dr. Rendel, 60, 61
 Harris Whaling and Fishing
 Co. Ltd., 225
 Hartmann, Philip James, 109
 sqq., 113
 Hasse, Dr. J. G., 26
 Hassleben, 151
 Havilah, the Land of, 26
 Hela sandbank, 97
 Helbig, —, 84 & *n.*
 Heliades, the, 40, 41, 45
 Helm, Prof. Dr. Otto, 21, 22,
 88, 89, 90 *sqq.*, 146,
 194, 228
 Henry III. of France, 224
 Hercules, 29
 Hermitage Museum, Leningrad,
 71, 76, 176
 Herodotus, 26, 30, 58 *n.*, 59
 Heron-Allen, E., 79-80, 90,
 234, 235
 Herpes, 77

- Hesiod, 29
 Hesse-Darmstadt, Grand Duke
 of, 160
 Hiiu Maa, 98
 Hippocrates, 203
 Hiram, King, 66
 Hoare, Sir R. Colt, 72
 Hohenzollerns, the, 104
 Holyrood, 153
 Homer, 26 *sqq.*, 52-3, 161
 Honiton, 82
 Hooke, Dr. Robert, 110
 Hove, 82
 Hukawng Hills, 220
 Hukong, river, 219
 Huloet, —, 43
- ILBERT, C. A., 158
 Iliad, the, 29
 India, 38
 Ipswich, 195, 227
 Ireland, 73-4, 77, 80
 Iron Age, 61
 Early, 72
 Islam, 65
 Istratti, Dr., 210, 215
 Italy, 67, 75, 209, 231
 Ixworth, 79
- JADE-LIKE Amber, 182-3
 Jaipur, 25 *n.*
 James Cox & Sons, Messrs.,
 Canton, 178
 Japan, 184
 Jaski, Israel, 107
 Paul, and the Jaski family,
 105 *sqq.*, 117, 118, 119
 Jenkins, Prof. Claude, 68
 Jesus Christ, 56
 Jet, 34, 51, 110, 179, 189, 199
 Jewellery, Amber as, 27 *sqq.*,
 70 *sqq.*
 Jonson, Ben, 42
 Judenus, 70
 Julianus, 38
 Jutland, 61, 71, 98, 99
 Juvenal, 32
- KANISS Island, 184
 Keith, Sir Arthur, 15 *n.*
- Kelernes, 71
 Keller, Count von, 122
 Kelleythorpe, 72
 Kertch, 78
 Kiel, 147
 Kiev, 71, 193
 King, C. W., 206
 Klaipeda (Memel), 97, 98, 126,
 211
 Klebs, Dr. R., 98, 102, 137, 141,
 142, 147, 228
 Kliwa Sandstone, 212, 216
 Kolberg Corporation, 103-4
 Königsberg and its Museum, 97,
 98, 100, 115, 117, 130,
 139, 141, 142, 157, 158,
 180, 197
 Königsberg Corporation, 104-5,
 107, 108-9, 120, 121
 sqq., 170
 Köslin Corporation, 103-4
 Kostelik, Caves of, 70
 Kozmnisky, —, 54
 Kramer, George, 117
 Kranz, 97, 124, 125
 Kranzite, 229
 Kremlin, the, 163-4
 Krems, 70
 Kurische Haff, 97, 126
 Kurische Nehrung, 97, 120
- LABHARD, —, 176
 Labuan, 230
 Lacroix, A., 148
 Laistener, Dr., 67
 Lange, Claus, 117
 Las Guerrias, valley, 189
 La Tene period, 62
 Latium, 75
 Latvia, 50, 95, 96, 184
 Lebanon, the, 57, 58, 229
 Ledyard, Adam, 44
 Leningrad (*see also* Hermitage),
 184
 Museum of Science, 184
 Leonforte, 209
 Leveen, Dr., 55
 Lever Brothers, Ltd., 225
 Leygebe, Gottfried, 157
 Libau, *see* Liepaja

- Liberty, Messrs., Ltd., 182, 218,
 220
 Liepaja (Libau), 97
 Liguria, 35, 66, 67
 Ligurious, 67
 Linz, 61
 Lipari Islands, 209
 Lithuania, 95, 96, 97, 184
 Little Cressingham, 72-3
 Livonia, 98
 Loban, 230
 Lochstädt, 120
 Loew, Dr. H., 199, 200
 Long Wittenham, 79
 Los Millares, 76
 Lott, John, 235
 Louis XIII., 156
 Louis XIV., 156
 Louis XVI., 153, 154
 Lowther, —, 80
 Lübeck, 117
 Lübeck Corporation, the, 100,
 102-3, 106, 157
 Luise, Queen of Prussia, 122
 Luminescence, 93-4, 190
 Lybia, 40
 Lydian necklace, the, 76
 Lymplesham, 44
 Lynx, the, 35

 MABLETHORPE, 195
 Maccall, —, 44
 Mackinnon, Prof. Doris L., 150
 McLaren, Hon. H. D., 162, 169
 Madagascar, 188, 192
 Magellan, 223
 Maingkwan, 218
 Malet, —, 45
 Manchuria, 184
 Mandalay, 219, 220
 Marcasite, 137, 189
 Marie Antoinette, 153, 179
 Marie Louise, Empress, 159
 Marlowe, Christopher, 45
 Marne District, 75, 77
 Martelli, Alessandro, 170
 Martial, 32 *sqq.*, 41
 Martin, Dr. Th. Henri, 59
 Martinstown, 83
 Marutus, Carolus, 154, 159

 Mary Queen of Scots, 178,
 180-1
 Massilia (Marseilles), 66, 67
 Maucher, Johann Michal, 107
 Mayendorff, Baron, 69
 Mecca, 230
 Mecklenburg, 98, 99, 196
 Medici Casket, the, 172
 Medicine and Magic, Amber
 in, 35, 37-8, 79, 117,
 203 *sqq.*
 Mediterranean Sea, the, 65, 66,
 69
 Meerschaum, 23
 Meinhold, —, 132
 Meleager, 36
Meleagrides, 36
 Mellichius, 34
 Mellite, 193
 Memel, *see* Klaipeda
 Menelaus, King, 26, 161
 Menge, Prof. A., 17, 133, 138
 Menilithic or Bituminous Schist,
 212
 Mentmore, 158
 Mentonomen, estuary, 35
 Merlin, Joseph, 178
 Merthyr Tydvil, 231
 Mesopotamia, 78
 Messina, 209
 Metrodorus, 35
 Mexico, 184, 194, 229
 Meyer, Andreas, 160
 Mezen, river, 193
 Milton, John, 41
 Mineral, Amber as, 87 *sqq.*
 Minsk, 193
 Mold, 73
 Moldavia, 214
 Montant, Nicholas de, 224
 Montelius, Dr., 61, 83
 Montezuma, 80
 Moore, T., 45
 More, Sir Thomas, 204
 Moronvillers, 77
 Moscow (*see also* Kremlin), 163
 sqq., 176
 Müller, A., 146
 Müller, Prof. Max, 58 *n.*
 Mundesley, 195

- Muntz, G. H. M., 234
 Murgoci, Dr., and the Murgoci
 Collection, 210, 213,
 214, 216-17
 Muru, 98
 Museo Biscari, 209
 Mycenæ, 53, 66, 78-9
- NANGOTAIMAW Hills, 220
 Naples Museum, 174
 Napoleon I., 65
 Nathan, Rabbi, 54
 National Physical Laboratory,
 the, 94
 Natural History Museum, the,
 226
 Navarro, J. M. de, 60 *sqq.*
 Naylor-Leyland, Sir E., 173
 Nehemiah, 58 *n.*
 Nero, 38, 39, 64
 Nestor, 27
 Neu-Stettin, 99
 Neuvorpommern, 99
 New York Harbour, 225
 New Zealand, 185, 229
 Newton, Sir William, 52
 Nicander, 35
 Nicias, 35
 Nicolai, —, 156
 Nicols, Thomas, 204
 Nimmerstadt, 120
 Nineveh, 42, 78
 Nizhegoria, 193
 Nola, 85
 Norfolk, 195, 196
 Norfolk, Duke of, 154
 North Mimms, 157
 North Sea, 196
 Norway, 34
 Nostitz, Count, 157
 Nürnberg, 100, 160
- OBRUCHESK district, 193
 Ocnita, 211
 Odyssey, the, 25 *sqq.*, 161
 Oesel Island, 36 *n.*, 190
 Olan'esei, 211
 Oliva, monastery of, 99
 Oliver, S. E., 188
 Omdurman, 95
- Oppert, Prof. J., 42, 43 *n.*
 Orford Ness, 195
 Orichalcum, 56
 Orland, 190
 Orleans, 154
 Ovid, 40
- PADUS, river, 37
 Paleolithic Period, 70
 Palestine, 56
 Palmnicken, 112, 114, 115, 120,
 128, 129, 229
 Pannonia, 37, 38
 Paradise, 26
 Paris, City of, 152
 Park, Walter S., 47, 48
 Parma, Duchess of, 224
 Parthey, Privy Councillor F.,
 122
 Paternosterers, 44, 100, 102, 103,
 116, 117
 Pausanias, 151
 Pechor, river, 193
 Peleus, 85
 Pelka, Otto, 107, 108, 109, 163,
 164, 166, 167, 176
 Penelope, 28
 Peresinotti, Antonio, 169
 Persia, 50, 51, 203
 Persian Gulf, the, 43
 Peshitta, the, 55
 Peter the Great, 167
 Petit Morin, 75
 Pflaum, Niclus, 117
 Phaëthon, 40, 85
 Philo Judæus, 54
 Philoxenus, 35
 Phæbus, 40
 Phœnicians, the, 29, 53, 57 *sqq.*,
 166, 210
 Pietra, Amber of, 216
 Pierpont Morgan Collection, the,
 173, 227
 Pigotite, 230
Pinites or *Pinus succinifera*, 16,
 134, 135, 138
Pinus succinus, 26
 "Pison, River," 26
 Pitti Palace, Florence, 170 *sqq.*
 Plato, 34, 53

- Pliny, 35 *sqq.*, 49-50, 59, 64,
67, 78, 203
- Po, the, 40, 195, 209
- Poland, 96, 99, 155, 215
King of, 105
- Polish Corridor, the, 97
- Polsk, 99, 120
- Pomerania, 96, 98, 99, 152, 196
Dukes and rulers of, 98, 118
Albrecht, 100, 105-6, 117,
119
Albrecht Friedrich, 118
Barnim the Elder, 104
Georg Friedrich, 120-1
Johann Friedrich, 104
- Pomeranian Corporation, the,
103
- Pontivy, 75
- Pope, Alexander, 28, 46
- Poppæa, 39
- Porphyry, 54
- Porschin, Christian, 108
- Portugal, 76
- Pozzalo, 209
- Præneste, 76
- Prague, 231
- Pressed Amber, *see* Ambroid
- Preston, —, 183
- Prideaux, C., 84
- Prosles, 77
- Prussia, 20
Eastern, 64, 95, 99, 109, 184,
197, 229
Home of Succinite, 96 *sqq.*
Northern, 23
West, 196, 197
- Psellus, 59
- Pseudo-Ambers, 227 *sqq.*
"Pseudodoxia" (Browne), 34
- Ptolemy, 25
- Putna, 211
- Pyrenees, the, 36, 70
- Pytheas, 35, 50, 66
- QUEYRIAUX, Major François
Louis and his descend-
ants, 153-4
- RADAUNE, river, 30, 54, 97
- Rafr, 49
- Ragusa, 209
- Raleigh, Sir Walter, 46
- Rastrelli, Carlo, the Younger,
170
- Raunonia, Island, 49
- Ravenna, 209
- Rawlinson, Dr., 30
- Reade, Charles, 234-5
- Redlin, Michal, 165-6
- Reformation, the, 117
- Reger, Johann, 165
- Reggio, 209
- Reid, Clement, 198, 199, 202
- Reiff, Hintze, 164
- Retinite, 185, 186, 187
- Revelation, Book of, 53, 56, 59
- Rhine, the, 58, 65
- Rhodes, 63
- Rhone, the, 58, 65
- Rice, Rev. W. A., 195
- Ridgeway, Prof., 54
- Ridgeway, Sir W., 63
- "Ritterordnen," the, 98 *sqq.*
- Rodriguez, Don Jaime Alemany,
185
- Rogge, Edward, 117
- Roggenbuch, Friedrich and
Johann, 170
- Rollum, 190
- Rome and the Romans, 38, 62,
63, 64, 78
- Root of Amber, 116
- Rosaries, *see* Paternosterers
- Rosca, Prof., 216
- Roscoiul, river, 211
- Rosebery, Earl of, 158
- Rothschild, Baron Meyer de,
158
- Roumania, 81, 210-11
- Royal Irish Academy, 74
- Royal Society, the, 110
- Rugen, 99, 147
- Rumanite, 87, 94, 179-80, 184,
185, 190, 210 *sqq.*
- Runge, W., 20, 133
- Russia (*see also* Leningrad, and
Moscow), 71, 164, 176,
193
- Russian Revolution, the, 163
- Rutter, J. O. N., 93

- SAARE MAA, 98
 Sac Frères, Messrs., 155
 Sadi, 224
 Sadowski, —, von, 63 *n.*
 Saghalien, 184
 St. Adalbert, 102
 St. Blasius, Church, 153
 St. Clement, 59
 St. Petersburg, *see* Leningrad
 Sakasosta, 50 *n.*
 Sakastina, 50 *n.*
 Salmassius, 39 *n.*
 Samland, 26, 63, 70, 96 *sqq.*,
 111, 113, 131, 195,
 196, 228
 Bishop of, 99
 San Domingo, 185
 San Filippo d'Agiro, 209
 Santander, 76, 189
 Santiago de Compostella, 179
 Saporta, Marquis de, 26
 Sarajevo Museum, 71
 Sassau, 128
 Satyrus, 35
 Savigno, 231
 Savin, A. C., 198
 Savoy, 229
 Saxe-Weimar, 151
 Saxony, 229
 Sayarde, Christen, 44
 John, 44
 Scandinavia, 16, 71, 83
 Schacht, Ernst, 166
 Schaufuss, Dr. L. W., 143 *n.*
 Scheelite, 93
 Scheveningen, 190
 Schleswig, 82, 98, 99, 196
 Schliemann, Dr. H., 66, 78-9
 Schneider, Simon, 128
 Schraufite, 230
 Schrotte, 88
 Schumann, Dr., 146
 Schwarzort, 114, 126, 127
 Schwiedler, Mary, 132
 Pastor, 132
 Scriba, George, 160-1
 Scythia, 35
 Scythian work, 76
 "Secrets of Alexis," 225
 Segebad, Johann, 103
 Serita or Osericta, Island, 36
 Shakespeare, W., 43
 Sheringham, 195
 Shilton, Miss D., 44
 Siam, 95, 156, 184, 189
 Siberia, 184
 Sicilian Amber, *see* Simitite
 Sidon, 57
 Sierra Leone, 189
 Simitite, 60, 74, 95, 179, 184,
 190, 208 *sqq.*, 214, 217
 Skegness, 195
 Skelton, —, 43
 Smith, Dr. William, 29
 Smith, Reginald, 62 *n.*
 Snow, B. G., 231
 Solomon, King, 66
 Seal of, 68
 Sophocles, 36, 59
 Sotacus, 35
 Sotheby, Messrs., 76
 Souffland, Madame G., 150
 Sources of Amber (*see also*
 Baltic, Germany, *etc.*,
 under names), 68, 184
 sqq., 195 *sqq.*
 South America, 80, 89
 Southwold, 195
 Sowerby, Dr., 231
 Spain, 68, 76, 77, 169, 189
 Spanish Art Gallery, the, 173
 Spinelli, Prince San Giorgio, 84
 Spink & Co., Messrs., 173
 Spurrier, Dr., 190
 Stanislaus, King, 153
 Stantien & Becker, Messrs., 101,
 111, 112, 115, 126 *sqq.*,
 228
 Stantinite, 228-9
 Stapleton, Sir Brian, 44
 Steding, Niklas, 103
 Stettin Museum, 70, 151
 Stockelberg, the, 132
 Stokes, Sir George G., 93
 Stolp Corporation, 103, 104-5,
 109, 121, 122, 123,
 130, 151
 Stone Age, the, 71
 Story, W. W., 35
 Stouting, 79

- Strombing, 74
 Stromboli, 209
 Stuttgart, 176
 Succinite, 49, 60, 74, 76, 81,
 94, 95, 190; home of,
 96 *sqq.*
 Succinum, 49, 59
 Sudines, 35
Sudlitternicum, 35
 Suffolk, 98, 195
 Sullivan, —, 45
 Sutton-on-Sea, 195
 Sweden, 157, 195, 196
 Switzerland, 62, 67, 75, 77
 Syracuse, 209
 Syria, Syrians, and the Syriac
 language, 55, 57 *sqq.*,
 64, 88 *n.*, 229
 Syrup of Amber, 205
- TACITUS, 31, 49, 64
 Talmud, the, 51 *n.*
 Taormina, 209
 Tasmania, 229
 Telemachus, 27
 Tennyson, Alfred, 46-7
 Terranova, 209
 Terzagus, 34
 Tests for Amber, 90 *sqq.*
 Thales, 51
 Theochrestus, 36
 Theodoric, the Goth, 64
 Theophrastus, 34, 35, 51
 Thetis, 85
 Thomas, Dr., 81
 Thompson, Prof. Sylvanus, 95
 Thorn, Second Peace of, 105
 Tiberius, 85
 Tiffany, Messrs., of New York,
 159
Times, The, 206
 Tiryns, 33
 Tornquist, Prof. Dr. A., 138
 Totton, Captain, 226
 Townsend, —, 189
 Transylvania, 79
 Trinacria, 210
 Trusthorpe, 195
 Tsarskoye Selo, the Amber
 room at, 162 *sqq.*
- Turan, Gottfried, 162, 166, 169
 Turkey and the Turks, 124,
 130-1
 Turnukhansk, 184
 Tyre, 57
 Tyrol, 75
- UNITED STATES OF AMERICA, 185
 Upton Lovell, 72
 Uruguay, 188
 Usedom, Island of, 132
- VAL de Soto, 189
 Valchorite, 231
 Valchov, 231
 Valeriani, Giuseppe, 169
 Vancouver, 188
 Varnishes, 187, 231 *sqq.*
 Amber in, 110
 of Amber, 92, 231 *sqq.*
 Veiby, 72
 Veneti, the, 37
 Venetisul, river, 211
 Venice, 100
 Verrall, W. H., 199
 Victoria and Albert Museum,
 157, 173
 Vienna, and its Museum, 130,
 176
 Vigenère, Balise de, 153
 Virgil, 29, 30, 55
 Vistula, the, 61, 62, 97, 99
 Vladivostok, 183, 184
 Voelsch, Karl Heinrich, 122
 Volhynia, 193
 Vuillaume, J. B., 235
 Vyshgorod, 193
- WADDES DON Collection, British
 Museum, 157
 Wallace Collection, the, 159
 Wallachia, 215
 Walle, Isabelle, 44
 Waller, Richard, 110
 Wallin, 147
 Walton-on-the-Naze, 195
 Warnicken, 127

- Wasilkof, 71
 Weimar, 151
 Wells, 44
 Welpendorf, Johann, 170
 Weltner, Dr., 197
 West Rocks, 195
 Whitaker, Dr. William, 231
 Whympfer, —, 185
 Wilamovitz-Möllendorff, Geh.
 U. von, 27
 Wilde, Lady, 132
 Willemite, 93
 Wilson, Sir Charles, 68
 Wiltshire, 73
 Winckler, Prof. —, 58 *n.*
 Windau, 97
 Winter Palace, Leningrad, 167
 Winterton, 195
 Wismar Corporation, 103
 Wladislaus IV., King of Poland,
 107
 Woldenberg, 151
 Wolfram, Gottfried, 166
 Wyndham, Miss, 214
 Wyndham-Cook Collection, the,
 159
 XENOCRATES, 36
 YARMOUTH, Lord, 189
 Yarmouth, Norfolk, 195, 196,
 201
 York, 44
 ZANZIBAR, 95, 190-1
 Zeus, 40
 Zitny, 70
 Zoology and Botany of Amber,
 133 *sqq.*, 180, 183,
 199 *sqq.*
 Lists of Plants found, 138 *sqq.*,
 and of Animal re-
 mains, 141 *sqq.*, 201,
 202
 Zoroaster, 59
 Zuicker, —, 211

M 5
32

F 7
132

S 1
32

K 5
32

~~S 1~~
82

Q 5
32

9
52

K 5
32

1 1/2
W 7
32

c

