A Collector's Guide to MINERALS ROCKS and GEMSTONES in CORNWALL & DEVON

Cedric Rogers

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MINERALS, ROCKS AND GEMSTONES

in Cornwall and Devon

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MINERALISED AREAS of CORNWALL & DEVON

Main Concentrations of mines.

Coastline most likely to contain minerals of interest.

◎ o Important Towns + Cities.

• Important mining Towns.

Au. - Gold Ag. - Silver

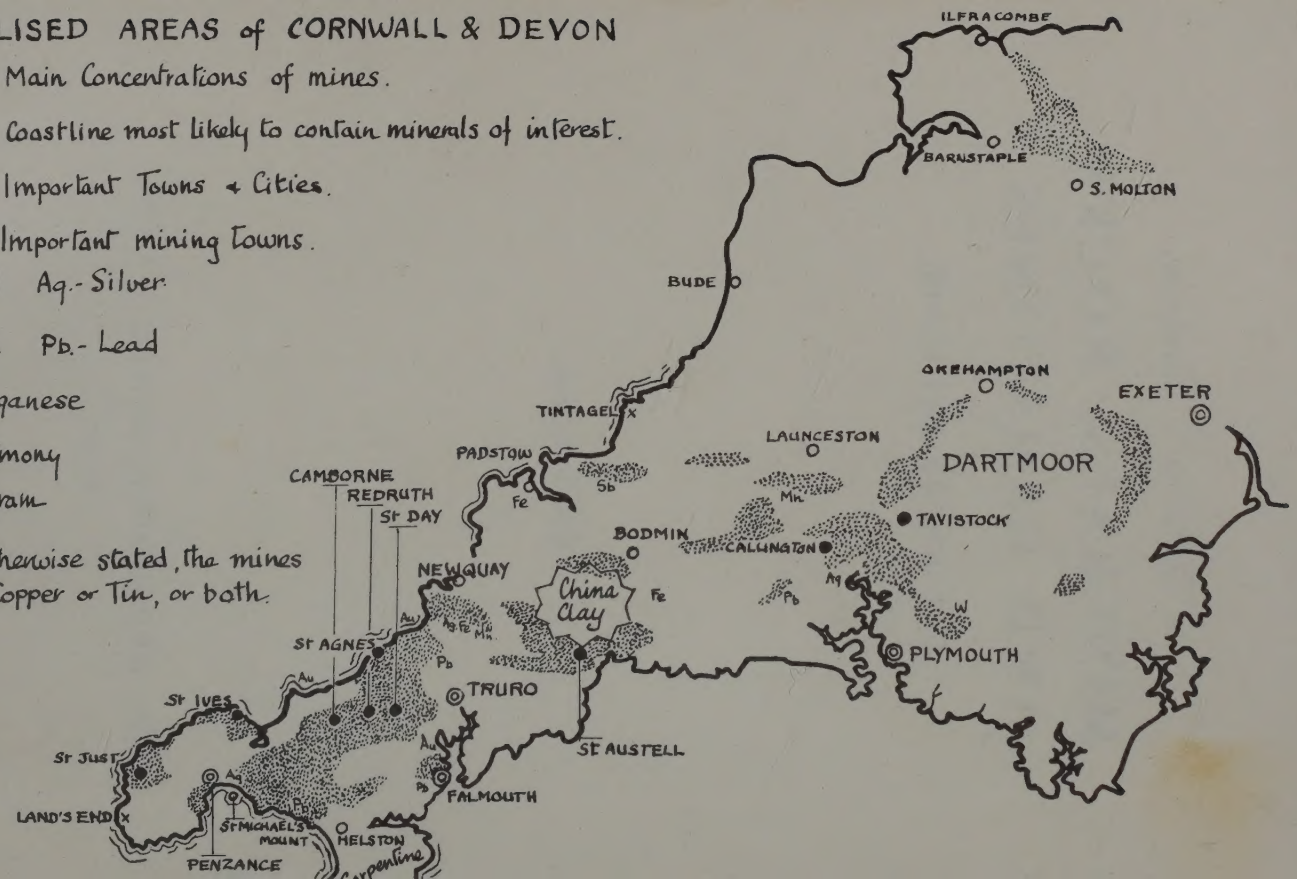
Fe. - Iron. Pb. - Lead

Mn. - Manganese

Sb. - Antimony

W. - Wolfram

Unless otherwise stated, the mines produced Copper or Tin, or both.



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INTRODUCTION

To see the contents of some of our museums one is persuaded that the mines of Cornwall must once have been veritable Aladdin's Caves. What the miners themselves thought is another matter.

The fact is that Cornwall has, in its time, yielded a remarkable treasure of minerals. Their quality and quantity and, above all, variety is unique in the world for an area of equal size. Today the picture is not quite so glamorous. For one thing the best specimens from the collector's point of view are apt to be fairly near the surface of the ground. The surface of Cornwall has been so thoroughly explored and mined one must assume that most of the cream has been skimmed from this rich mineral 'milk'. Much, of course, remains unrevealed, but this will be uncovered at a much slower rate than in the hey-day (late eighteenth and nineteenth centuries) of mining.

Yet in spite of this the keen amateur can expect to find for himself a collection of good mineral specimens to compare with those from anywhere in the world, if he perseveres. And the fascination of this hobby is such that, once embarked upon it, rarely does anyone give it up. With the increase of leisure time and the mobility that motoring brings, it seems inevitable that interest in mineral collecting will increase greatly. In America for instance it has become, within a few years, the fastest-growing outdoor leisure-time occupation of all.

This guide has been written with the inexperienced amateur in mind and to help launch interested people into the fascinating hobby of collecting and identifying minerals. But there is much information included which the experienced collector who is unfamiliar with Cornwall and Devon should find helpful. There has been no attempt to cover the whole field, and for the most part details and technicalities have been avoided. Anyone wishing to pursue the matter further will find excellent books (see bibliography) which cover the more advanced aspects of the subject.

The book has been divided into two parts, the first part containing the bare information for getting the beginner started with a minimum of technicality, the second half containing fuller details of minerals to be found, plus charts and other information which might be required as the collector gains experience.

WHY

The advantages of mineral collecting as a pastime are many; here are some of them:-

It is practical and cheap, the bare equipment being a hammer and a magnifying glass.

The materials are free.

It is healthy, taking one into the open air, and it supplies the incentive to exercise beyond one's lazier inclinations.

On the other hand it is something which appeals to the romantic side of our imagination. It inspires dreams of treasure-hunting, - for gold, or precious stones. To discover some crystals of an unfamiliar mineral is as exciting as finding a chest full of pieces of eight.

Anyone who has ever dreamed of being a prospector is a natural candidate for mineral hunting.

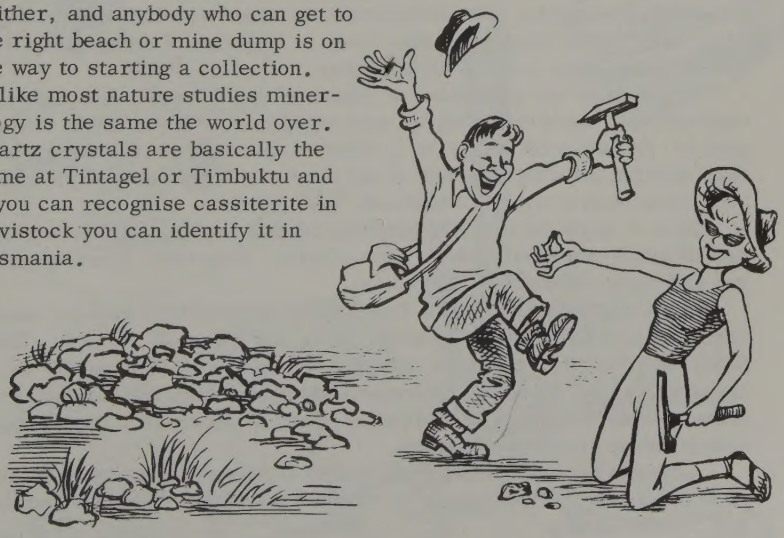
It is also instructive and a jumping off ground for more serious study.

It is ideal for the casual visitor with some time to spare.

For some, the pleasure is simply in recognising minerals and being able to surprise their friends by pointing out, say, needles of tourmaline or felspar crystals embedded in their front door-step.

It is a pastime which can be pursued at any time of day or year, especially in Cornwall's mild climate! Of course the best time for the actual collecting is in daylight, but if you are keen (and rich) enough to possess an ultra-violet lamp you can keep on collecting after nightfall. In sunshine it is more pleasant, but when it is wet the minerals show up better! In some places the winter months have an advantage as there is less vegetation to obscure your vision. Let persistence be your guide, for the only thing which could really foil you is snow.

There is hardly any limit of age or profession. Climbers and pot-holers have a slight advantage, mine workers and quarrymen a big one. But most mineral collectors are neither, and anybody who can get to the right beach or mine dump is on the way to starting a collection. Unlike most nature studies mineralogy is the same the world over. Quartz crystals are basically the same at Tintagel or Timbuktu and if you can recognise cassiterite in Tavistock you can identify it in Tasmania.



HOW

This heading refers chiefly to equipment, which is only as elaborate as you wish to make it. One can manage with hands and eyes alone. But no self-respecting collector would be without his hammer (preferably a geologist's hammer) and a strong magnifying glass (x 10). To these the serious collector will add -

A Bag (such as a canvas satchel or rucksack) for carrying specimens.
Newspaper for wrapping delicate specimens which could otherwise be damaged, or Paper Tissues for extra care.
A Cold Chisel for freeing crystals from rock masses.
A Light Sledge Hammer if you have a car to carry it!
A Note Book and appropriate Maps
Heavy Garden Gloves to protect your hands.
Glasses or Goggles to protect your eyes from flying rock chips.
A Protective Helmet is a useful precaution when working near cliffs or in a quarry. A motor-cycle helmet would be ideal.
Also useful for making simple tests (explained later) are -
Penknife, Glass, Copper coin, Magnet and a Streak Plate
This latter is a small piece of hard, unglazed tile.

The dedicated mineral collector will also sooner or later start thinking about Geiger counters and ultra-violet lamps. These are interesting instruments but expensive, and need not concern us here beyond a brief mention of their uses.

Most readers must, at some time or another, have heard the distinctive crackling of a radio-active mineral exposed to a Geiger-counter, either in some museum, at school or on television. Geiger-counters are standard equipment for the modern prospector in search of uranium bearing ores such as Pitchblende.

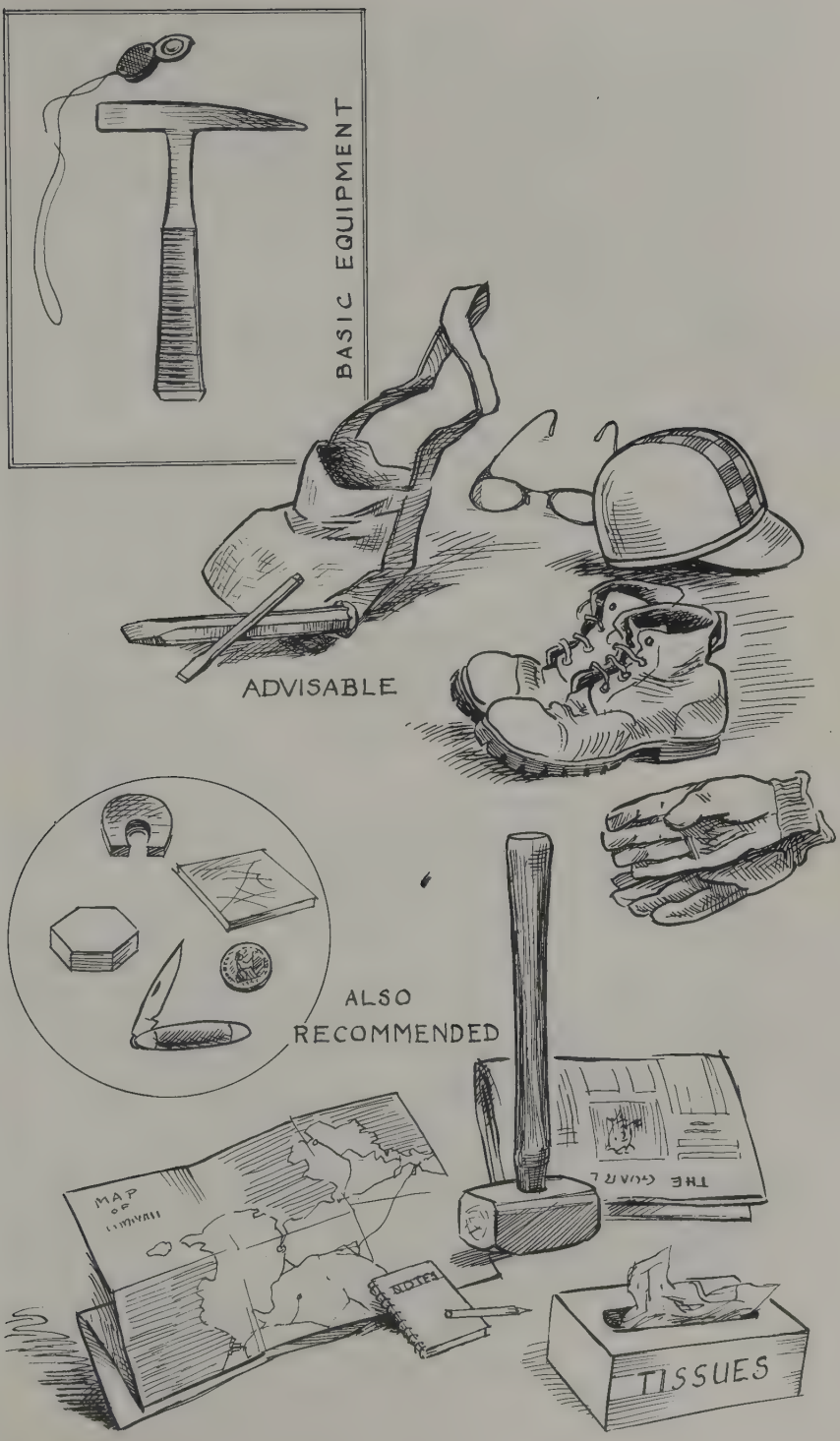
The ultra-violet lamp ('black light') is used for both identification and display purposes. Certain minerals fluoresce with distinctive colours when seen under the ultra-violet lamp. A group of these so lit in a cabinet make quite a remarkable display.

If you have an abundance of patience and a super-abundance of optimism you could add a pan to your equipment. If you fail to find any gold in the streams there is a mineral peculiar to Cornwall called Manaccanite, an ore of titanium in the form of a black sand, which can be recovered from a river at Manaccan, near Helston.

Here it might be worth mentioning another aspect of collecting minerals, which is acquiring them from others; by barter, purchase or, if you are lucky, inheriting a collection.

In the days when Cornwall (and Devon) teemed with working mines, many fine crystals were constantly being dug out with the ore. These found their way into museums and private collections all over the world. Many miners had their own collections which have been handed down from father to son and there are probably many of these still lying around, abandoned by disinterested heirs.

Although the most satisfaction comes from specimens found by one-self, these can rarely compare in size and perfection with those one may beg, barter or buy.


BASIC EQUIPMENT
ADVISABLE
ALSO
RECOMMENDED
MAP
OF
HAWAII
NOTES
TISSUES

WHAT

It is time to define just what 'minerals' are. They are, in fact, elements and chemical compounds in their natural state. They are the ingredients of rock, just as milk, flour, lard, salt, sugar and currants are the ingredients of cake.

Ninety-nine per cent of the material you find (in most places) will be bits of rock, i.e. an assembly of minerals, the grains of which are usually too small to identify with the naked eye. But don't be discouraged at this figure, because those which are, or contain, minerals of interest usually have a different look about them.

When examining a beach for pebbles, or a rock pile, one looks for the piece that is lighter or darker, greener or browner than the rest. Take particular note of any rock that appears 'rotten', i.e. riddled with fissures, bumpy or cracked. The cavities may have tiny crystals lining them.

When you find a promising piece, break it open with your hammer and examine the fresh face of the broken piece. If you have never examined a freshly broken piece of stone closely, you will be surprised how varied rock can be once the dull, weathered exterior is penetrated. You should take special pains to break up fissured rock for further fissures inside with possible crystals.

Specimens collected from dumps will often benefit from cleaning. One of the first things to do after returning from an expedition is to scrub your finds in a basin of warm water, containing a drop of detergent. If you are lucky enough to find specimens with delicate crystals, great care must obviously be taken in cleaning them or they may be lost altogether. Also, those which are in the form of powder or a soft coating should be similarly cared for.

IDENTIFICATION The next step is to identify your finds. For those with a leaning to chemistry there is a world of fascination in store, with the simplest of home labs. The key to this will be found in "Rutley's Mineralogy", a book which is recommended to the reader who wishes to carry his studies a step farther, and fill in some of the gaps which are inevitable here. But most identification is done by eye and a few simple field tests are here described.

Colour While minerals such as fluorite, quartz and tourmaline come in a bewildering range of colours, a few minerals keep fairly rigidly to one. Some, like erythrite (carmine pink) or azurite (deep, azure blue) are often identifiable by colour alone. But on the whole colour by itself is never a sufficient guide and may be misleading.

Streak This is the colour left when your mineral is scratched across a piece of hard, unglazed tile. It may be different from the colour of the mineral itself (e.g. black hematite gives a red streak).

Weight (Specific gravity), can only be used as a very rough guide by the amateur, but tin, lead, and tungsten ores, will often betray their presence by a notable heaviness of the specimens.

Magnetism Three West Country minerals are magnetic (e.g. Magnetite, Micaceous Hematite and Pyrrhotite - a magnetic form of Pyrite).

Hardness Minerals range in hardness from the softest, talc, to diamond, the hardest known natural substance. A rough scale of hardness can be gauged by the following common items - your fingernail, a copper coin, a penknife, a steel file, and a piece of quartz. To find the hardness group to which your mineral belongs see what is the softest of these which will scratch it (see page 43 for table). More sophisticated is the Mohs' Scale of Hardness (see page 45).

Lustre This is the shininess of the mineral's surface. For the sake of simplicity this can be divided into four groups.

Glassy Transparent or translucent (e.g. amethyst). This group includes 'adamantine' used to describe brilliantly glittering minerals such as cassiterite.

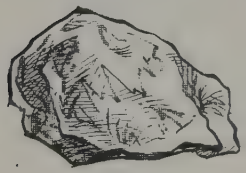
Porcelainous Shiny, but cloudy or opaque (e.g. felspar). This term has been chosen for use in this book to cover several similar groups.

Earthy or **Dull** (e.g. kaolin).

Metallic Opaque with a brilliant lustre (e.g. galena).

To these we add the qualifying descriptions of **Waxy** and **Resinous**. A chart based on this grouping will be found on pages 40 - 41.

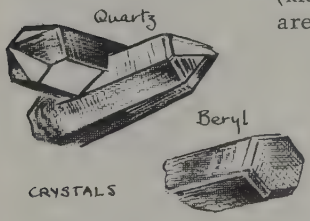
FORM Most mineral matter is in the self descriptive form known as 'massive', i.e. without a distinct shape. However nearly all have definite geometric forms in which they are occasionally found. These are the crystals. Since every mineral follows certain definite rules of crystal formation - which never vary - these can be important items of identification for the more experienced collector. For instance, quartz crystals are normally six-sided if complete, and capped with a six-sided pyramid. Beryl crystals also have six sides, but with squared off ends.



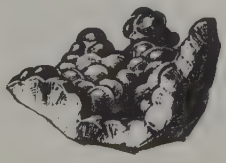
MASSIVE (Quartz)

Another distinct form taken by some minerals is a kind of crystallization with a lumpy or bubbly appearance known as "botryoidal" (shaped like a bunch of grapes) or "reniform" (kidney shaped). Some well known examples are:-

Limonite (black). Chalcedony (waxy blue, grey, yellow etc.)



CRYSTALS



BOTRYOIDAL (Goethite)

Hematite (reddish to black) famous examples from Cumberland.
Malachite (velvety green); rare in this form in Cornwall, much sought after.
Chalcopyrite (tarnished brass-yellow), "blister copper ore".

RENIFORM (Hematite)

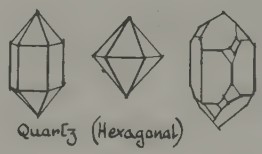
CRYSTALS The crystals of a given mineral may vary in detail from one another, but always conform to a system of crystallization which is constant for each mineral. This form it may share with other quite different minerals. For instance both fluorite and galena crystals occur as both cubes and octahedrons (double ended pyramids). These forms are part of the same crystal system (i.e. cubic). The structure of a crystal is based on the structure of the mineral's molecules, which is always constant. The six main systems (with simplified descriptions) are as follows:-

Cubic, (self-explanatory). More accurately known as Isometric. Tetragonal, (square prism). Hexagonal, (six-sided prism). Orthorhombic, (tablet or match box-shaped). Monoclinic, (a box collapsing forwards). Triclinic, (a box collapsing forwards and sideways (no right-angles).

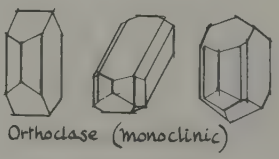
These descriptions should not be taken too literally, as they are simply a rough guide to help the reader visualise the foundations of the systems. For example a crystal of the tetragonal system will probably not be actually a 'square prism', but a many sided figure whose main dimensions fit neatly into this shape.

Here are some of the minerals you may encounter in crystal form

Quartz Very common, a certain find which varies considerably within the theme of a hexagonal pyramid capping a hexagonal prism. May be long and thin or short and stubby.

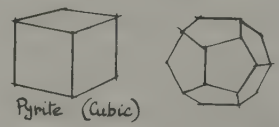


Felspar Crystals are not very common in a free state but may be found embedded in 'porphyritic' granite.



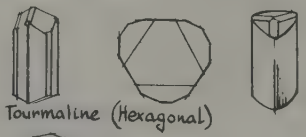
Schorl Black 'needles' embedded in white quartz or granite.

Pyrite 'Brassy' cubes.

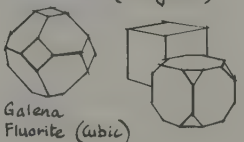


Galena Leaden cubes or octahedrons.

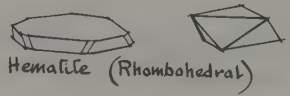
Fluorite Glassy cubes or octahedrons (several colours possible).



Hematite Small, brilliant black 'blades' or 'tablets'.



Calcite Hexagonal, rather like quartz at times but much softer.



CLEAVAGE Many minerals can be identified by the fact that when broken they split up in a very definite way. Cleavage is the tendency to split cleanly along certain planes. Some minerals have several planes of cleavage, whilst others have two, or one only, while many have none at all. Care should be taken not to confuse a cleavage plane with the flat, shiny facet of a crystal. Although cleavage is connected with the crystalline structure of the mineral, cleavages and crystal faces are not necessarily on the same planes.

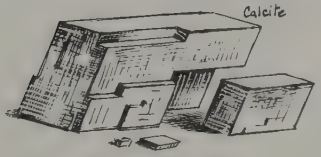
A few of the more common minerals which have distinctive cleavage planes are -

Mica This shows the most familiar of all cleavages, splitting up into even, smooth flakes like the pages of a book.

Felspar The cleavage faces of felspar are often seen in granite (along with mica) as shiny flat patches on the rough rock.

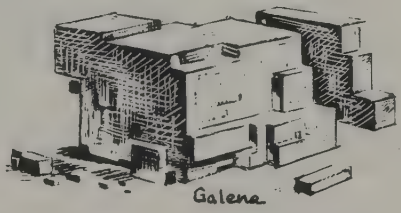
Sphalerite A mineral of resinous appearance, varying from yellow to brown, to black. Has several very distinct cleavage planes.

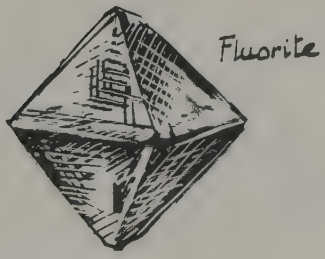
Wolframite Resembles black sphalerite at times, with one distinct cleavage; but wolframite is not so easily scratched with a knife blade. The single cleavage along a lath-shaped crystal (often embedded in white quartz) is usually distinctive enough for identification.



Calcite This breaks into blocky rhombohedrons.

Galena Like calcite, breaks into blocks but rectangular in this case.





Fluorite This mineral breaks into four very sharp, glassy cleavage planes, sometimes forming a perfect octahedron, not to be confused with the octahedral crystal form. Fluorite and calcite are quickly distinguished from quartz by the fact that quartz has no cleavages.

FRACTURE Any surface of breakage which is not along a cleavage plane is a fracture. Fractures are described as -

Conchoidal, Curved and faintly rippled suggesting the form of certain shells, (e.g. flint).

Even, flattish.

Uneven, the most frequent type.

Hackly, rough or jagged surface, as with cast iron.

Earthy and **Splintery** are self descriptive.

Gold. Although gold is extremely rare in Cornwall and the chances of the collector finding any are remote indeed, it does exist in small quantities. There is no need to describe it to the reader although it is superficially like the very common iron and copper pyrites, or 'Fool's Gold'. The simplest test is to scratch it with a knife blade: if the mineral seems hard and brittle it is probably one of the pyrites; if it is soft (as lead is soft) you have gold. The expert can often recognise gold by the slightly warmer yellow and the lack of any tarnish.

Gold exists in microscopic grains in the "raised beach" at Godrevy (St. Ives Bay), and in quartz veins at Cligga Head (near St. Agnes). It has been reported from several mines scattered about the county, but never in economic quantities. In the early nineteenth century £40 worth was found at Sheepstor in Devon, while the largest nugget reported from Cornwall weighed nearly two ounces. Wherever tin has been found in the streams, gold is likely to exist, particularly in the Carnon Valley, near Falmouth, and with manaccanite at Manaccan, near Helston.

Silver. Silver has been mined in some quantity at different periods and places in Cornwall. Some of this has come from compounds of silver such as its sulphide (argentite) or its chloride (cerargyrite) but most notably from a mixture of silver and the lead sulphide (galena). Most of the galena in Cornwall and Devon contains silver, some being comparatively rich, which has earned itself the name of "silver lead". It has the largest silver content of any area in Britain.

Native (natural) silver has been found at a number of mines and may be considered as a possible but unlikely find on the dumps. If discovered it would have a leaden exterior, perhaps looking like a gnarled root made of the metal, tarnished from grey to black.

Gemstones. Other precious minerals which exist in Cornwall, but must be considered unlikely finds **in gem quality** are -

True Topaz, not to be confused with yellow quartz (citrine). It is noticeably heavier than quartz and a grade harder on the Mohs' scale of hardness (P.45) and unlike it, has one perfect cleavage. The likeliest locations for topaz are the beach between Marazion and Penzance, at Lamorna in joints in the granite, at Cligga Head and Castle-an-Dinas. Cornish topaz is usually pale bluish to colourless.

Beryl, rarely, in pegmatite, e.g. granite quarries near Falmouth, St. Michael's Mount.

Garnet, not uncommon in massive, non-gem quality, e.g. St. Just area, Carn Brea, and at Ramsley, near Okehampton.

Turquoise, in china-clay (St. Austell area) e.g. Gunheath pit, Hensbarrow.

Peridot, (Precious olivine) reported from beaches at the Lizard but very doubtful.

Tourmaline, minute red and green prisms from Meldon Aplite quarry Devon. This is the only British locality for the gem type although coarse black, dark greenish or brownish tourmaline is very common.

Cornwall's reputation as a source of gemstones however comes almost entirely (and excluding the ornamental stone, serpentine) from the quartz family, a description of which follows:-

QUARTZ GEMSTONES

Quartz. Known locally as 'spar' or 'cross-course spar' is the commonest mineral on the face of the earth (not counting water, which is also a mineral!). In its purest form it is glass-clear in beautiful crystals. In this form it is known as rock crystal, with the local name of 'Cornish Diamond'.

The common form of quartz is usually white or greyish, often stained brown with iron oxide (limonite). It is encountered nearly everywhere as pebbles and even boulders, as a major constituent of granite, as veins running through rock of all kinds and when seen on mine dumps is often a guide to the presence of ores.

Amethyst. This is the glamour queen of the quartz family, with a colour too well known to need describing, although the shades most frequently encountered in Cornwall are the paler, lilac ones. Don't count on crystals, although you may be lucky. Land's End and in the china-clay district are the most likely hunting grounds.

Citrine or False Topaz. The yellow to yellow-brown varieties of quartz may not be as familiar as amethyst, but citrine runs a close second as a gemstone. It is reported from Botallack and Marazion beach. Also known as 'Cornish Topaz'.

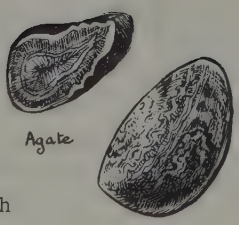
Cairngorm. This is the gem name for smoky quartz. It is a smoky brown or grey colour sometimes almost black, when it is called morion. Some small crystals of the latter were recently found at the large St. Ives car park (built on the waste dumps of Wheal Trenwith). It has also been found at St. Stephen-in-Brannel. The colouring is supposed to be due to the proximity of uranium bearing minerals.

Amethyst, citrine, rock crystal, and smoky quartz are all transparent properly crystalline forms of silica. The chalcedony-flint group is, apart from impurities, chemically the same (oxide of silicon) but does not occur as crystals.

Chalcedony. Chalcedony is translucent rather than transparent, as compared to pure quartz. The difference between the two has been rather neatly compared to the difference between ice and packed snow. It varies in colour from bluish, to grey, to yellow, to brown. A beautiful red, or orange-brown variety is better known as carnelian.

Chalcedony often has the appearance of candle grease. It is found as veins, knotty lumps and knobbly crusts (botryoidal). Pebbles of chalcedony are common, which are apt to look rather like potatoes.

Agate. Is a form of chalcedony, usually built up of several different coloured layers. These may be seen as bands or (when sliced open) as concentric rings. They are most attractive when a section is polished, but much of the agate to be found is pale, and of insufficient interest to be worth polishing. It is found at Marazion, Loe Bar, Kynance, Godrevy Point, the Tamar Valley, Budleigh Salterton (in a pebble bed) and other places.



Onyx. Is a form of agate with very straight banding. In some regions it is found with distinctive black and white layers from which cameos can be cut. Do not confuse the pebbles of quartz-veined slate with onyx. These are recognisable by the fact that the softer slate wears away leaving the quartz in ridges.

Flint. Is not a gemstone but a member of the chalcedony family. There is some mystery about how it came to be found in Cornwall since the usual geological structure (chalk beds) associated with flint are not to be found here. Some suggestions are that it was brought here by ice floes during the glacial period or as ship's ballast, or is the remains of a long since vanished layer of chalk. Anyone familiar with the beaches of south east England does not need a description of flint. This is actually very similar to chalcedony but is opaque (or almost so) rather than translucent, coloured grey to black inside but usually a much lighter grey on the unbroken surface.

Jasper. Is a form of chalcedony with a rich inclusion of iron oxide which may give it quite strong colouring. It is common in some places, and usually looks like a sort of dull toffee or a dull red sealing-wax, ranging in colour from toffee-yellow to brown-black, from orange-red to dull purple or green. Bloodstone is a dark green jasper flecked with red.

Opal. A cloudy yellow or white. Unpolished, opal is difficult to recognise, even for the expert. It is occasionally found with other quartz varieties such as agate at scattered points in Cornwall, for instance the St. Just area, the china-clay district, at Haytor and Lustleigh in Devon.

Rose Quartz. Has been reported in Cornwall but this is probably quartz stained by red iron oxide and not true rose quartz.

Also note the following varieties of agate which have been reported and may or may not be likely finds.

Moss Agate, from inclusions of chlorite etc.

Sardonyx, Carnelian with white banding, like onyx.

Chrysophrase, clear grass-green.

Prase, dull leek-green, (less transparent than Chrysoprase)

Simple agate, is hard, clear, very plae yellow to almost white. It used to be sought (at Marazion) for making bearings for scientific instruments, such as the 'knife-edge' on scales, but this small local industry now imports the agate from Brazil where it is more abundant.

GRANITE AND OTHER ROCKS. Before proceeding further with the descriptions of minerals it might be advisable to consider some of the rocks in which they occur.

Perhaps the most characteristic rock of Cornwall is granite. This is light in colour, composed of three very common minerals, and some others in varying proportions. The common ones are quartz, felspar and mica.

Quartz has already been discussed.

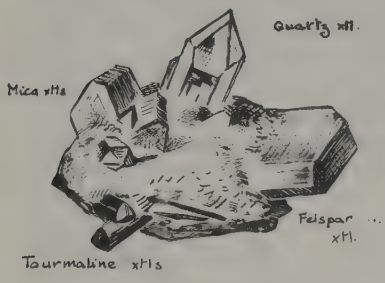
Felspar is a name given to a group of minerals of slightly different composition but of similar appearance. As a group they are even more abundant in granite than quartz.

Mica is also the name of a group of minerals dealt with later.

Schorl (or Black Tourmaline) is also often present.

Beryl, Topaz and Garnet are sometimes to be found in small quantities.

Granite in different forms is very conspicuous throughout West Cornwall. Most of the stone for houses, barns, walls, and cobblestones is granite; and it forms out-croppings in fields and moors everywhere. An interesting variety is porphyritic granite. This contains crystals of felspar which formed first while the rock was in a molten state, the quartz and other minerals crystallizing later.



PEGMATITE

Also common is a dark grey or buff shale known locally as Killas. Shale is a sedimentary rock which originated as mud, the sequence of formation being mud, mudstone, shale, altering to phyllite and then slate. Most of the ore veins occur in granite or killas so the mine dumps are apt to be composed of one or the other.

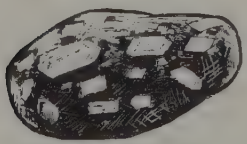
Pegmatite. Of special interest to the mineral collector is a freakish formation of granite called pegmatite. This usually occurs as veins in normal granite but with the usual granite minerals very much enlarged. A pocket or fissure in pegmatite is liable to contain large, well formed crystals of quartz, felspar, mica, tourmaline and even apatite beryl and topaz. Pegmatites may be found running through some of the rock in cliffs and on the foreshore (e.g. Tremearne, Mounts Bay) in granite quarries (e.g. Knill's Steeple Quarry, St. Ives) and amongst the waste of some mine dumps (e.g. Botallack). Other pegmatites are found at Rinsey Cove (near Tremearne), Cligga Head, and Trelavour Downs (near St. Dennis).

Gabbro is a dark rock similar to granite but formed of different minerals. Gabbro pegmatite is to be found at Coverack Cove.

Greenstone is the name given to a group of dark igneous (originally molten) rocks which are less productive of specimens for the mineral collector than granite or killas.

Serpentine. This is discussed further under its mineral heading.

Felspar. Probably the first crystals of any mineral that you see in Cornwall will be embedded in the granite known as porphyritic granite, which is used everywhere for building stones, paving stones, kerbs and cobbles in the streets. They are crystals of felspar. This particular variety is called orthoclase (other felspars found in Cornwall are albite and labradorite). The latter being found in gabbro, (see above).

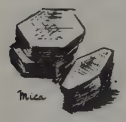


Felspar crystals in Granite Porphyry

Look carefully at the porphyry and you may see some very well shaped sections of crystals on the surface of the stone. They are usually lighter coloured than the rest of the rock. Although you can't dig up the cobble streets to swell your collection, many beaches have a promising assortment of porphyry pebbles.

An important difference between felspar and quartz, which are often found together, and may look similar, is that felspar usually shows a distinct cleavage, whereas quartz breaks unevenly, like glass. Quartz is also slightly harder and will scratch felspar.

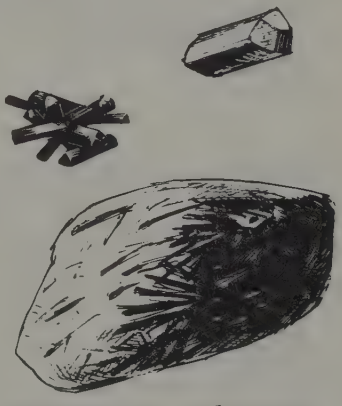
Mica. The appearance of this mineral is too familiar to need dwelling upon. It will be found in granite everywhere, from tiny pearly flakes, to bunches of thin sheets an inch across.



Mica

The pale type is known as **Muscovite**, because once it was used in Moscow in place of window glass, whilst the dark mica is called **Biotite**. There are other varieties which need not concern us here. The Cornish micas are rarely found as crystals, but when they are they appear as a stack of thin, hexagonal plates.

Schorl (Black Tourmaline). Tourmaline, as a glassy pink or green prismatic crystal is a gemstone. Small specimens occur at Meldon Aplite Quarry in Devon. But elsewhere you will only find the black variety (and some dull brown or green) which is as common as the gemstone is rare. It occurs in granite, in quartz and chlorite veinstone looking like needles of coal. If a prism of tourmaline is well developed enough to be seen in section it has a distinctive 'fat' triangular shape. Roche rock, on Goss Moor consists entirely of quartz and tourmaline.



Pebble of Quartz + Tourmaline

Chlorite is another very common mineral. Generally it's appearance is not interesting, being a dull, earthy green or rarely blue or grey. However close observation will sometimes reveal that the mass is made up of thousands of tiny, mica-like green flakes. It is easily scratched (even with the fingernail), although very tough as a rock, and hard to break with the hammer. Often found on mine dumps with white quartz.

China Clay. The huge white cones which are so conspicuous in central Cornwall (facetiously called 'the Cornish Alps') are the waste from china-clay pits. This waste consists largely of quartz, and is the hard residue of decomposed granite.

This thriving industry has taken over from tin and copper mining as the most important in Cornwall at present. China-clay is the prime ingredient of fine porcelain and china, and is used as fillers for paper, rubber and paint manufacture. As such it is exported all over the world.

Kaolin (to give china-clay its mineralogical name) is the result of the decomposition of felspar in the granite of that area. The exact process is too complicated to go into here, but in some places the crystals of felspar embedded in the granite were altered to kaolin without losing their shape (pseudomorphs) and these are known to the clay workers as 'pigs' eggs'. If one can find these they make interesting additions to a collection. It is easy enough to obtain specimens of rock containing the chalk-like kaolin. In itself it is not the most interesting specimen, but a collection of Cornish minerals would be incomplete without at least one. But don't be put off exploring the china-clay area for other minerals because some of the best specimens of amethyst and other quartz crystals are to be found in these quarries. Other minerals which may be encountered are turquoise - a pretty pale blue but not suitable for jewellery; wavellite, a rare phosphate of aluminium which occurs as radiating, needlelike crystals forming circular patterns in the joints (cracks) in the granite. Purple fluorite also occurs as coating in joints whilst opal has also been found in the area.

Serpentine. Serpentine is a "marble-like" stone which is found in many shades of mottled green and red. It is the mainstay of Cornish gift shops whose ornamental ashtrays and lighthouses are well known everywhere. The name comes from its supposed resemblance to a snake's skin and a look in any of those shops will show what a variety of material you can expect to find - although, unpolished, the natural stone may not be recognised at first.

A large part of the Lizard peninsula is composed of serpentine. In fact it is difficult to draw a dividing line between serpentine the mineral and serpentine the rock. It has no crystal form for one thing. Some mineralogists advocate the use of a new word, **Serpentinite**, to specify the mineral. The rock is often much intermixed with other minerals such as **Bastite, Tremolite** and **Chromite** (an oxide of iron and chromium) and is generally impure chemically. Serpentine the mineral is a hydrous magnesium silicate and comes in many shades of green. The red and black variations are the result of impurities. Precious serpentine is a dark, oily, translucent green.

At Kynance Cove you may expect to find dark red and black serpentine along with various shades of green. It is identified by its colours and its softness being easily scratched with a pen knife. Pebbles of jasper which may look like some shades of serpentine are much harder. The white veins running through much of the serpentine is steatite, better known as 'soapstone'.

A number of other minerals are closely related to it, such as talc and a variety of asbestos.

The Sulphides. Certain minerals will be found which look like bright, shiny metals, particularly on freshly broken surfaces. These are almost always members of the chemical group known as sulphides (i.e. a metal in combination with sulphur). The best known of these is Pyrite or 'Fools' Gold'. This and others you might find are tabled below.

THE SULPHIDE -	METAL -	COLOUR -
Iron Pyrites ('Mundic')	Iron	Pale brass-yellow
Copper Pyrites	Copper & iron	Bright brass-yellow
Bornite (horseflesh ore)	Copper & iron	Bronze. Purple tarnish
Chalcocite	Copper	Lead grey
Covellite	Copper	Indigo blue
Galena	Lead	Bright silvery grey
Arsenopyrite ('Mispickel')	Iron & Arsenic	Dull silvery grey
Sphalerite ('Blende')	Zinc	Not metallic, resinous
Stannite	Tin, copper, iron	Greenish grey

There are many other sulphides, not all of which have the appearance of metal. These are beyond the scope of this book, but some of the above need further comment.

Pyrite ('Mundic' or Iron Pyrites). The various yellowish sulphides were all known to the ancients simply as 'pyrites' as they were unable to differentiate between them. Iron pyrite is very widespread and should be one of your earliest finds (including small crystals which may be cubes or other cubic shapes as illustrated).

Chalcopyrite (or Copper Pyrites). As common as iron pyrites but is a deeper yellow and often tarnished with the colours of the rainbow ("peacock ore"). One of several sulphides containing copper, it is the main ore of that metal in Cornwall.

Galena (Silver lead). The lead sulphide is one of the easiest minerals to identify. When rock containing galena is broken open it will be seen that the bright, silvery mineral exposed has broken into tiny cubic blocks, due to its cleavage. The outside is usually tarnished a dull, blue-grey.

Stannite (Stannine. Tin Pyrites. Bell-metal Ore). This is not a common mineral, and not easy to distinguish from other sulphides, but it is of interest as being almost the only other tin bearing mineral than cassiterite (see **Ores, Tin**). It has the appearance of a tarnished specimen of one of several yellowish sulphides.

Arsenopyrite ('Mispickel' or Arsenical Iron). This mineral is often found with pyrite and sphalerite (the zinc sulphide), embedded in lumps of quartz-chlorite veinstone. An interesting fact, and an aid to identification, is that when struck with a hammer it gives off a strong smell suggestive of garlic (actually arsenic). It is the chief ore of arsenic although in its sulphide form it would be more dangerous as a blunt instrument than as a poison.

Sphalerite ('Blende'. Zinc Sulphide) very widespread and a notable exception to the metallic-lustre-of-sulphides rule. It is dealt with under ORES-ZINC.

Pyrrhotite (Magnetic Iron Pyrites). Found at the large B.R. quarry, Meldon. Similar to ordinary pyrite but with a bronzish hue and is attracted to a magnet.

Carbonates. The carbonates form another important group of minerals. They all contain one atom of carbon and three of oxygen to each molecule, and, more to the point from the amateur's point of view, many have the same pronounced rhombohedral cleavage as calcite. All dissolve in hydrochloric acid with effervescence, although in some cases the acid must be heated. None are hard. Calcite is the commonest, being the major mineral constituent of limestone, chalk and marble. The most likely to be found in Cornwall are -

Calcite (Calcium Carbonate). Clear, milky, honey coloured, cream or pinkish, more rarely, colourless. Rather like some quartz in appearance but with a distinctive cleavage and much softer. It is fairly widespread in small quantities. At limestone and slate quarries it is possible to find excellent crystals (e.g. Devonshire and North Cornwall).

Siderite or **Chalybite** (Iron Carbonate). Honey-brown to dark, reddish-brown. Abundant in many places (Porthleven, St. Austell, Treamble Nr. Perranporth). An impure variety known as '**Ironstone**' is widespread in the Midlands and constitutes an important ore of iron. The crystals are in the hexagonal system and come in several forms parallelling those of calcite. See 'Crystals'.

Dolomite (Carbonate of magnesium and lime). Mountains in Northern Italy are named after this mineral, which is a major constituent of the limestone rock. It may be found in masses of minute rhombohedral **crystals** (as opposed to cleavages) sometimes curved into a so-called saddle shape. It effervesces in warm acid only. Colour, creamy or pinkish, lustre - pearly.

Reniform malachite showing radial structure

Malachite (Copper Carbonate). If found massive it is easy to recognise by its rich green colour and velvety appearance, especially if a fracture shows the characteristic wavy bands and rings that make it sought after as a decorative stone. But one is more likely to encounter it as thin coatings which are hard to distinguish from a number of other green copper minerals.

Azurite (Chessylite. Copper Carbonate). Sometimes found with malachite. Characterised by its deep, royal-blue colour.

ORES. Most of the sulphides and carbonates just described are ores. A large number of metals have been mined in Cornwall over the years. Tin and copper are the most notable, but quantities of iron, lead, zinc and tungsten as well as manganese, antimony, uranium and silver have also been produced. A brief description of the main ores of these follows -

Tin. **Cassiterite** (Tin Oxide). This is not easy to collect, because its economic importance meant that very little of it found its way to the waste dumps. Nor is it an easy mineral to pick out at once. If you are lucky enough to find a piece of high grade tin ore you will immediately notice that it is extremely heavy. It may be black, or a kind of dark toffee colour or occasionally a dirty cream. Crystals are a glittering dark brown or black. (Do not confuse with black hematite crystals).

Zinc **Sphalerite** (Blende. Zinc Sulphide). The main ore of zinc. This does not have the characteristic metallic lustre of most of the other sulphides. Instead it has a lustre peculiar to itself best described as 'resinous'. It does in fact often look like a piece of brown resin. Sphalerite is often so dark as to be black (when it may be confused with wolfram) but it may be pale yellow or even red. It breaks with several very bright, clear cleavage planes. The streak is white to reddish-brown.

Tungsten **Wolfram** (Wolframite. Tungstate of Iron and Manganese). As just mentioned this may be mistaken for black sphalerite, but is a more opaque black with a more metallic lustre. It has a good cleavage on one face only. Also it is harder than sphalerite and less easily scratched with a knife. The streak is chocolate coloured.

Uranium **Pitchblende.** This is a dull brown-greyish-black material which is hard to identify without a geiger-counter. It is found in several places in Cornwall in small quantities e.g. Wheal Owles, Wheal Trenwith, Carbis Bay. At South Terras uranium ore was mined until comparatively recently.

Cobalt **Erythrite** (Cobalt Bloom). This mineral is uncommon, but if encountered cannot be missed because of its powdery lilac-to-pink colour (almost carmine if wet). Erythrite itself is not sufficiently abundant to be called an ore, but its distinctive colour often betrays the presence of a true cobalt ore, such as **Smaltite** (Cobalt arsenide) which could otherwise be mistaken for arsenopyrite.

Antimony Several ores (e.g. **Stibnite, Jamesonite, Bournonite, Tetrahedrite**) were mined in the Port Isaac area. Rare.

Lead **Galena** (See Sulphides).

Silver **Galena** (See Sulphides, and under 'Silver' page 12).

Titanium **Manaccanite.** A form of **Ilmenite** (an Oxide of Titanium). It is a heavy black sand found in a river bed at Manaccan, near Helston.

Manganese **Rhodonite** (Manganese Silicate) **Rhodochrosite** (Manganese Carbonate) **Pyrolusite** (Manganese Oxide). The two former are an attractive pink, the latter a sooty black. They often occur together near Tavistock and also south and west of Launceston. The best location for manganese minerals was Treburland (p 44), a site now much obliterated and overgrown.

Iron

Limonite (Iron Oxide). May be found as blackish brown veins in quartz or as botryoidal encrustations. When pure black may be quite hard, but in its yellow-brown earthy form, is crumbly and soft. This is chemically the same as rust. It is also a source of yellow ochre pigment. "Gozzan" is a rough form of limonite and cellular quartz, the result of decomposition of the top, or 'back', of a mineral lode. Gozzan is often encountered on the dumps. Although of little interest in itself, it is worth investigations since interesting and attractive minerals may occasionally be found in its pockets and fissures. This is one of the most likely places to find the arsenates, phosphates, sulphates and chlorates described on page 23.

Goethite is crystalline limonite, and much of the material once labelled in collections as 'limonite' has since been shown to have a true crystalline structure and should therefore be re-labelled 'Goethite'. Typical of the crystal structure of Goethite are the botryoidal specimens showing fibrous radiations on a broken section. Restormel Mine, near Lostwithiel (now inaccessible), was once the classic location whilst rather weathered specimens can still be found at Botallack.

Hematite. A close relation to Limonite-Goethite but basically red rather than yellow. Its red streak at once distinguishes it from similar looking forms of limonite and goethite, whose streaks are yellow-brown.

Specular Hematite a hard black variety in brilliant crystals found at Botallack.

Micaceous Hematite is also black, but soft and flaky (rubbing off on the fingers). It glistens like mica and is slightly magnetic. It is found on Dartmoor. Hematite causes the red staining of a large amount of rock, particularly in Devon.

Magnetite (Another iron oxide). The colour and streak of this are both black. As its name implies, it is magnetic. Not very common but found at Botallack, and in parts of Devon.

Siderite. See Carbonates.

COPPER ORES. In the hey-day of Cornish mining copper was the mainstay of the industry, until larger and richer deposits were found in other parts of the world. Unlike its local rival, tin, which is virtually a one-ore metal, copper links up with other minerals in a bewildering variety of combinations. In Cornwall alone there are over fifty different mineral species containing copper. We have space to examine only a few of the commoner ones here.

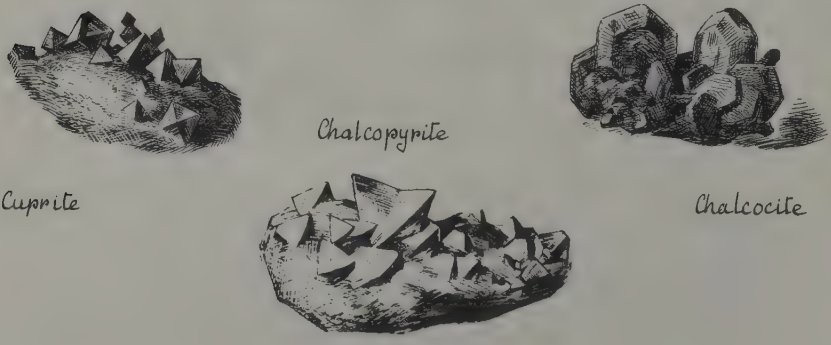
Native Copper, may be found with a little luck. It will almost certainly be covered with a dull green tarnish but if a corner is scratched or broken, the bright copper colour is seen at once. It is by no means rare, although apt to be inconspicuous among other green-coated material which is often nearby. There is much native copper scattered through the serpentine rock of the Lizard, and it is often encountered in old copper mines.

Cuprite (Copper oxide). The ores of copper consist of the sulphides already mentioned, native copper itself and cuprite. This is reddish, sometimes a deep, ruby red and with a metallic lustre where broken. The small crystals when found are double ended pyramids. These have been found recently at Wheal Basset amongst other sites. Masses, when found on the weathered dumps, will usually be coated with a powdery green outer layer.

Tenorite is a black, earthy oxide of copper found in conjunction with other copper minerals. Most of the copper ore of Cornwall consisted largely of two minerals, both sulphides (dealt with further under that section).

Chalcopyrite. The yellow copper sulphide was the chief ore of most parts of Cornwall and Devon. 'Blister Copper' is a botryoidal form of chalcopyrite.

Chalcocite. The grey copper sulphide was predominant in the Land's End area, also common near Redruth.



BLUE and **GREEN SECONDARY COPPER MINERALS.** In certain areas your eye will be attracted by green and blue stains in the rock. These are usually the result of some copper mineral being altered by the chemical action of the weather or by water filtering through copper bearing rocks, bearing other minerals. There are so many of these colourful secondary copper minerals that it would be beyond the scope of the beginner to identify any one. However it is a fascinating field of study which has attracted many advanced mineralogists. Out of interest, a list of some of these is given here.

CARBONATES
Malachite
Azurite
HALIDES
Atacamite
Paratachamite
Tallingite
Botallackite
SULPHATES
Linarite (+ lead)
Langite
Chalcanthite (Blue Vitriol)
Connellite
Brochantite
SILICATE
Chrysocolla

PHOSPHATES
Pseudomalachite
Chalcosiderite
Libethenite
Turquoise (+ aluminium)
Torbernite (+ uranium)
ARSENATES
Cornwallite
Olivenite
Clinoclase
Zeunerite (+ uranium)
Liroconite (+ aluminium)
Chenevexite (+ iron)
Bayldonite (+ lead)
Chalcophylite

Sometimes a close inspection will reveal the presence of beautiful, microscopic crystals. With practice the vivid turquoise of chrysocolla may be recognised, while suspected malachite and azurite can be verified by the acid test.

OTHER PHOSPHATES, ARSENATES and **SULPHATES.** Copper is not the only mineral to combine with these chemical groups to form delicate and colourful minerals. From lead come the interesting twins **Pyromorphite** (phosphate) and **Mimetite** (arsenate), normally green and yellow respectively, but either may be greenish yellow and with similar hexagonal crystals. Wheal Alfred near Hayle produced classic specimens of pyromorphite, as well as mimetite. Wheal Penrose and Penberthy Croft are also sources for each.

The cobalt arsenate **Erythrite** is notable for its carmine-pink colour, and has already been mentioned under 'Ores'.

From iron we get **Melanterite** (sulphate), a pale green, which is soluble in water like the brighter blue-green **Chalcanthite** (copper sulphate) and both taste bitter on the tongue. Also from iron are **Vivianite** (phosphate), **Pharmacosiderite** and **Scorodite** (both arsenates). Scorodite is not uncommon as pale bluish-green crystalline coatings on other minerals. Pharmacosiderite could be mistaken for minute cubic crystals of greenish fluorite.

Annabergite is an apple-green arsenate of nickel. **Wavellite**, a phosphate of aluminium, forms distinctive white needle-like crystals in radiating wheels. **Autunite**, a phosphate of calcium and uraniums, found as tiny lemon-yellow 'scales', is highly fluorescent.

SILICATES. Silicates form the largest and commonest group of minerals. They all contain oxide of silicon, and several have already been mentioned i.e. quartz, the felspars, the micas, serpentine, talc, steatite, kaolin, tourmaline, chlorite, topaz, beryl, garnet. There are dozens more and are mostly comparatively abundant, being major constituents of the rocks.

Apart from those already mentioned, most silicates are hard to identify individually. Because of their negative reaction to common tests however they can usually be recognised as members of the group without much difficulty. For instance, most silicates are insoluble (or nearly so) in acids. Most will not react to strong heating. They are harder on the average than most minerals, and even dark silicates are translucent on a thin section. They all give a pale, or white streak, and are lighter (in weight) on the average than other minerals.

Two important silicate groups (both tending to greens, browns or black) are **Pyroxenes** and **Amphiboles.** They tend to parallel each other in their sub species but have one important difference. Both have two distinct cleavage planes but while the pyroxene cleavages are about at right angles to one another the amphibole cleavages form angles of 55^{o} and 125^{o} making a wedge-shape. Here are some pyroxenes and amphiboles which occur locally.

PYROXENES:-	AMPHIBOLES:-
Augite	Actinolite
Enstatite (Bronzite etc.)	Hornblende
Wollastonite	Tremolite

Other silicates worth a mention, for the record, are:-

Axinite	Cordierite
Andalusite	Epidote
Chrysocolla	Olivene

Chrysocolla (a silicate of copper) already listed with the copper minerals, is worth a second look as it may be recognised more easily than most of the bright blue copper minerals, if only because of the brilliance of its colour and that it is relatively common.

Bastite is also recognisable as gold-tinged flecks in some reddish serpentine. The closely related **Bronzite** is found as a flaky, bronze-coloured mineral in some rocks of the Lizard area (e.g. Coverack).

Fluorite (Calcium Fluoride).

This mineral does not belong to any of the groups so far mentioned but must be included as a very common one which often supplies attractive specimens. It has a glassy appearance reminiscent of quartz and runs to similar colouring. However it is softer than quartz (but harder than calcite) and breaks into distinctive cleavage planes. Like quartz it often occurs as veinstone carrying ores, and so is common on certain dumps. With luck you may find some attractive cubic crystals. Its most spectacular colour is a rich amethyst purple (which has misled many hopeful collectors), but more commonly in Cornwall it is a watery green, or pale honey to colourless.

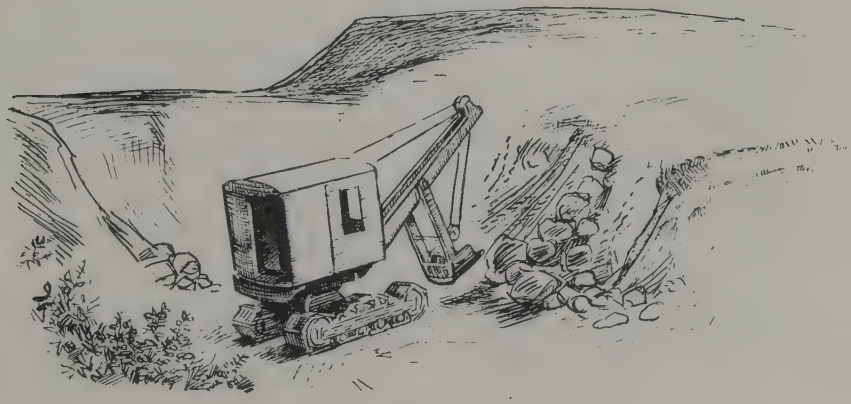
Grains of fluorite placed on a hot stove in the dark will give a pretty display of phosphorescent fireworks.

Barytes or **Barite** (Barium Sulphate). This is a whitish or cream-coloured (sometimes brown-stained) mineral which may look superficially like calcite when massive, (it has a cleavage suggestive of, but not the same as calcite). The first thing one notices on picking up a piece is its weight. Most 'spar' minerals (that is to say light coloured, glassy or pearly in lustre and found in some quantity e.g. quartz, fluorite, felspar, calcite) are relatively light in weight. Barite is distinctly heavy, and so is known as 'Heavy Spar'. It is found in several places locally, notably at Bridford in Devon, where it was mined as a filler in making paint. The crystals have a distinctive tabular shape.

To round off this short list of Cornish minerals (barely a quarter of those recorded) here are a few more which might be encountered and recognised by collectors with some experience:-

Apatite	**Chromite**	**Scheelite**	**Tennantite**
Cerussite	**Molybdenite**	**Smithsonite**	**Zippeite**

Since this is not a text book on mineralogy but simply an informal introduction to one aspect of the subject, descriptions of these less common minerals must be left to books such as those recommended on page 47.



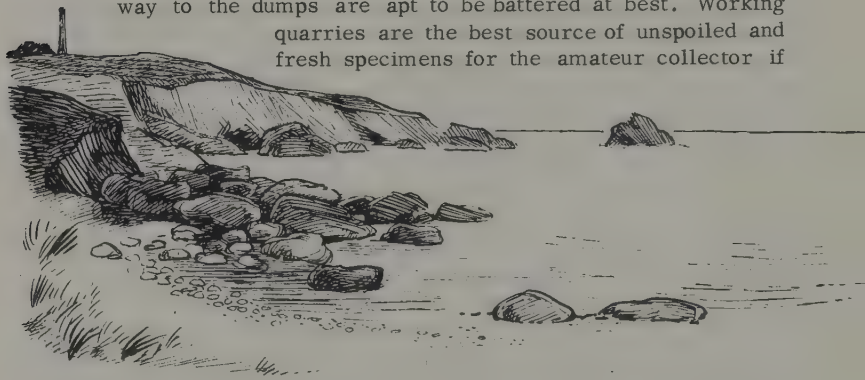
WHERE

Although Cornwall is such a rich source of minerals, from the collector's point of view there are certain drawbacks. The mine dumps, where he would expect to get his biggest hauls are often so old and weathered that it is impossible to sort out the one likely specimen from the fifty duds. The dumps themselves vary in the quantity and quality of minerals to be found, and many fruitless hours may be lost by tackling the wrong ones.

The best places to try are where the mounds have been broken into and excavated, for the unweathered centre is then exposed.

The great number of possible sites for searching is in itself a disadvantage from the point of view of compiling a guide of this sort, and the lack of organised contact between collectors makes it difficult to present a balanced, overall picture. Therefore the places recommended in this guide are necessarily those which the author has been to himself. Information on good sites which are not mentioned here would be welcomed for use in possible future editions.

Museum specimens from the mines have mostly been found in situ by some miner who removed it by hand, knowing its worth. Any crystals which missed this individual attention and found their way to the dumps are apt to be battered at best. Working quarries are the best source of unspoiled and fresh specimens for the amateur collector if



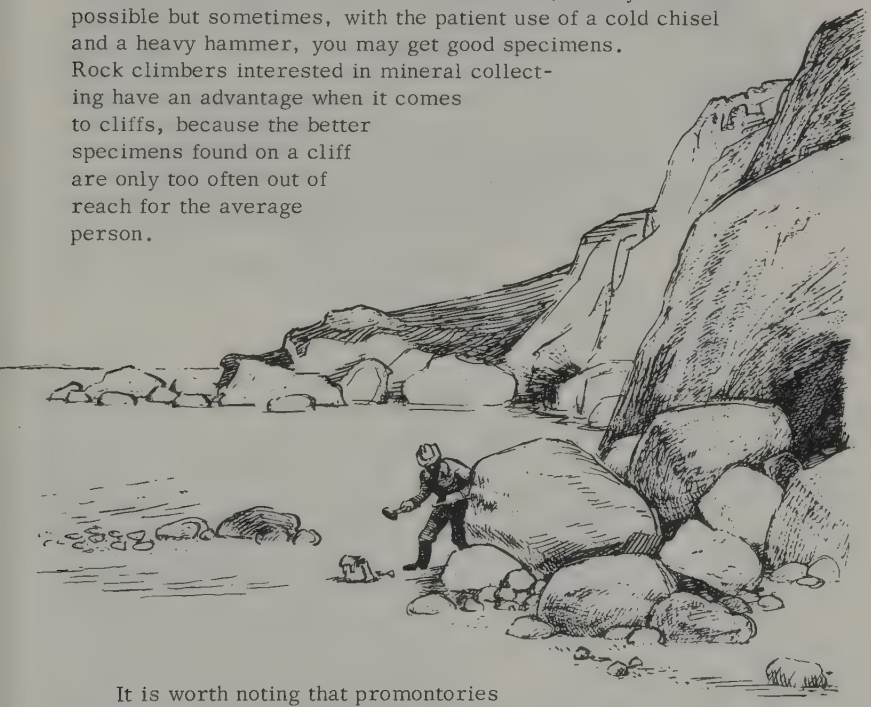
he can find the right ones at the right time. Mines are usually the places to find ore and veinstone minerals, while quarries, with luck, contain pegmatites with crystals of rock-forming minerals.

BEACHES. The easiest and most natural place for the casual searcher to start is on one of the dozens of beaches. Any of these is potentially a hunting-ground, although some may produce only a monotonous repetition of the same kind of pebbles. It is unlikely that you will find any crystals on a beach, unless they come from pieces of cliff which have broken off recently and have not yet had their shape blunted by the action of the sea. But some beaches will have pebbles of agate and other semi-precious stones which may be worth having cut and polished. The best known of these beaches is at Marazion (opposite St. Michael's Mount).

The surest way of picking out good pebbles is to find them wet, when their colours will show up better. This means that the ideal area is along the edge of a receding tide.

CLIFFS and **CAVES.** From the beaches it is usually a short step to some caves. These are often coated with green stains from copper or red stains from hematite. The minerals they consist of are usually too thin or too crumbly to be of much use to the collector, but quite often, in the rubble on the floor of the cave one may find interesting specimens, and it is always worth looking to see if there are any veins of ore in the walls or roof of the cave. Many of the caves in Cornwall are actually adits or tunnels which are part of old mine systems, so take care to explore with great caution.

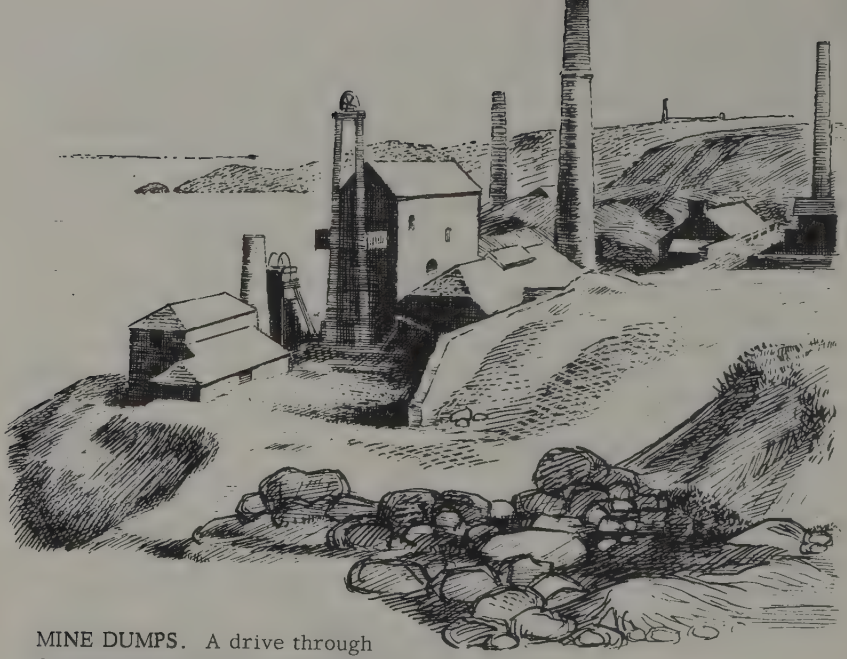
Cliffs often have minerals which are easily visible but very difficult to extract, since they are part of veins which are embedded in the solid rock. If the rock is hard, it may be impossible but sometimes, with the patient use of a cold chisel and a heavy hammer, you may get good specimens. Rock climbers interested in mineral collecting have an advantage when it comes to cliffs, because the better specimens found on a cliff are only too often out of reach for the average person.



It is worth noting that promontories on the coast are often an indication of the presence of a concentration of interesting minerals, and the cliffs and boulders of the foreshore should be carefully examined. Sometimes one may find fissures below the tide level which are lined with quartz crystals and with care these may be removed bodily.

Cliffs in mining areas may contain lodes of ore which was not rich enough to be worth mining, but may include minerals of interest. Keep an eye open for pegmatites (q.v.).

Anywhere that the ground has been cut away to expose rock such as road and railway cuttings, or river beds is worth at least a quick look over; considerable amounts of tin, as well as traces of gold, have been recovered from the latter.



MINE DUMPS. A drive through Cornwall will quickly reveal where the old mine workings are grouped. These are the best places for the collector to concentrate upon. A rough rule (but not infallible) is that the greater the concentration of mines, the greater the chance of a varied concentration of minerals.

Parts of Cornwall look like something from another planet, because of wastes of old ruined buildings and dumps, (or burrows as they are sometimes called). Although the sensitive ones may be repelled, the 'rock hound' is delighted with the prospect of good hunting. Look for the freshest seeming dumps, particularly for signs of excavating.

The local rock from which the ore veins are extracted is known as 'country' rock. There are two main types forming the bulk of material in the dumps - granite and killas. They are often stained red or brown by iron oxide.

Look for veinstone which is usually white, massive quartz. Chlorite with or without quartz, may also indicate the presence of other minerals. Another mineral veinstone is fluorite.

Often found with veinstone is a rough, porous material largely consisting of yellow-brown limonite called Gozzan. This is the result of alteration of pyrite due to weathering and other agencies. It is of limited interest but sometimes it may contain in its cavities minute crystals of some other mineral. In areas where copper minerals are in evidence rare phosphates and arsenates may occasionally be found.

At present there are only two working mines in Cornwall, both producing tin. Geevor Mine at Pendeen is available for collecting (from the waste dumps only) on request. The other, South Crofty at Pool near Camborne is not available.

QUARRIES. One may be lucky and find something of interest in an old, disused quarry but usually not. Most quarries originated because the rock was suitable for building. Mineralised rock (which would be uneven in texture) would be avoided, and any pegmatite material or other mineralised pieces would have been removed by other collectors. However one may be rewarded by a careful search for veins, or signs of irregularities in the walls, and investigation of any rubble near them.

Because of the fresh, broken rock around, active quarries are a much better proposition, if you can get permission to enter that is. Certain hazards are involved in wandering around a busy quarry including falling rock, blasting, and unguarded cliff edges, and such permission may not be forthcoming, so one should take any refusals in good grace.

These remarks apply equally to stone quarries and the china-stone quarries, as found to the north of St. Austell. If you are able to get permission to explore one of the latter the minerals to look for are quartz and amethyst crystals, turquoise, wolfram, tourmaline, wavellite (a phosphate of aluminium) and purple fluorite in thin crusts.

The largest and most famous of Cornish quarries is at Delabole, near Tintagel. The product is slate and good specimens of quartz and calcite (etc.) have turned up here. Unfortunately, however, permission to enter for the purpose of collecting will not be granted.

ST. JUST - BOTALLACK - PENDEEN

This should be the first area to consider. If you find nothing here (which is unlikely) your trip will be well rewarded by the scenery. As with the Camborne-Redruth area it is difficult to single out any one spot for there are too many. But a special point should be made to work over the Wheal Edward dumps at the far end of the rough road leading south along the cliff from Botallack (see map). This mine produced an impressive list of minerals in its time. Uranium minerals are still to be found there with apatite, calcite, siderite, mica, chalcedony, red jasper, copper minerals etc. Around and above Crown's Rock (where the old engine-houses can be seen at the bottom of the cliff) it is possible to find garnet, magnetite, apatite, axinite, actinolite, copper etc.

The dumps as you turn left to Wheal Edward have much black limonite (some botryoidal), quartz crystals and brown jasper. The cliff path leading from Botallack to Levant and Geevor passes outcroppings of rock which in places contain specimens such as garnet, hornblende, actinolite, axinite, etc. A cold chisel, a sturdy hammer and a strong arm will be needed to remove these.

Geevor is still actively extracting tin from the ground and the old Levant mine is being explored with a view to working it again. A request to look over the dumps will not be refused although it is unlikely that you will find anything remarkable. The veins being worked now are much leaner than those of the old days, and the methods of extracting the ore are more ruthless and less selective where good and bad specimens are concerned.

CAMBORNE - REDRUTH - ST. DAY. Too extensive to be able to pinpoint any one spot. The dump will be only too apparent, explore the side roads. Camborne dumps are pretty well picked bare by generations of students from the world-famous School of Mines. A better area is to the east of St. Day and south of Redruth.

When in this area note the two old pumping engines which are preserved by the Cornish Engines Preservation Society at Pool. Also try to visit Holman's Museum (opposite Camborne Library, near the station) where there is another old engine in perfect working order. It may actually be run while you are there. The School of Mines has a superb collection of minerals which is also well worth the effort of seeing.

Minerals to be found are pale green fluorite, copper minerals such as cuprite, bornite, chalcopyrite etc. Basset Mines, below the radio tower south of Redruth, have a fair amount of malachite, in small blobs and crusts. Torbernite is occasionally found there also. Wheal Gorland, at the cross roads east of St. Day, has produced many rare copper minerals, and was once the source of some of the prize specimens to be seen today in museums and private collections. The dumps are much less productive than its reputation would suggest but a variety of copper and other minerals are still around. One interesting mineral which might, with luck, be unearthed is the copper arsenate **Clinoclase**. This is distinguished by its deep peacock-blue colour and its very noticeable cleavage.

To the south and east of St. Day will be found one of the most extensive areas of old waste heaps and ruined engine houses. Much of it is quite barren of worthwhile minerals, even where the old dumps have been freshly broken by excavation. But some of these excavations will occasionally reveal a minor **jackpot** of good specimens, like clusters of sixpences in a vast Christmas pudding. To the east of Carharrack is the large group of mines known as Consols. In the Wheal Fortune section of this are still found large quartz crystals, dirty with age but which can be cleaned in oxalic acid.

ST. MICHAELS MOUNT

This is a private residence, open to the public only at certain times with a guide. Therefore the mineral collector will have to forget his hobby while visiting this fascinating place. It is unavoidable but unfortunate since the Mount is packed with interesting minerals. It is worth noting some which have been reported, since the beaches opposite could contain occasional odd pieces.

Apatite	Fluorite	Lepidolite (mica)	Stannite	Wolfram
Beryl	Garnet	Pinite	Topaz	Zippeite
Cassiterite	Felspar	Quartz Crystals	Tourmaline	

MARAZION BEACH. This beach has already been mentioned. All the varieties of semi-precious quartz and chalcedony have been reported from here at some time or other, and many other minerals in pebble form as well. The stretch of shore just opposite the Mount is probably as good a place to start as any.

PENZANCE, is worth a mention, less for the beach pebbles than for the fact that just over a hundred years ago there was a mine (the Wherry) operating actually in the sea, a few hundred yards off the present promenade. The rocks on which it was built can still be seen at low tide.

PENLEE QUARRY. This is a conspicuous sight in Mount's Bay, between Newlyn and Mousehole. Some minerals occur there, specimens being displayed in the Geological Museum of Penzance, but it is a busy place and in the ordinary way mineral collecting will not be allowed.

THE LIZARD. As already mentioned under 'Serpentine', the Lizard peninsula is well worth exploring. This is a different section, geologically speaking, from the other areas mentioned here. The mines peter out around its edge and the minerals of interest are mostly the 'rock-forming' ones, silicates for the most part (felspars, micas, pyroxenes, amphiboles and an occasional zeolites). Calcite occurs in places as veins thinly dispersed through serpentine. Copper is found as specks and layers in serpentine at different places (e.g. Mullion). The minerals are perhaps more appealing to the hardened collector than the casual amateur since, in most cases, they are hard to locate and harder to identify. But the area has its attractions. Collecting will have to be done mostly from

beaches and cliffs. Those who relish the rambles over rocks and cliffs typical of the West Country coast, will not be disappointed around the Lizard, but don't fill your collecting bag too full before the return climb up a cliff path! Some beaches, on the other hand, offer no problems. The one at Coverack, easily accessible, contains some interesting material not common to other parts of Cornwall. You should find plenty of BRONZITE (a variety of the pyroxene, **Enstative**). As the name implies it is bronze coloured, and the shiny cleavage planes are suggestive of Mica. Places worth noting in this area are Mullion, Parc Bean Cove (Predannack), Pentreath, Holseer Cove, Lizard Point, The Balk, Pen Olver

ST. AGNES to PERRANPORTH. Around St. Agnes are several disused mines, some of which still produce good specimens. At Cligga Head, on the way to Perranporth, there are extensive dumps along the cliffs. Gold in veins of quartz has been found, while a very interesting array of minerals which are much more likely to be found turn up now and then, (e.g. wolframite, stannite, topaz in small crystals).

Between Perranporth and Newquay is the Perran Iron Lode, indicated by a series of mines running inland from Perran Beach towards Newlyn East. The chief ore was Siderite.

PADSTOW to TINTAGEL. Unfortunately the mine sites of this area are hard to find, being largely overgrown. These were once major producers of the ores of antimony (tetrahedrite, stibnite, jamesonite, bournonite) and occasionally gold.

The rocky coast around Tintagel contains a number of minerals to be discovered by the persistent searcher. It is a recognised locality for good quartz crystals, calcite and **Albite** (a white felspar). The scenery is spectacular and you need not feel that an empty collecting bag indicates a fruitless visit. Slate is the typical rock and the great Delabole Quarry (inaccessible to collectors) has yielded quartz crystals, calcite, albite and the titanium oxides **Rutile** and **Anatase**. Do not overlook the pebbles on the beaches.

CENTRAL CORNWALL. There are a number of mines scattered between Bodmin and St. Austell. To the west of St. Austell lies a group whose mineral lodes once contained ores of nickel, cobalt and uranium as well as more familiar ones. Such mines as Great Hewas, Dowgas, Polgooth and especially St. Austell Consols have been listed as sources for collectors but with the levelling and building over of the dumps the collector's chances are rapidly diminishing.

Castle-an-Dinas, near St. Columb Major, was, until recently, a rewarding locality. Good specimens of wolfram could be found (a tungsten mine was operating there during the Second World War). Traces of gold are reported and small topaz crystals were common. At the time of writing this site has been cleared for farming and although the situation has improved for the moment by the turning over and exposing of dumps, the future chances of finding any specimens will rapidly diminish. This fact is mentioned not to exasperate the reader but to point out a typical situation in the continually changing scene in Cornwall.

CALLINGTON, GUNNISLAKE and EAST CORNWALL. The hills around Callington, i.e. Cheesewring, Caradon, Kit Hill and on to Gunnislake, are quite conspicuous for their mines. Notable at some are the rarer copper minerals, with more common malachite, azurite and chrysocolla. A lead mine, Wheal Mary Ann, just north of Menheniot is a 'must'. The dumps have recently been quarried and have much fresh material. One may find fluorite as crystals and in chunks of a honey yellow colour, as well as pale blue. Also notable are white Chalcedony pseudomorphs of fluorite crystals (in the octahedral form), pyrite crystals, barytes, galena, sphalerite (light brown), siderite and tiny crystals of glassy Selenite (gypsum) coating other minerals. This excellent situation will not last indefinitely of course. Either the excavating will cease and the surface will be denuded of its best specimens and the rest will weather, or the whole dump will be exhausted of material to excavate. Since this should take some years, the latter alternative is preferable. This is another aspect of the changing scene. New sources open up every now and then while old ones slowly dry up, so always keep an eye open for bull-dozers and other excavating equipment.

Two sites worth investigating are Old Gunnislake Mine (torbernite and other green copper minerals) and the freshly excavated part of Drake - walls (cassiterite, molybdenite and wolframite).

OTHER CENTRES OF MINING. Also worth of mention are the following areas:

ST. IVES. Several mines once operated in and around St. Ives. When the old dumps, now mostly obliterated, can be located, a little digging may reveal some interesting specimens.

GWINEAR - HAYLE. These need some hunting out but much good material is there for the finding. The best known is perhaps Wheal Alfred, once famous for its excellent specimens of pyromorphite. Small pieces still turn up on occasion, and it is worth visiting for other minerals, both common and rare. Native silver has been reported. Trevascus, just south of Gwinear Road Station is noted for chalcedony in nodular and botryoidal forms.

AROUND MOUNTS BAY. From Marazion to Porthleven and inland, these will be found by touring around and seeking out the old mine stacks. Two places worth noting are Penberthy Crofts, (popular with collectors for a wide range of minerals, especially secondary copper and lead ores) and Wheal Carpenter (**Bayldonite**, a rare copper-lead arsenate).

Anyone wishing for more details of the above mines is advised to consult H.G.Dines' '**The Metalliferous Mining Region of South West England**', to be found in any good local reference library. It covers every known mine in the area, giving the locations and in some cases describing the ore material. Also helpful in locating mines are the two books by D. B. Barton on the mines of east and west Cornwall. In the appendix, on page 44 will be found the Ordnance Survey grid reference numbers for a selected list of mines.

DEVON. The minerals to be found in Devonshire parallel those of Cornwall. The mines themselves are fewer and more scattered for the most part, but there are many which are still very productive for the collector, and some of the minerals actually occur in greater quantity and as better specimens than in Cornwall (e.g. barytes at Bridford, axinite at Meldon).

The chief mining area in Devon is in the form of a ring around Dartmoor, narrow north and south, wider on the east border and widest on the west. This latter area forms an arc from Okehampton to Tavistock, and down the Tamar valley towards Plymouth. The Tavistock mines are closely linked with those on the other side of the Tamar, (Gunnislake - Callington) and form, in effect, one system centred on the Tamar Valley. To the east of Dartmoor the Teign Valley, from Bridford to Chudleigh, marks out another interesting group of mines.

Dartmoor itself is one huge mass of granite, and as such is a potential hunting ground. The places to look are stream beds, gravel pits and wherever loose rock is to be found. In the middle of the moors, half way between Two Bridges and Moreton Hampstead, is an isolated group of mines around Warrenhouse Inn.

North Devon has a few sparsely scattered mines from Combe Martin to the North Molton area. Those around Combe Martin produced 'silver-lead' ores and several minerals reported include siderite, chalcopyrite and in the 'Gozzans', covellite, malachite, azurite and filaments of native silver. Gold was found in traces at Heasley Mill, four miles north of South Molton. A brief look at some individual locations in Devon follows:

RAMSLEY, 4 miles east of Okehampton at Zeal is clearly seen from the main road (A30). Found there are garnet (massive, dark yellow-brown), axinite (dark brown), actinolite (fibrous, dull green) and others.

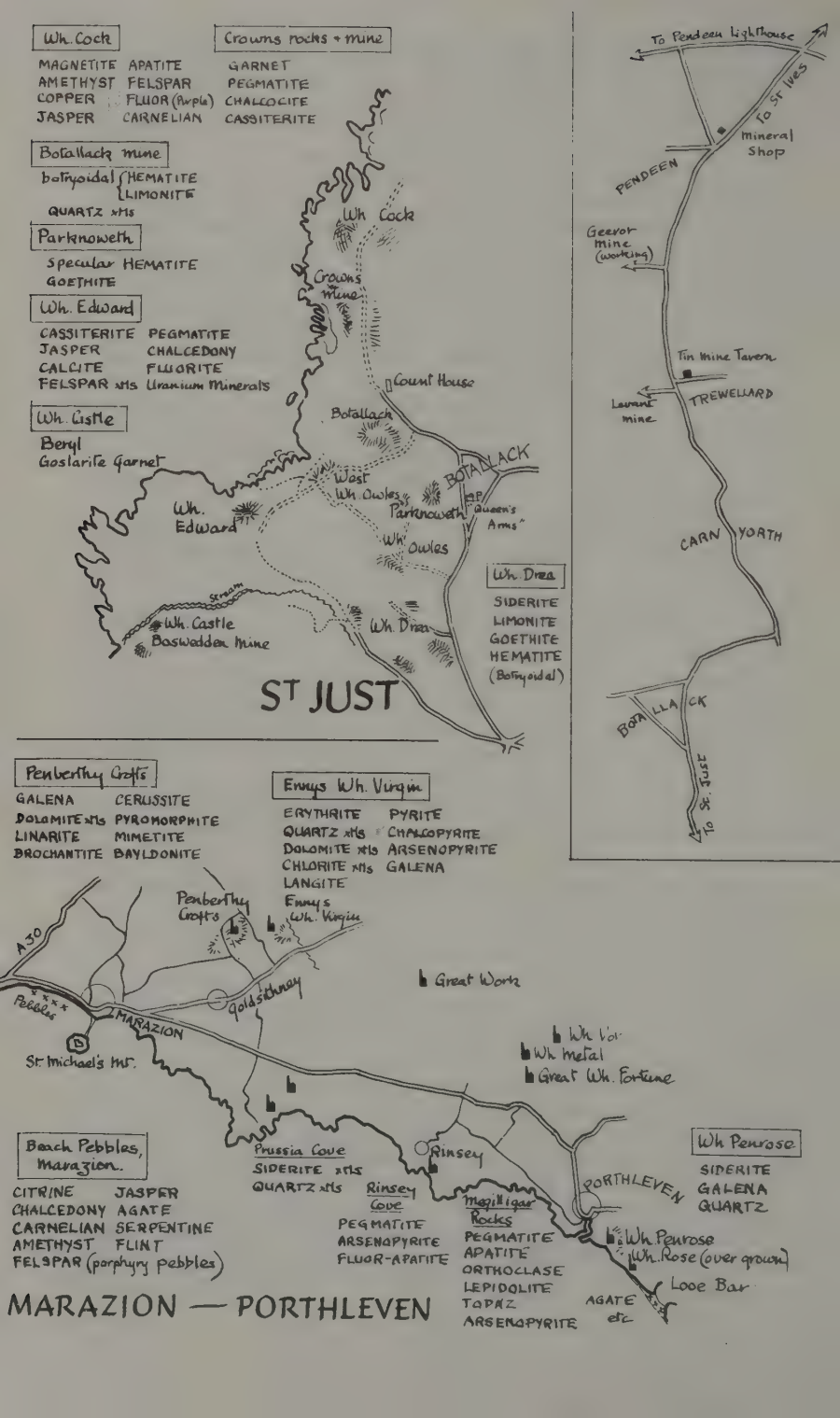
BRIDFORD. Barytes in quantity and some variety. A barytes mine and small quarry are near by, the former recently working.

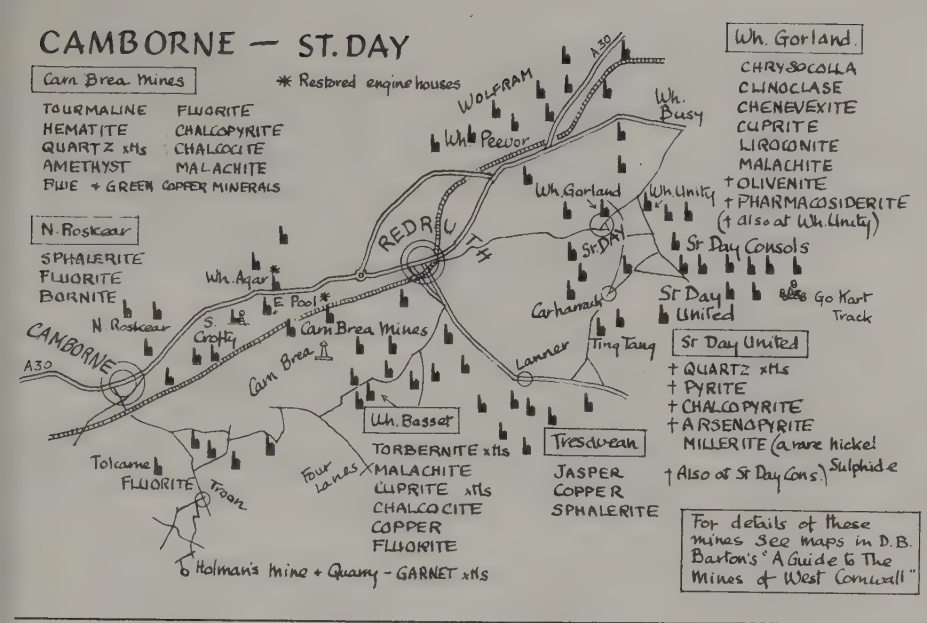
GREAT ROCK. A recently worked mine, two miles north by east of Bovey Tracey. Micaceous hematite was produced here for use as a filler in paint.

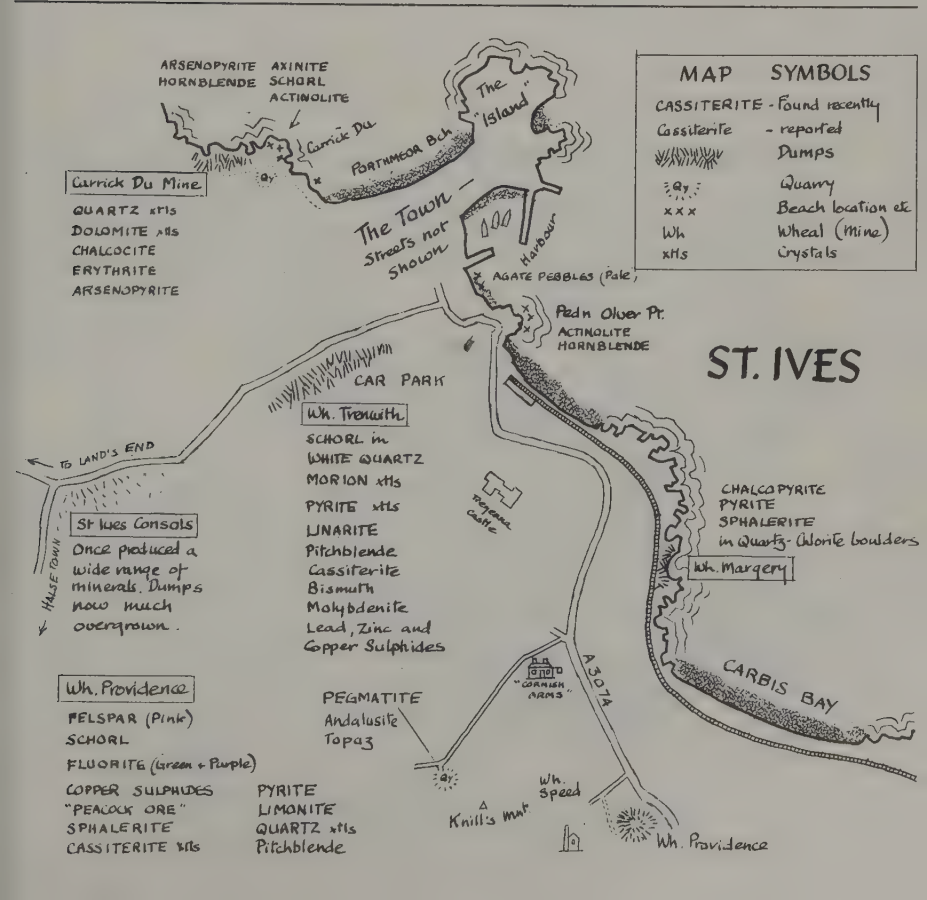
BLACK ROCK QUARRY at Buckfastleigh. Calcite, dolomite and magnetic micaceous hematite.

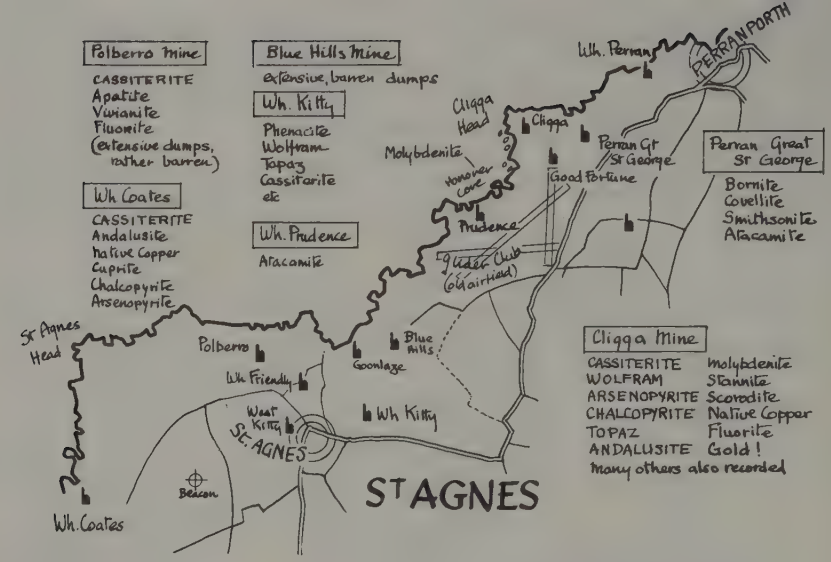
FILLEIGH. North-west of South Molton. This is the given location for many specimens of Wavellite to be found in local collections. They come from the defunct and now overgrown High Down Quarry, at the western end. This is about one and a quarter miles west-north-west of Filleigh. It is possible that persistence might be rewarded here.

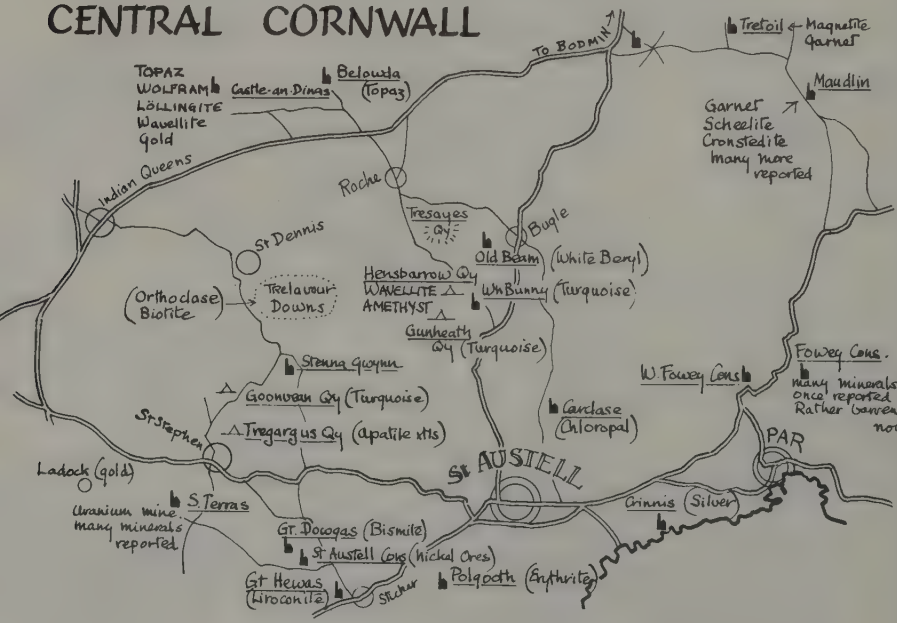
MELDON is one of the most interesting localities in either county, especially for experienced collectors. There are two quarries here. The largest, owned by British Railways is less productive but is noted for pyrrhotite and Wollastonite (a white silicate which occurs as fibrous, radiating crystals). Also reported are apophyllite, garnet and scheelite. To the west is a small granite (aplite) quarry which is also a mineralogist's mecca. Foremost among specimens here are axinite crystals, pink and green tourmaline (gem type but not gem quality) Lepidolite (a lilac-coloured Mica in minute scales), also apatite, topaz, garnet, and several rare minerals.

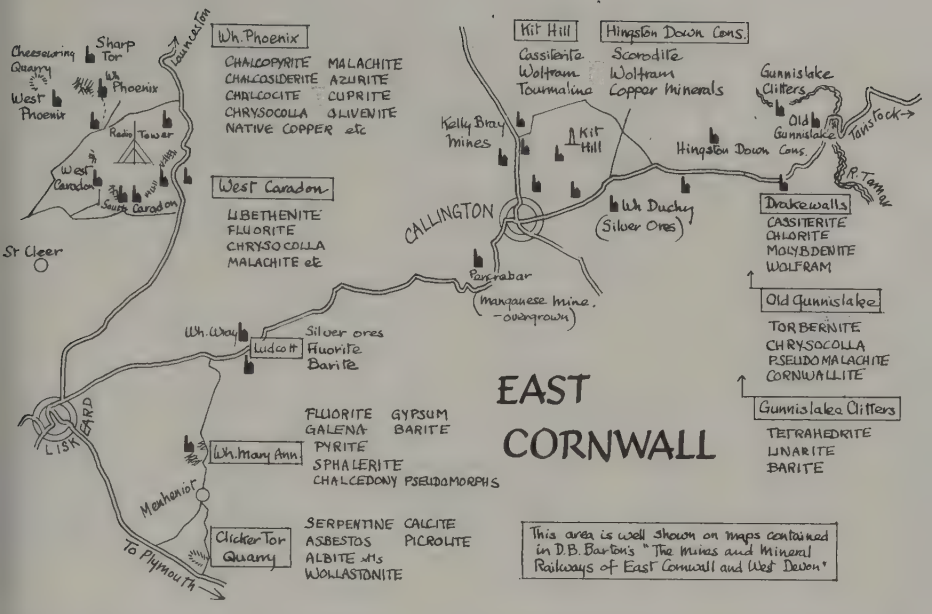

Wh. Cock
MAGNETITE APATITE
AMETHYST FELSPAR
COPPER FLUOR (Purple)
JASPER CARNELIAN
Crowns rocks + mine
GARNET
PEGMATITE
CHALCOCITE
CASSITERITE
Botallack mine
botryoidal HEMATITE LIMONITE
QUARTZ xtls
Parknoweth
Specular HEMATITE
GOETHITE
Wh. Edward
CASSITERITE PEGMATITE
JASPER CHALCEDONY
CALCITE FLUORITE
FELSPAR xtls Uranium Minerals
Wh. Castle
Beryl
Goslarite Garnet
Wh Cock
Crowns Mine
Count House
Botallack
West Wh Owles
Wh. Edward
Parknoweth
Queen's Arms
Wh Owles
BOTALLACK
Wh. Castle
Boswadden Mine
Wh. Drea
Wh. Drea
SIDERITE
LIMONITE
GOETHITE
HEMATITE
(Botryoidal)
ST JUST
To Pendeen Lighthouse
TO ST IVES
Mineral Shop
PENDEEN
Geevor Mine (working)
Tin Mine Tavern
Levant mine
TREWELLARD
CARN YORTH
BOTALLACK
TO ST JUST
Penberthy Crofts
GALENA CERUSSITE
DOLOMITE xtls PYROMORPHITE
LINARITE MIMETITE
BROCHANTITE BAYLDONITE
Ennys Wh. Virgin
ERYTHRITE PYRITE
QUARTZ xtls CHALCOPYRITE
DOLOMITE xtls ARSENOPYRITE
CHLORITE xtls GALENA
LANGITE
Ennys Wh. Virgin
Penberthy Crofts
A30
Pebbles
MARAZION
St Michael's Mt.
Goldsthney
Great Work
Wh Vor
Wh metal
Great Wh. Fortune
Beach Pebbles, Marazion.
CITRINE JASPER
CHALCEDONY AGATE
CARNELIAN SERPENTINE
AMETHYST FLINT
FELSPAR (porphyry pebbles)
Prussia Cove
SIDERITE xtls
QUARTZ xtls
Rinsey Cove
Rinsey
PEGMATITE
ARSENOPYRITE
FLUOR-APATITE
Magilligar Rocks
PEGMATITE
APATITE
ORTHOCLASE
LEPIDOLITE
TOPAZ
ARSENOPYRITE
PORTHLEVEN
Wh Penrose
SIDERITE
GALENA
QUARTZ
Wh Penrose
Wh. Rose (over grown)
Looe Bar
AGATE etc
MARAZION — PORTHLEVEN

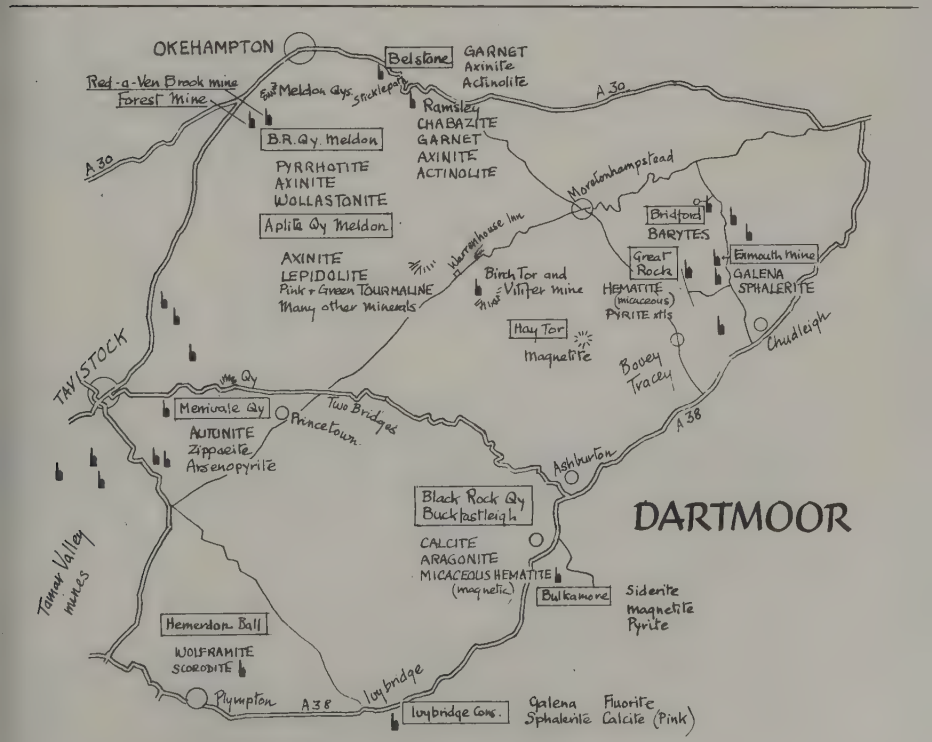

CAMBORNE — ST. DAY
Carn Brea Mines
* Restored engine houses
TOURMALINE
HEMATITE
QUARTZ xtls
AMETHYST
BLUE + GREEN
FLUORITE
CHALCOPYRITE
CHALCOCITE
MALACHITE
COPPER MINERALS
N. Roskear
SPHALERITE
FLUORITE
BORNITE
Wh. Agar *
E. Pool *
S. Crofty
N Roskear
CAMBORNE
A30
Carn Brea Mines
Carn Brea
REDRUTH
WOLFRAM
A30
Wh. Peevor
Wh. Busy
Wh. Gorland
Wh. Unity
St DAY
Carharrack
Tincroft
Lanner
Ting Tang
St Day Consols
St Day United
Go Kart Track
Wh. Gorland.
CHRYSOCOLLA
CLINOCLASE
CHENEVEXITE
CUPRITE
LIROCONITE
MALACHITE
† OLIVENITE
† PHARMACOSIDERITE
(† also at Wh. Unity)
St Day United
† QUARTZ xtls
† PYRITE
† CHALCOPYRITE
† ARSENOPYRITE
MILLERITE (a rare nickel Sulphide)
† Also at St Day Cons.)
Wh. Basset
TORBERNITE xtls
MALACHITE
CUPRITE xtls
CHALCOCITE
COPPER
FLUORITE
Tresavean
JASPER
COPPER
SPHALERITE
Four Lanes
Tolcarne
FLUORITE
Troon
To Holman's Mine + Quarry - GARNET xtls
For details of these mines see maps in D.B. Barton's "A Guide to The Mines of West Cornwall"


ARSENOPYRITE
HORNBLENDE
AXINITE
SCHORL
ACTINOLITE
Currick Du
Currick Du Mine
QUARTZ xtls
DOLOMITE xtls
CHALCOCITE
ERYTHRITE
ARSENOPYRITE
The 'Island'
Portmeor Bch
The Town — Streets not Shown
Harbour
AGATE PEBBLES (Pale)
Pedn Olver Pt.
ACTINOLITE
HORNBLENDE
MAP SYMBOLS
CASSITERITE - Found recently
Cassiterite - reported
Dumps
Quarry
Beach location etc
Wheal (Mine)
Crystals
ST. IVES
CAR PARK
Wh. Trewith
SCHORL in WHITE QUARTZ
MORION xtls
PYRITE xtls
LINARITE
Pitchblende
Cassiterite
Bismuth
Molybdenite
Lead, Zinc and Copper Sulphides
TO LAND'S END
HALSE TOWN
St Ives Consols
Once produced a wide range of minerals. Dumps now much overgrown.
Rosgarne Castle
CHALCOPYRITE
PYRITE
SPHALERITE
in Quartz-Chlorite boulders
Wh. Margery
CARBIS BAY
A3074
"CORNISH ARMS"
Wh. Providence
FELSPAR (Pink)
SCHORL
FLUORITE (Green + Purple)
COPPER SULPHIDES
"PEACOCK ORE"
SPHALERITE
CASSITERITE xtls
PYRITE
LIMONITE
QUARTZ xtls
Pitchblende
PEGMATITE
Andalusite
Topaz
Knill's mnt
Wh. Speed
Wh. Providence


Polberro Mine
CASSITERITE
Apatite
Vivianite
Fluorite
(extensive dumps, rather barren)
Blue Hills Mine
extensive, barren dumps
Wh. Kitty
Phenacite
Wolfram
Topaz
Cassiterite
etc
Wh. Coates
CASSITERITE
Andalusite
Native Copper
Cuprite
Chalcopyrite
Arsenopyrite
Wh. Prudence
Aracamite
Wh. Perran
PERRAN PORTH
Cligga Head
Cligga
Perran Gt St George
Perran Great St George
Bornite
Covellite
Smithsonite
Aracamite
Molybdenite
Honover Core
Good Fortune
Prudence
Glitter Club
Goldiethead
St Agnes Head
Polberro
Blue Hills
Goonlaze
Wh Friendly
West Kitty
Wh Kitty
ST AGNES
Beacon
Wh. Coates
Cligga Mine
CASSITERITE
WOLFRAM
ARSENOPYRITE
CHALCOPYRITE
TOPAZ
ANDALUSITE
Many others also recorded
Molybdenite
Stannite
Scorodite
Native Copper
Fluorite
Gold!


CENTRAL CORNWALL
To BODMIN
Treroil
Magnetite
Garnet
Maudlin
Garnet
Scheelite
Cronstedite
many more reported
TOPAZ
WOLFRAM
LÖLLINGITE
Wavellite
Gold
Castle-an-Dinas
Belowda (Topaz)
Indian Queens
Roche
Tresayes Qy
Bugle
St Dennis
Old Beam (White Beryl)
Hensbarrow Qy
WAVELLITE
AMETHYST
Wh Bunny (Turquoise)
(Orthoclase Biotite)
Trelavour Downs
Gunheath Qy (Turquoise)
Stenna Gwynn
Fowey Cons.
many minerals once reported — Rather barren now.
W. Fowey Cons
Goonvean Qy (Turquoise)
Carclase (Chloropal)
St Stephen
Tregargus Qy (apatite etc)
PAR
Ladock (gold)
St AUSTELL
S. Terras
Uranium mine many minerals reported
Gt. Dorogas (Bismite)
Crinnis (Silver)
St Austell Cons (Nickel Ores)
Gt Hewas (Liroconite)
Polgooth (Erythrite)
Stenar


Wh. Phoenix
CHALCOPYRITE MALACHITE
CHALCOSIDERITE AZURITE
CHALCOCITE CUPRITE
CHRYSOCOLLA OLIVENITE
NATIVE COPPER etc
Cheesewring Quarry
Sharp Tor
West Phoenix
Launceston
Radio Tower
West Caradon
South Caradon
St Cleer
West Caradon
LIBETHENITE
FLUORITE
CHRYSOCOLLA
MALACHITE etc
Kit Hill
Cassiterite
Wolfram
Tourmaline
Hingston Down Cons.
Scorodite
Wolfram
Copper Minerals
Gunnislake Clitters
Old Gunnislake
Tavistock
Kelly Bray mines
Kit Hill
Hingston Down Cons.
R. Tamar
CALLINGTON
Wh. Duchy
(Silver Ores)
Drakewalls
CASSITERITE
CHLORITE
MOLYBDENITE
WOLFRAM
Portrabar
(manganese mine, - overgrown)
Old Gunnislake
TORBERNITE
CHRYSOCOLLA
PSEUDOMALACHITE
CORNWALLITE
Wh. Way
Liddcott
Silver ores
Fluorite
Barite
EAST
CORNWALL
FLUORITE GYPSUM
GALENA BARITE
PYRITE
SPHALERITE
CHALCEDONY PSEUDOMORPHS
LISKEARD
Wh. Mary Ann
Menheniot
Gunnislake Clitters
TETRAHEDRITE
LINARITE
BARITE
Clicker Tor Quarry
SERPENTINE CALCITE
ASBESTOS PICROLITE
ALBITE etc
WOLLASTONITE
To Plymouth
This area is well shown on maps contained in D.B. Barton's "The Mines and Mineral Railways of East Cornwall and West Devon"


OKEHAMPTON
Belstone
GARNET
Axinite
Actinolite
Red-a-Ven Brook mine
Forest Mine
East Meldon Qys
Sticklepath
A30
Ramsley
CHABAZITE
GARNET
AXINITE
ACTINOLITE
B.R. Qy. Meldon
PYRRHOTITE
AXINITE
WOLLASTONITE
Aplite Qy Meldon
AXINITE
LEPIDOLITE
Pink + Green TOURMALINE
Many other minerals
Moretonhampstead
Bridford
BARYTES
Warren House Inn
Great Rock
Exmouth mine
GALENA
SPHALERITE
Birch Tor and Vitifer mine
HEMATITE (micaceous)
PYRITE etc
Hay Tor
Magnetite
Chudleigh
Bovey Tracey
TAVISTOCK
Merrivale Qy
Two Bridges
Princetown
AUTUNITE
Zippeite
Arsenopyrite
A38
Ashburton
Black Rock Qy
Buckfastleigh
DARTMOOR
CALCITE
ARAGONITE
MICACEOUS HEMATITE
(magnetic)
Bulkamore
Siderite
Magnetite
Pyrite
Tamar Valley mines
Hemerdon Ball
WOLFRAMITE
SCORODITE
Plympton
A38
Ivybridge
Ivybridge Cons.
Galena
Sphalerite
Fluorite
Calcite (Pink)

IDENTIFICATION CHART OF SOME CORNISH & DEVONSHIRE MINERALS

COLOUR	GLASSY	"PORCELAINOUS"	DULL or EARTHY	METALLIC
BLACK	Cassiterite Schorl *Sphalerite Garnet	* Many rock-forming minerals Serpentine	Pyrolusite Pitchblende (W) Tenorite	Magnetite (sub-metallic) Hematite " " Goethite " " *Wolfram " "
GREY	Quartz	Chalcedony (W)	Chlorite	*Galena Chalcocite
BLUE	*Fluorite Azurite Many Copper minerals	Chalcedony (W)	Chlorite Many copper minerals	Covellite Tarnish on copper sulphides
GREEN	Malachite *Fluorite Many copper minerals	Praze (W) Jasper (W) Malachite Chrysocolla Some rock-forming minerals	Chlorite Talc Serpentine (W) Malachite Many copper minerals	Tarnish on copper sulphides Stannite (green-grey)
BROWN	Cassiterite Axinite *Sphalerite (R) Garnet	Chalcedony (W) *Siderite Jasper (W)	Serpentine (W) Pitchblende Limonite	Pyrrhotite Pyrite (Tarnish)

	*Fluorite	Siderite	Limonite stains	Pyrites
YELLOW	Carnelian	Opal (W)		Copper pyrite
	Garnet	Chalcedony		Gold
	*Sphalerite (R)	Jasper (W)		
	*Calcite	*Dolomite		
REDDISH or PINKISH	*Fluorite	Jasper	Erythrite	Bornite (Bronze)
	Carnelian	*Felspar	Serpentine	Copper
			Hematite	Cuprite (Ruby red)
PURPLE	Amethyst			Tarnish on Bornite
	*Fluorite			
WHITE	Quartz	*Felspar	Talc	Silver
	*Calcite	*Calcite	Kaolin	Arsenopyrite
	*Fluorite		Steatite (W)	
COLOURLESS	Quartz			
	*Calcite			
	*Fluorite			

(W) = Waxy (R) = Resinous

* Distinct cleavage planes likely to be observed.

The **Micas** are not included as they are distinctive enough as a group.

This is a rough guide only. Allowing for frequence of occurrence it should be at least reasonably accurate. But minerals do not lend themselves easily to this sort of chart and there is necessarily much overlapping of colour and lustre in most specimens.

THE QUARTZ FAMILY TREE

as found in Cornwall and Devon

SILICON OXIDE (SiO_2) or SILICA

Clear (Crystals)	ROCK CRYSTAL	Colourless
	MILKY QUARTZ	White (opaque)
	CITRINE	Yellow
	CAIRNGORM	Grey, smoky brown
	AMETHYST	Purple
	+ROSE QUARTZ	Rose pink
Translucent (No Crystals)	CHALCEDONY	Yellow-blue-grey
	CARNELIAN	Orange red
	AGATE	Wavy bands and rings
	+ONYX-SARDONYX	Straight bands
	+MOSS AGATE	Moss-like markings
	PRAZE	Dull leek green (less translucent)
	+CHRYSOPRAZE	Clear, grass green
	OPAL	Cream, white, yellow
Opaque (No Crystals)	FLINT	Grey - black
	CHERT	Grey - cream
	JASPER	Brown - Red-Yellow-Green
	+HELIOTROPE	Green with red flecks

Hardness of all varieties **except** OPAL is 7

Hardness of OPAL is 5 - 6

+Reported but not confirmed

SOME MINERALS LIKELY TO BE FOUND IN CORNWALL

(Arranged in their chemical groupings. Letters refer to hardness - see below)

ELEMENT	
Native Copper	S
SULPHIDES	
Pyrite	H
Chalcopyrite	M
Chalcocite	S
Bornite	S
Arsenopyrite	H
Galena	S
Sphalerite	M
OXIDES	
Cassiterite	HH
Pyrolusite	SS-H
Pitchblende	H
Tenorite	SS
Cuprite	M
Magnetite	H
Hematite	SS-H
Limonite	SS-H
CARBONATES	
Azurite	M
Malachite	M
Siderite	M
Calcite	S
Dolomite	M
HALIDE	
Fluorite	M
TUNGSTATE	
Wolfram	M
SILICATES	
(Quartz varieties see page opposite)	
Felspars (i.e. Orthoclase)	H
Pyroxenes (i.e. Bronzite)	H
Amphiboles (i.e. Horneblende)	H
Micas (Muscovite, Biotite)	SS
Serpentine	S-M
Steatite (Soapstone)	SS
Talc	SS
Kaolin (China clay)	SS
Tourmaline (Schorl)	HH
Garnet	HH
Chlorite	SS (but very tough)
Axinite	HH
Chrysocolla	SS

Simple Hardness Scale for above

Mohs		
7	HH =	Very hard = Quartz or harder
$6\frac{1}{2}$	H =	Hard, scratched by Quartz (steel file)
$5\frac{1}{2}$	M =	Medium, scratched by Quartz (steel file, penknife or glass)
3	S =	Soft, scratched by Quartz (steel file, penknife, copper coin)
$2\frac{1}{2}$	SS =	Very soft, scratched by Quartz (steel file, penknife, copper coin and fingernail)

See page 46 for Moh's scale of hardness.

ST. JUST	Wh. Edward	361328	Jasper, Autunite, Orthoclase, Pitchblende and many more
	Wh. Owles	368322	Specular Hematite, Copper Chlorides and many more.
	Wh. Cock	363338	Magnetite, Garnet, Copper, Carnelian and many more.
	Botallack	365330	Quartz crystals, Hematite, botryoidal Goethite.
	Levant	370347	Schorl, Garnet, Copper Chlorides, Rock forming minerals.
	Geevor	375346	Siderite, Fluorite, Cassiterite (the Ore).
ST. IVES	See detailed map.		
GWINEAR	Wh. Alfred	578371	Silver and Silver ores (once), Pyromorphite etc.
	Wh. Alfred Consols	585369	Many ore minerals.
	Trevaskis	610380	Chalcedony, Chlorite (rosettes) Cassiterite
	Wh. Carpenter	586353	Bayldonite, Malachite, Chrysocolla etc.
ST. HILARY	Penberthy Croft	554314	Many Copper and Lead minerals.
	Ennys Wheal Virgin	562326	Erythrite, Dolomite, Quartz crystals.
	Wh. Penrose	635252	Galena, Siderite, Pyromorphite etc.
CAMBORNE	Carn Brea	680412	Garnet, Blister Copper etc.
	Wh. Basset	690398	Torbernite, Cuprite crystals, Malachite.
GWENNAP	Tresavean	722394	Jasper, Copper, Malachite, Sphalerite.
	Consols	748420	Quartz crystals, Pyrite.
	Wh. Gorland	732428	Olivenite, Clinoclase, Chenevixite, Scorodite.
	Wh. Unity	738430	Cuprite, Fluorite, Pharmacosiderite, Clinoclase.
	Wh. Jane	783434	Ores of nickel once found here.
ST. AGNES etc.	Gt. Retallack	788562	Silver, Garnet, Erythrite, Sphalerite, Hedenbergite.
	Wh. Kitty	725509	Wolfram, Topaz, Apatite, Cassiterite.
	Polberro	715514	Apatite, Fluorite (Purple), Cassiterite.
	Wh. Coates	700500	Cassiterite pseudomorphs after Felspar.

	Cligga	739537	Wolfram, Stannite, Topaz, Cassiterite.
	Perran St. George	745536	Bornite, Smithsonite, Atacamite, Covellite.
	Castle-an-Dinas	945623	(Recently levelled, maybe inaccessible), Topaz, Wolfram.
	South Terras	934523	Uranium mined here in recent years.
LAUNCESTON	Treburland	238795	Once noted for Manganese minerals. Overgrown.
CALLINGTON	Phoenix	263723	Olivenite, Malachite, Chrysocolla, Azurite, Chalcosiderite etc.
	West Caradon	262702	Libetheinte, Fluorite.
	Wh. Mary Ann	288638	Fluorite crystals, Chalcedony, pseudomorphs etc.
	Kit Hill	376713	Cassiterite, Wolfram, Tourmaline, Arsenopyrite.
	Hingston Down	388712	Sulphides, Wolfram, Copper ores etc.
	Gunnislake (Old)	430720	Torbernite, Pseudo-malachite, Chrysocolla.
	Gunnislake Clitters	421723	Tetrahedrite, Linarite, Barite.
	Drakewalls	424707	Cassiterite, Molybdenite, Chlorite.
DEVON			
OKEHAMPTON	Meldon Aplite Qy.	568920	Tourmaline (gem) Axinite, Lepidolite etc.
	Meldon B.R. Qy.	570925	Pyrrhote, Wollastonite
	Ramsley	650930	Garnet, Axinite, Actinolite, Calcite, Chabazite.
	Merrivale Qy.	546753	Autunite, Zippeite.
PLYMOUTH	Hemerdon Ball	572583	Wolfram, Cassiterite, Scorodite.
EXETER	Bridford	833865	Barite crystals
	Great Rock	820817	Micaceous Hematite, Pyrite crystals.

(Most of the minerals mentioned above were found at these sites recently by the author.)

Old books and museum labels may confuse those used to more modern naming of minerals.

	OLD	NEW (as in 'Dana')
	ANTIMONITE	STIBNITE
	BARYTES*	BARITE
	BITUMEN	ASPHALTUM
(ZINC)	BLENDE	SPHALERITE
	CHALCOLITE	TORBERNITE
	CHALYBITE	SIDERITE
	CHESSYLITE	AZURITE
	CROMFORDITE	PHOSGENITE
	CYANOSITE	CHALCANTHITE
	DIALLOGITE	RHODOCHROSITE
	ERUBESCITE	BORNITE
	FAHLERZ	TETRAHEDRITE
	FLUOR (SPAR)	FLUORITE
	KERATE or CERAGYRITE*	CHLORAGYRITE
	LEUCOPYRITE	LOLLINGITE
	LUNNITE	PSEUDOMALACHITE
	MELACONITE	TENORITE
	MISPICKEL	ARSENOPYRITE
	MUNDIC	PYRITE
(IRON)	PYRITES*	PYRITE
	PITCHBLENDE	URANINITE
	TITANITE	SPHENE
	WOLFRAM*	WOLFRAMITE

The old endings '-ine' or '-ane' have, in many cases been changed to the common '-ite', e.g. STANNINE to STANNITE.

*Still in common use in this country

Mohs Scale of Hardness

1	Talc	6	Orthoclase (Felspar)
2	Gypsum	7	Quartz
3	Calcite	8	Beryl
4	Fluorite	9	Corundum
5	Apatite	10	Diamond

Heavy Minerals (local)
(with a specific gravity over 6)

Arsenopyrite	Galena
Cassiterite	Copper
Wolframite	Cuprite
Pitchblende	

BOOKS ON MINES AND MINERALS

A Handbook to the Mineralogy of Cornwall and Devon, (1871), J.H.Collins. (Unfortunately out of print but available in libraries.)

Dana's Textbook of Mineralogy, W. Ford. (The mineralogist's bible.)

Rutley's Elements of Mineralogy, H. H. Read. (Recommended for students.)

Metalliferous Mining Regions of S.W.England, H.G.Dines (two volumes). (In most libraries of the area: Lists and describes most mines in the region.)

Pebbles on the Beach, C. Ellis. (Covers this aspect of collecting.)

A Guide to the Mines of West Cornwall, D. B. Barton.

Mines and Mineral Railways of East Cornwall and West Devon, D.B.Barton.

Rocks and Minerals, Paul Hamlyn. (Colourful and inexpensive: highly recommended to the amateur and beginner.)

Minerals, Rocks and Gemstones, R. Borner.

An Introduction to the Mineral kingdom, R. H. Pearl. (Includes good colour photographs of British minerals.)

Mineralogy, A First Course, J. Sinkankas.

BOOKS ON GEOLOGY

An Introduction to the Geology of Cornwall, R. M. Barton.

The Observer's Book of Geology, I. O. Evans.

British Regional Geology, S. W. England, H. Dewey.

Geology of the Lizard and Meneage, J. S. Flett (Mem. Geol. Sur.) The other memoirs covering Cornwall are out of print, but available in some libraries. Each is to be read in conjunction with the relevant Geol. Sur. map which it explains (see below).

MAPS

Ordnance Survey maps. 1" to 1 mile. (Especially Nos. 175, 185, 186, 189, 190.)

Ordnance Survey maps. $2\frac{1}{2}$" to 1 Mile. (For local Detail.)

Geological Survey maps. 1" to 1 mile. (Showing mines and lodes.)
(All these use the same grid reference numbering.)

SHOPS specialising in mineral specimens and equipment:

Gregory, Bottley and Co., 30, Old Church Street, London S. W. 3. (The largest mineral dealers in Britain. Detailed catalogues available.)

The Tin Mine Tavern, Trewellard, St. Just, Cornwall. (A mecca for local collectors.)

Reg Simpson, Island Square, St. Ives, Cornwall

R. F. D. Parkinson, Shepton Mallet, Somerset (the largest West Country dealer.)

MUSEUMS. It may happen that after reading this book and trying to put its advice into practice you are disappointed with the results. There is an element of luck in picking the right mine, then in picking the right part of the dumps and in picking up the right lumps of rock; skill and experience are valuable but not everything. It may be that the best available to the casual collector are not good enough for you. You may not have had the time, or the opportunity to give this pursuit a fair trial. But successful or not, having studied the subject and attempting to put your knowledge into effect you can hardly fail to get extra enjoyment and understanding from visiting a museum. And once you are interested in mineral collecting, visits to the museum collections play a major part of the activity. Learning to recognise minerals, even if the comparisons between your finds and museum pieces is rather deflating, is an essential aid to your understanding and skill in recognition.

When in Cornwall a visit to the County Museum in Truro is particularly recommended. The mineral section here consists chiefly of the world-famous Rashleigh collection - which was formed in the late eighteenth and early nineteenth Centuries in the hey-day of mining - and, of course, of collecting. The pieces represent the finest of the specimens found at that time in Cornwall. The emphasis is on crystal form and certain groups of minerals, notably the silicates, are not completely represented. whilst some minerals not discovered or recognised until recent years are missing.

For a completely representative collection go to the British Museum, Natural History Section, in South Kensington. There you will not only find an exhaustive display of most known minerals, well indexed, but can make use of an identification service if you have a difficult specimen to pin down. The collection of a more recent collector and a famous mineralogist, Sir Arthur Russell has been left to the British Museum and choice pieces are on view here.

Next door, in the Geological Museum, is another famous collection, that of Henry Ludlam, compiled in the latter part of the nineteenth Century. This one is a comprehensive collection of minerals of the British Isles, and inevitably the section containing those of Cornwall and Devon is the dominating one.

In Cornwall, as well as the one in Truro, there are large mineral collections at the Geological Museum in Penzance and at the Camborne School of Mines. The Penzance Museum houses the very fine, comprehensive collection belonging to the Royal Geological Society of Cornwall. At the School of Mines is a very complete collection of specimens from all over the world. Besides these, of course, are numerous smaller local Museums whose displays are also very interesting.

CLUBS for the amateur mineralogist.

Unlike America, where dozens of clubs are run for the benefit of amateur mineralogists, no independent organised club exists here. Recently the Royal Geological Society of Cornwall has developed a subgroup of members whose chief interest is in collecting minerals and organising outings for this purpose. Their headquarters is in the museum attached to the Municipal buildings at Penzance.

ROCKS.

stalwarts, rocks

& gemstones.

Ref.