Gemstones

Jocelyn Thornton

Originally published in 1985 in the
Mobil New Zealand nature series.

Contents

Acknowledgments

The author thanks Ray Stokes and members of the New Zealand Mineral Club for the loan of cabochons and rough rock and for advice.

Further reading

The New Zealand Rockhound, Natalie Fernandez

Field Guide to the Geology on New Zealand, Jocelyn Thornton

New Zealand Jade, Russell Beck

Legends in the Rocks, Maxwell Gage

Introduction

By definition, a gemstone is beautiful, durable and rare. Although New Zealand lacks the commonly accepted "precious gems" (diamond, ruby, sapphire, emerald), many local stones deserve our recognition.

Most prized would be greenstone or nephrite jade in all its variety, still one of the most beautiful gemstones to be found here. Most widespread would be the many forms of the mineral silica, which is found in almost all rocks throughout the country and keenly sought by gem hunters. Why is something so common classed as a gemstone? Silica is not only durable - it is harder than steel - but it exists in a tremendous range of colours and patterns, such that for everyone there must be a piece they would consider perfectly beautiful. Since every piece is different, the gem is unique if not rare.

Stones of "gem quality" are free of flaws, they have good colour and transparency (where applicable) and are large enough to be cut and worn effectively. But even in the world's major gem fields the number of top-quality stones is limited, and poor stones are most often found. Gemstones are members of widespread mineral families, most of which are very ordinary in appearance and never considered jewels.

New Zealand stones make up a number of such poor relations. Our rubies and sapphires, tourmalines and peridots are included in this book because of the names they bear, not because they are of gem quality. Generally, they are rare minerals and are collected as such. Other gems shown here are good-quality but unusual varieties, such as the green garnets which come as a surprise to many who think garnets are always red. Thulite, rhodonite and kyanite are some lesser-known semi-precious stones to be found.

The more adventurous gem cutters have discovered many interesting materials which polish well and are attractive, although certainly not precious. Collectors are encouraged to study our odd and unusual rocks.

Few people need urging to look at beach pebbles - even the most casual traveller picks up a pretty stone as a souvenir of a picnic stop - and beaches are still a freely available source of gemstones. While most beach areas will furnish the knowledgeable collector with one rare gemstone, there are many other colourful stones that should be identified. The section on rock types and beach pebbles should help the beginner in this purpose.

The stones illustrated in this book are not generally the finest examples from each area, since these are nearly always owned by local collectors. The photographs show the kinds of stones available to visitors who are prepared to search carefully and patiently according to the rarity of the material. However, it is a sad fact that once a stone is removed Nature does not automatically replace it with another of equal quality.

Gemstones are a finite resource, and collectors should not be greedy, taking no more than they can use. Many gem cutters (lapidaries) prefer to swap or buy their materials - for jade this practice is usually essential.

The best sources of material and knowledge on the subject are the various local rock and mineral clubs, in which enthusiasts meet to learn the skills of identifying and cutting stones and to share the pleasures of field trips. There is a National Association of New Zealand Rock and Mineral Clubs which each year runs national competitions, and many clubs hold shows for the public. Rock shops provide rough material as well as the machinery used to turn it into polished gems.

Polishing is done in several ways, all with coarse to fine grits which grind the rough surfaces of the stones smooth. A polishing powder provides the final gloss Tumbled stones are worked in a revolving or vibrating drum which polishes many stones at one time They are usually beach pebbles or hammer-broken stones of irregular shape Stones shaped with a smooth, rounded top surface are called cabochons, from the French word for a bald head. Cabochons, or cabs, begin with a slice of rock cut with a saw blade edged with

diamond chips The slice is saw-trimmed to the selected shape, the edges are rounded on a grindstone and the rough may then be finished in a tumbler. When this method is employed the stone is called a preform. More usually, the stone is fixed to a handle and held against sandpapers and a polishing pad spinning on a machine. Cabochons may be standard-sized ovals or circles to fit commercial jewellery mounts, or they may be any fancy shape the lapidary may decide is best for the particular stone.

Clear stones, of which the diamond is the most familiar example, are usually cut with a series of flat surfaces or facets which reflect light and increase the stone's brilliance Faceted stones are ground and polished on a flat wheel with the stone mounted on an arm which controls the number and angle of the cuts very precisely. While there are lapidaries in New Zealand who facet fine gemstones, they generally work with overseas material because very few of our stones are facet grade; they mostly have internal flaws or cloudy patches.

Anyone may collect gemstones on beaches or rivers with public access, but permission must be gained for entry to all private property, and the usual rules of courtesy apply - no guns, no dogs, no litter, and all gates must be left as they were found; especially, collectors mustn't leave holes or broken rocks which could endanger animals. The Department of Conservation issues permits for collectors to enter their land, especially in the Coromandel area where special rules apply. Collecting in national parks is not allowed.

Equipment for beach collecting consists of a bag for stones and maybe a geological hammer to dislodge half-buried stones or chip fresh surfaces This type of hammer has a pick end as well as a squared hammer head and is made of tempered steel to lessen the likelihood of splintering. Heavy hammers and cold chisels may be used on massive rocks such as jasper or rhodonite, but protective goggles or unbreakable sunglasses should be worn. Serious collectors also use geological maps and keep a record of the localities where their material was found.

It takes practice to recognise good-quality stones. Beginners often take home material which will never polish well, with pits, holes and cracks or stones that are just too open in texture or soft. Such stones may be kept for their sentimental value or discarded later when the collector becomes a more experienced lapidary.

However, many people collect rocks because they enjoy their colour and pattern and feel no desire to turn them into polished stones.

In the following photographs the stones are about actual size, with the exception of rubies and sapphire on page 17 Here the small crystals are enlarged to about one and a half times their true dimensions

Return to Contents

Greenstone or nephrite jade

The Maori made tools and ornaments of pounamu, a material both tough and beautiful. Europeans called it greenstone without realising that it was actually nephrite, one of the two minerals so highly valued as jade. (The other, jadeite, is not found in New Zealand.)

Most New Zealanders think greenstone is always bright green, but the cabochons show that nephrite comes in many colours, and while top-quality nephrite lets the light shine through it, other equally lovely stones may be opaque.

Waterworn or beach jade has a greasy-looking surface which sometimes shows its true colour, but more often a jade boulder has a thick, weathered rind - a yellowish or grey outer layer which may even be slightly fibrous.

Under the microscope nephrite is a densely felted material, and unless it is flawed with natural breaks it is almost impossible to knock part of the rind off a boulder.

Jade does not have the crystalline or sparkling appearance of the green quartz and schist boulders in similar locations. Green serpentine is equally common where jade is found; it is only slightly softer than jade, and very closely related to it, and there are many intermediate stones or semi-nephrites. Nephrite is a deceptive stone. Until it was cut, the stone at the top of Plate 1 did not look smooth enough to be jade, but the waterworn examples at the bottom had shining green patches and were obviously nephrite boulders.

Most New Zealand nephrite comes from the mountains between the Taramakau and Whitcombe Rivers and the river plains and beaches below them, although smaller nephrite deposits have been found in Central Otago.

Plate 1

Return to Contents

Patterned jade

Nephrite jade occurs also in a variety of patterns.
1. Pale nephrite with brown flecks is sometimes called kokopu, for the speckled mountain trout which the pattern resembles. The cabochon has a brown iron-rich border.
2. In this stone the flecks are in clusters, formed of mineral growths called dendrites from their often tree-like shape.
3. Nephrite is closely related to serpentine in which the mineral asbestos is found. Some jades contain seams of this fibrous material, which has been altered to a kind of nephrite. It can be coarse and hard to polish, but can also add shimmering lines of colour to a stone.
4, 5. Pale or golden rind on the outside of a jade boulder may be of sufficiently good quality to polish.
6. Slice showing the yellow rind and a variety of paler greens around an inner deep-green core.
7. Some boulders have yellow flower-like patterns in a translucent green and this stone is rare and highly prized, it seems to come from the area near Marsden,
8. In this cabochon a white pattern is visible within the apple-green stone,
9. Pendant from a stone with a golden-orange rind and agate-like banding in the green jade.

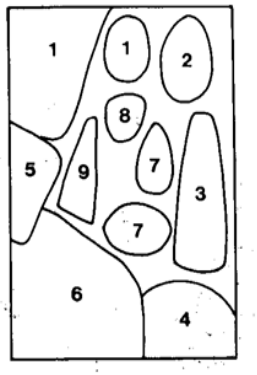


Plate 2

Return to Contents

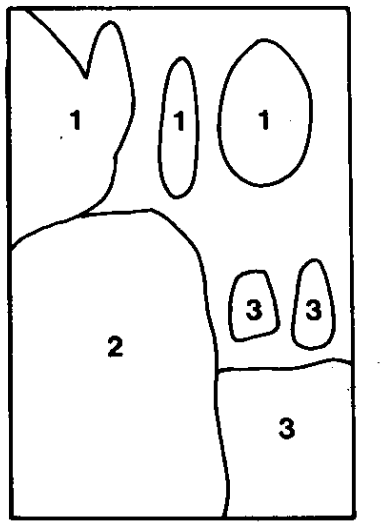
Serpentine and its associates

Serpentine is a dark-green rock often used overseas as a building stone or for small ornaments; in New Zealand it is generally quarried as a source of magnesium for fertilisers. (Strictly speaking, serpentine is the magnesium silicate mineral which makes up the rock serpentinite.)

1. Tangiwai greenstone is bowenite, a translucent, slightly fibrous variety of serpentine with an oily appearance and a bluish or olive green colour. It is softer than nephrite and tends to have cleavage or fracture lines through it. Ornaments and pendants made from this stone can be very beautiful, especially when worn where the light can shine through them. Like nephrite, bowenite can contain areas of shimmering fibres, as in the right-hand cabochon. The traditional source of bowenite is Anita Bay at the entrance to Milford Sound.

2. The soapstone used for this carving of a baby seal was found at the old asbestos mine in the upper Takaka Valley. Soapstone is the massive variety of talc, which is used for carving as it can be easily cut with a knife. It comes in shades of green and brown, is easily scratched by a fingernail and has a very greasy texture (talcum powder is just finely ground talc). It is generally found with serpentine and should be handled with care as it may contain asbestos fibres.

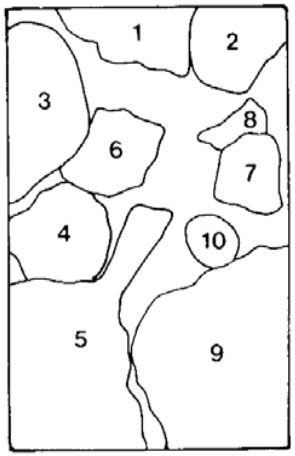
3. Serpentine from the old asbestos mine in the upper Takaka Valley contains small patches of the pink manganese silicate thulite, which makes an attractive gemstone, especially with the contrasting green of the serpentine.



Return to Contents

Beryl, tourmaline corundum (ruby and sapphire)

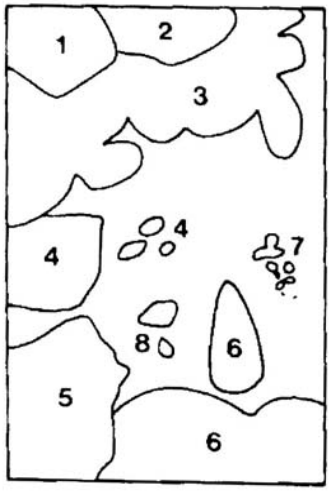
Precious gems are flawless examples of these minerals. which are rare in New Zealand.
1, 2. Emeralds and aquamarines are varieties of the mineral beryl, which occurs in blocky, six-sided crystals with flat ends. Pale green beryl is from Deep Creek near Charleston. Pale blue beryl in granite, (2), from Turiwhate on the Taramakau River, is too opaque to be cut as an aquamarine
Most of our tourmalines come from Golden Bay. They are members of a family with a complicated chemistry but a single structure and generally form needle-shaped crystals with grooved or striated surfaces and a triangular cross-section.
3. Brown dravite in granite from the Parapara Inlet.
4. Tourmaline, in white calcite and green chlorite, from Canaan Valley on Takaka Hill.
5. Black iron-rich schorl in chlorite schist from Richmond Flat.
6. Minute green needles in goodletite (see below) are gem elbaite tourmaline far too small to be cut as gems.
Ruby and sapphire are varieties of the mineral corundum
7. Ruby or red corundum in crystals measuring up to 2 mm, together with chrome-green mica and minute green tourmaline crystals, found in scattered boulders near Hokitika in the rock called goodletite.
8. Larger rubies in hornblende from a single boulder found further south.
9. Rare blue sapphire occurs with the tourmaline at Richmond Flat.
10. Even rarer are waterworn pebbles found on the beach on at Orepuki in Southland. Their source is unknown.



Return to Contents

Garnet

Garnets are a group of minerals with different combinations of elements in a single atomic pattern. They occur in a wide range of colours.
Grossular is the calcium aluminium garnet. Massive varieties are found not in single crystals but in an interlocking mass.
1. A stone from the beach at Orepuki, showing a dark crystal of diopside in the garnet.
2. A piece of massive garnet from Maitai River, Nelson.
3. Rough and polished pebbles from Orepuki beach. Wave action has removed from these stones any weaker material and the diopside which usually occurs with the grossular. All that remains is smooth, heavy and waxy-surfaced garnet in all shades of green and gold.
4. Grossular crystals from Red Hills, Otago, in the peach-coloured variety called hessonite. They are rare and inaccessible and too cloudy to facet well.
Red garnets are generally the iron-aluminium stone almandine or the rarer manganese aluminium garnet pyrope, or a mixture of the two. Very few in New Zealand are large or clear enough to facet.
5. Garnet crystal in granite, Charleston.
6. Almandine in gneiss from the lower Westland beaches. The crystals are large, fractured and opaque, but they can be tumbled.
7. Loose garnets from old gold dredge concentrates.
8. Fragments of garnet from the rocks at Kakanui Beach where a few have been large enough to cut, although most are badly shattered.



Return to Contents

Quartz

Silica is the most common material found by gem hunters; its crystalline form is quartz or rock crystal. Most quartz found will be massive, composed of small, interlocking crystals. Pebbles of this material are the most widespread pale stones on our beaches. Large well-formed crystals are uncommon and more likely to be found in cavities in volcanic rocks in Canterbury and the Coromandel area or where other rocks have been fractured and cemented.

1. Colourless quartz crystals from the Coromandel area. Clear quartz crystals sparkle and are often misnamed diamonds. "Herkimer diamonds" are found in New York State, but less well known are "Mt Somers diamonds", both quartz.

2. Purple quartz is **amethyst.** The colour comes from traces of iron affected by radiation, and some amethyst fades after long exposure to sunlight. Most New Zealand amethyst has too many flaws for faceting. These crystals from Ngaumu near Masterton show the colour zoning common in amethyst.

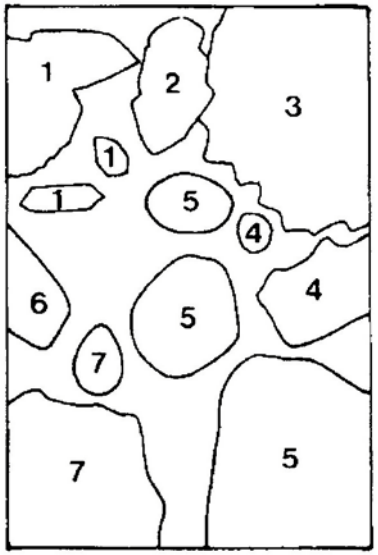
3. Amethyst crystals from the Rakaia Gorge containing black goethite needles.

4. Small examples of amethyst crystals in agate nodules.

5. Polished pieces and a chunk from seams of pale amethyst and white quartz found at Tokatea above Coromandel township and at Waihi.

6. Small patches of pink rose quartz have been found in the granite near Rahu Saddle on the Lewis Pass road.

7. Pale green quartz crystals with internal flaws, from the Clent Hills.



Return to Contents

Chalcedony and agate

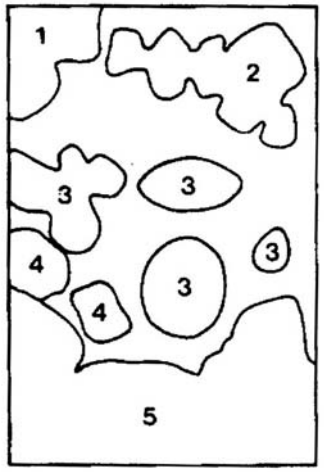
Quartz crystals sometimes grow in layers so small they can barely be seen under a strong microscope. Such cryptocrystalline silica is called chalcedony (pronounced kalsedonee). The layers may build up to fill cracks and cavities in sediments, but they mostly occur in holes left by gas bubbles in volcanic rocks.

Agate is banded chalcedony. Impurities and variations in the amount of siliceous solution passing through the rock give rise to different colours and textures in the layers.

A hollow nodule is known as a geode. With time the volcanic rock enclosing the nodules weathers to form soil and the hard agates roll free.

Unless indicated otherwise, all the stones in Plate 7 are from Canterbury.

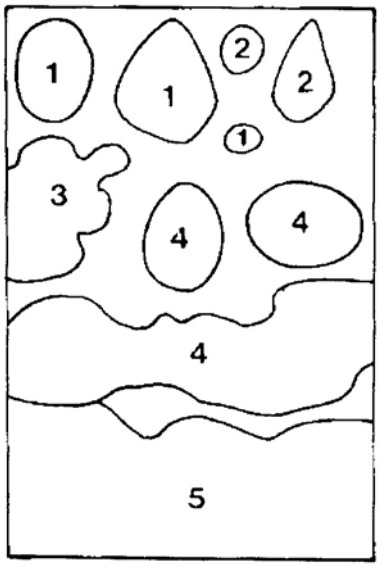
1. Seam chalcedony with a rough surface and a river-worn pebble, from the Coromandel area.
2. Tumbled chalcedonies in various colours.
3. Banded agates. Chalky surface layers, caused by exposure to the weather for a long time, especially on beaches, can be seen on the stones at left. These layers can be removed by tumble-polishing or grinding, but the inner stone may show no pattern at all. Often the stone is improved by allowing the weathered pattern to remain.
4. A dark nodule of chalcedony and the clear polished form. When held up to the sun the stone shows its inner colour.
5. Rough agates, showing the potato-like appearance of a nodule newly out of the rock and the waxy texture of a broken surface. Agates should never be hammer-broken as the blow will put shatter cracks all through the stone.



Return to Contents

Onyx and eyes

1. Onyx is agate with straight parallel bands, especially the black and white commercial agate which today is often produced using dyes. (The pale green and cream onyx used for the carving of ornaments is banded calcite, a much softer stone - see page 53.)
2. Sard, or golden to brown agate and sardonyx, with straight bands of brown-gold and white. Both are found in Canterbury and the Coromandel area
3. Some agates contain small concentric rings or eyes, generally on the surface of the stone, while the inside may be of plain quartz crystals These are from Mt Somers and Whitecliffs in Canterbury.
4. A bull's-eye effect may be gained by cutting an onyx parallel to the bands and then doming a cabochon These stones and the agates below with parallel and eyed white and yellow bands are typical of those of the Whitecliffs area, where the landowner has arranged that digging be under the strict control of the Canterbury Mineral and Lapidary Club.
5. Patterned grey, black and white onyx is very common in Canterbury, especially on the beaches. The stone at left shows the rough surface of an agate freshly weathered from the rock, while the bottom right-hand stone shows a similar onyx from Birdlings Flat beach. Its surface has been smoothed by tumbling along the beaches.

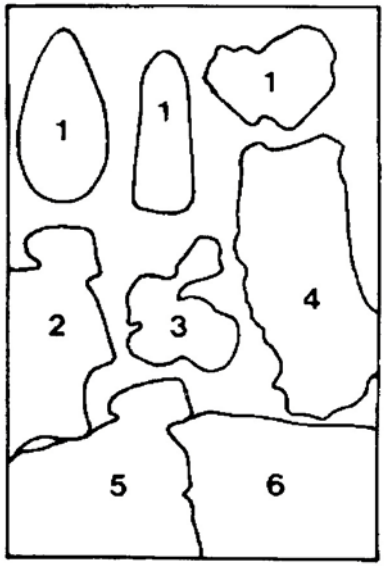


Return to Contents

Carnelian

Carnelian is red or orange agate, stained with iron which may have been part of the original silica solution forming the rock or may have been introduced later into the agate from the soil; many carnelians have a red colour in cracks or on a broken surface or the outside of the nodule while the inside is colourless. Cornelian was the original name for these stones, but carnelian is more often used today.

1. Cabochons and slice from the Te Mata area, Coromandel.
2. Bubbly (botryoidai) carnelian and a thin plate, with a tumble-polished sliver from such a plate showing cracks of a deeper colour.
3. Moas used agates and other pebbles as gizzard or crop stones to grind their food. Rounded carnelian pebbles with polished surfaces or whitish rinds may be found on some hillsides. Note that further polishing destroys their value as fossils.
4. A slice of sardonyx from the Coromandel area, showing how the original cavity was first lined all round with agate and then the centre was filled with onyx layers.
5. Carnelian also weathers with a white pattern which will be lost if the stone is polished. When thin, the weathering appears blueish.
6. Carnelian from North Auckland at Curnow Road, where the Whangarei Rock and Gemstone Club have a lease on crown land on behalf of rock collectors who pay a very reasonable fee.



Return to Contents

Moss agate

Moss agates are so named because they contain moss-like growths, not of plants but minerals that grew as the stone was being formed. This could have occurred while the silica was still in gel form, or maybe in empty or gas-filled cavities. We now sometimes find agate nodules with spaces left after calcite crystals have been etched out, and in these spaces are the same branching mineral growths. They can be fine or coarse and occur in a wide variety of patterns and colours from white through greens, yellows, reds and browns to black.

The agate around them may be clear chalcedony, straight onyx or agate banded in a multitude of patterns and may also include quartz crystals or amethyst.

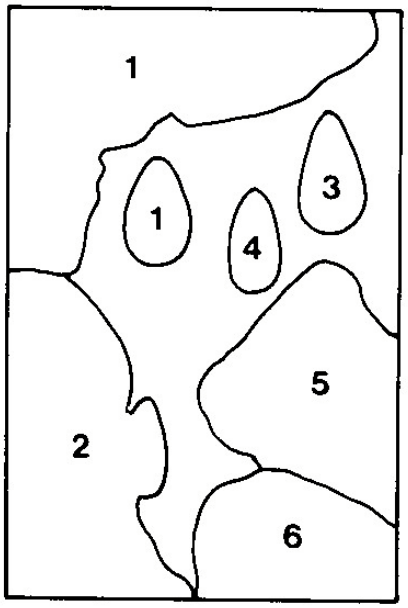
Moss agate is most likely to be found in Canterbury, although the stone at top left is from south of Oamaru. While most patterns occur anywhere, moss cutting across onyx seems to be mostly found in the Rangitata River area, and there is a coarse white moss in the Rakaia Gorge area.

Moss agate is usually visible in traces on the outside of a broken face, but only cutting will reveal the true quality of the stone. Whole nodules with a cut and polished face can be more attractive than sections rut out as cabochons. The moss is softer than the agate and tends to undercut. Stones containing thick moss are therefore less suitable for tumbling as the moss will wear away and leave lower areas with a dull surface.

Return to Contents

Agate with inclusions

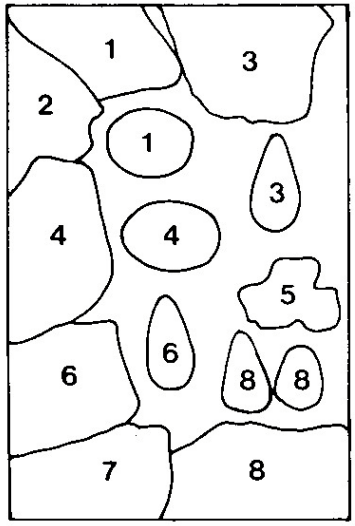
Moss-like minerals are not the only minerals found in agates.
1. North of Moeraki the beach agates contain black manganese which has grown in a treelike pattern called dendrites, together with brownish or yellow spiky needles known as sagenite. Unfortunately, much of this material occurs in thin plates, and it is hard to cut a cabochon without crystal-lined cavities.
2. Dendrites often grow along the surfaces between layers of agate, as seen in the broken stone at the bottom which has parted between the concentric shells of agate. Dendrites sometimes form flower-like patterns inside an otherwise plain chalcedony. Pyrite, iron sulphide or fool's gold, can also be found in agate, chalcedony and jasper.
3, 4. Cabochons showing iron pyrite cubic crystals in jasper (right) and chalcedony (left).
5. Layers of pyrite in carnelian from near Coromandel.
6. Chalcedony surrounding stalactitic growths of pyrite. found on the Wairarapa coast.



Return to Contents

Opal

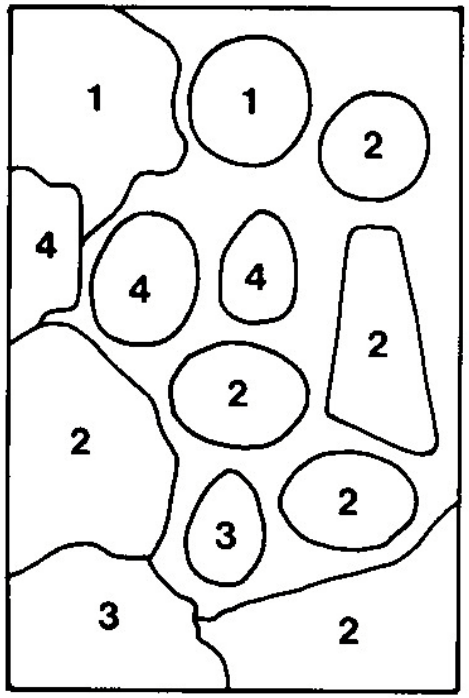
Opal is silica in microscopic glassy spheres containing some water and impurities that give it colour. Generally, the spheres cluster at all angles, but occasionally they form a regular pattern or grating which diffracts the light and provides a play of colour or fire effect. This we call precious opal. Without the brilliant fire, the opal is called opalite or common opal. It is softer and more brittle than chalcedony and the broken surface is shiny, whereas chalcedony has a waxy surface.
Opalite wears away in the tumbler and needs special care or hand polishing.
1. Rough green opalite from Muriwai, north Auckland, with a green and yellow cabochon.
2. Brown opalite from Whangamata.
3. Green and yellow opalite found inland of Oamaru. 4. Common opal in rhyolite from Great Barrier Island.
5. Minute patches of precious opal in rhyolite from Hikuai near Tairua The deposit was small and the opal even smaller. (Australian opal is formed in old marine sediments, not volcanic rocks as it is here. Mexican opal also is found in rhyolite.)
6. Pink common opal from Tairua.
7. Yellow opalite from Hahei in the Coromandel Peninsula.
8. Opal from Puddingstone Rock, Otago Peninsula, where seams of opalite in the basalt at the base of the cliffs are covered by the sea at high tide.



Return to contents

Jasper

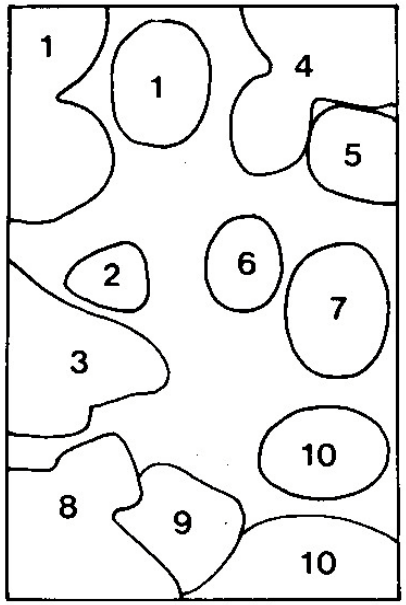
Jasper, chert and flint are all impure, opaque to translucent varieties of silica with a duller fracture surface. In practice, collectors tend to give the name of jasper to the stones that are more colourful with translucent areas and sometimes patches of agate or quartz crystals and harder edges to the patterns.
The jaspers on this page are associated with agates and volcanic rocks,
1. Green and brown jasper often edges the agate in the nodules in Canterbury and sometimes fills the entire nodule or seam.
2. The rivers of the Coromandel Peninsula contain a tremendous variety of colourful jaspers.
3. Red and blue-black jasper with white agate or opal, from a seam cut by the Kopu-Hikuai highway. It may now occasionally be found in the Tairua River.
4. Grey to cream cabochons, more like chert with their soft gradations in colour.



Return to Contents

More jasper

Most of the jaspers on this page are associated with sedimentary rocks.
1. Some yellow jaspers have been broken and cemented with chalcedony or agate; these are from North Auckland at Curnow Road and near Taipuha.
2. A small red jasper-agate in a turtle-back pattern from Kawakawa Bay near Auckland.
3. A larger piece of jasper with more crystalline quartz and agate from Southland.
4, 5, 6. Jasper sometimes develops an orbicular pattern like a head of closely packed flowers. The red stone (4) is from Ponui Island in the Hauraki Gulf and the larger pebble (5) from Southland. The yellow jasper with orbs (6) is from the Wairarapa coast.
7. A more common plain yellow jasper from the Wairarapa.
8. Red rocks in the greywacke main ranges are often porous and cracked, but occasionally they contain enough silica to make good lapidary material. Jaspers from the Pakuratahi River north of Upper Hutt contain metallic iron as well.
9. Yellow and red jasper from the Maharahara River near Woodville.
10. Green and ochre jasper from the beaches north of Moeraki. Dark green chalcedony is known as prase, and some local collectors give this name to the jasper.

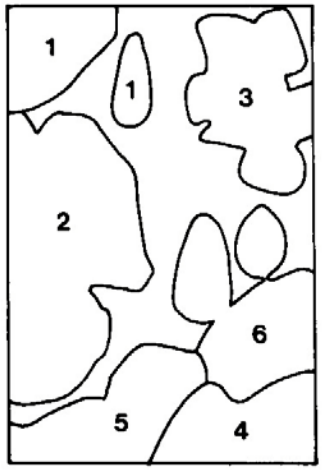


Return to Contents

Chert and flint

Chert is a less colourful siliceous rock, usually opaque. Flint is a variety of chert which occurs very often in nodules in chalky limestone; however flint can be translucent and colourful.

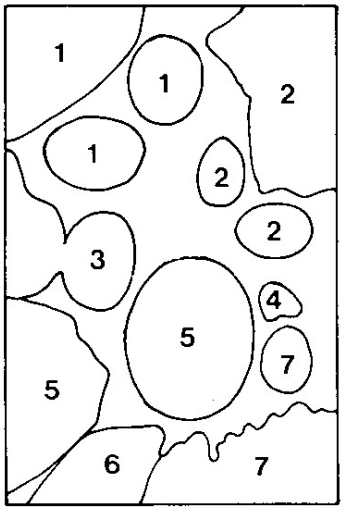
1. Pale blue and green chert from the small beach west of Ohope in the Bay of Plenty. A similar material may be found further east.
2. Flinty concretions from Port Albert and other areas in Northland have colourful banding inside a plain exterior. The bands are not part of the structure as in agate but a colour staining in the massive material,
3. Some beaches in our harbours still bear flints brought out in ballast from England. These, from Balaena Bay in Wellington are said to have arrived during the Second World War in the sailing ship Pamir. They are often translucent and occasionally contain fossils that were present in the chalk where the silica gathered itself into flint nodules.
4. Flint nodules formed also in the chalky white limestone found near Kaikoura, and these may be translucent, grey or tan.
5. Other flints have been broken and cemented by agate in many patterns. Silicified mudstones and flints with bands of agate are found all up the east coast from Marlborough to Hawke Bay, although not all the mudstone contains enough silica to polish well.
6. When the agate follows layers in the mudstone the rock may be calved zebrastone.



Return to Contents

Other varieties of silica

1. Quartz sands cemented by silica make an extremely hard and durable quartzite which is found on some hillsides in Central Otago and washed down rivers and out along the coasts. These quartzites have cloudy patterns and take a very good polish. They are locally called sarsen stones or chinamen -stone.
2. Waters from hot springs containing silica and other minerals build upsinter deposits which are generally too porous for gemstones, However, old sinter deposits at Puhipuhi in Northland contain the red mercury sulphide cinnabar and some layers within the colourful sinter are solid enough to polish. The occasional crystal-lined cavity can be an attractive part of the stone.
Even in polished stones the colour fades in sunlight, and in the quarry all the old surfaces are a dull grey.
3. Rhyolite is a volcanic rock with a very high proportion of silica. It is sometimes solid enough to polish like this red sample from Great Barrier Island.
Obsidian is volcanic glass which needs careful handling as the fragile material breaks with a razor-sharp edge.
4. Small, clear nodules of obsidian are called "Apache tears in the United States and are found near Marototo; they can be tumble-polished with care.
5, 6. Most obsidian is hand polished, like the honey gold material from Mayor Island (5) and the black and brown material from near Taupo (6).
7. Solid black obsidian near Kaeo seems to be denser than the black Taupo material. The Northland obsidian takes an excellent polish.



Return to Contents

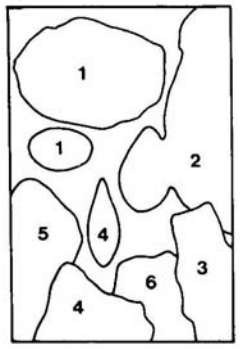
Petrified wood

Wood can be turned to stone when it is buried in waterlogged sediments carrying dissolved minerals which soak into the wood and replace the organic material or seal it from decay. Silica, especially from volcanic ash, gives the best preserved wood for lapidary purposes.

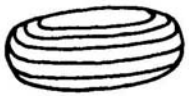
Petrified wood sometimes has an open texture, caused when not all the cells were flooded with silica. This wood will not polish well. Small pieces of petrified wood make attractive gemstones, but any large specimens are best left whole with a cut face to reveal the grain and colour. The cutting of a whole limb section into little pieces for jewellery is vandalism.

Petrified wood is often associated with other layered material such as rhyolite, banded jasper or sandstone. Some cell structure and especially the change of grain across the annual rings should be visible in the wood. Sometimes a mould left by a piece of wood buried in ash and then decayed is filled by silicified mud or jasper which looks rather like wood. This is when arguments start, especially where the outside of the material bears the impression of the original bark.

1. Limb section and cabochon from Mt Somers in Canterbury. Wood from this locality tends to be brittle but very colourful.
2. Three pieces of Coromandel wood with an interesting grain.
3. Central Otago wood looks like schist on its weathered surface. 4. Southland wood tends to be dark inside.
5. A chunk of Southland wood with an outer wind-polished surface where it lay among sand dunes.
6. A waterworn piece of Southland wood which was driftwood before it was buried and silicified.




Wood

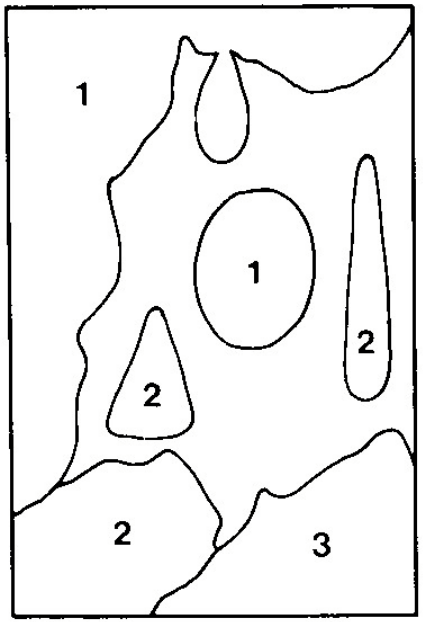

Layered rock

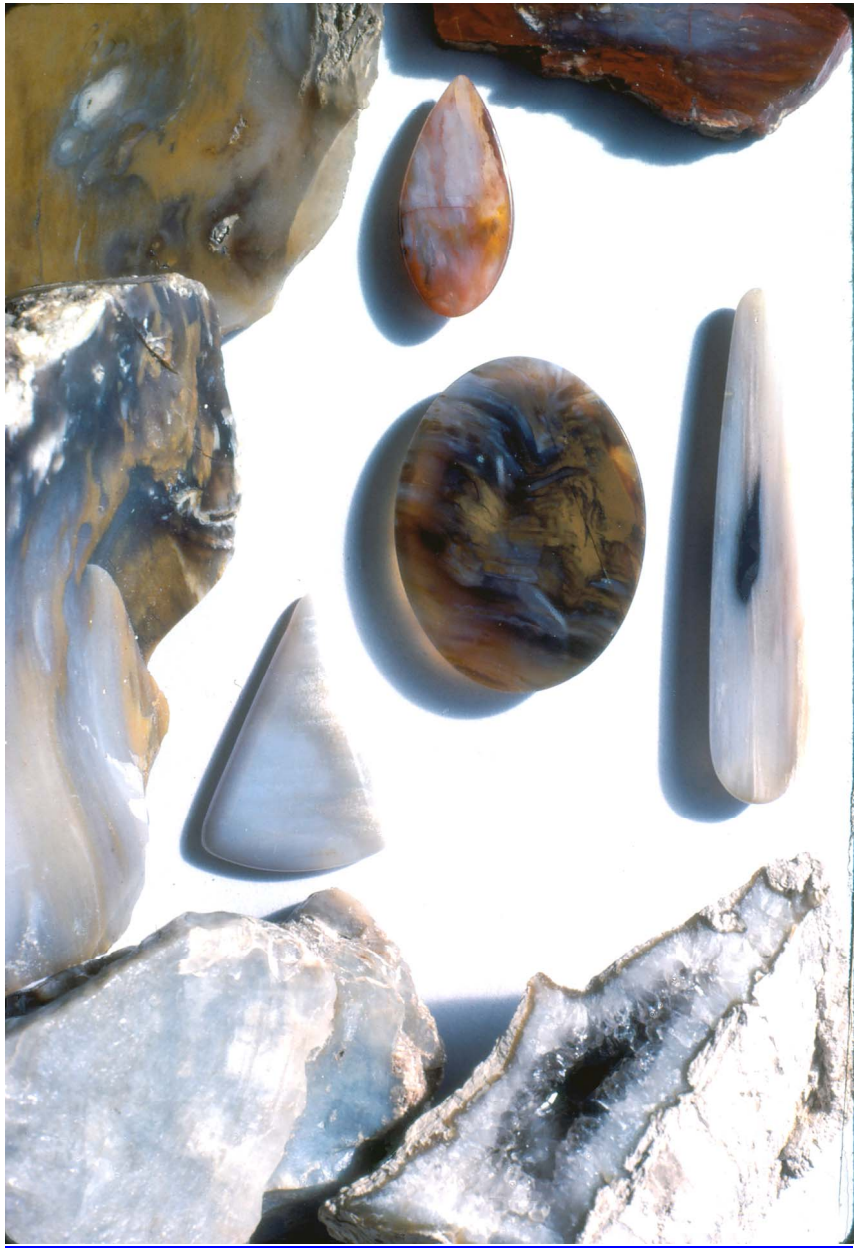
Return to Contents

Agatised wood

When wood is petrified often the cell structure of the original wood is only partially preserved, the rest being replaced with quartz, chalcedony or varieties of agate. Occasionally the only trace of the original log is the shape and outer bark textures on an agate limb cast.

1. Agatised wood with streaks of red, brown and gold woodgrain in very solid chalcedony comes from the Kauaeranga Valley behind Thames in the Coromandel Forest Park.
2. Some wood from the Kaeo area in Northland has a bark-like exterior and streaks of cellular texture through blue chalcedony, with patches of black and yellow in some material. The cell areas tend to be softer and not easily polished, and in thin pieces the blue is less obvious.
3. When there were splits in the timber of buried wood they could be later filled with agate or quartz. The smoky quartz and agate in the crust of petrified wood illustrated here were found in Southland.



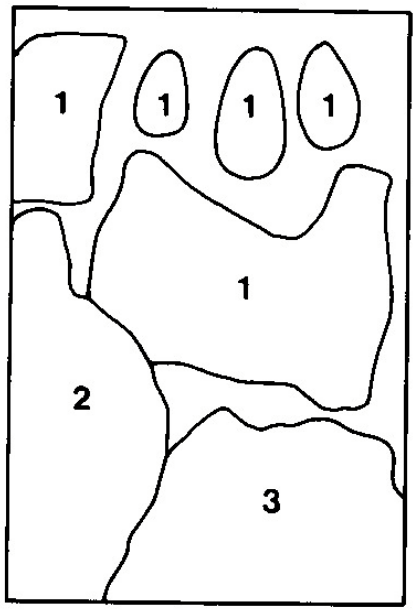


Return to Contents

Opalised wood

Opalised wood can be colourful with a beautiful grain on a lustrous broken surface, but unfortunately this hydrated form of silica is a softer material than agate, and opalised wood is slightly brittle and demands more care in polishing. Often it is more attractive left in its natural state.

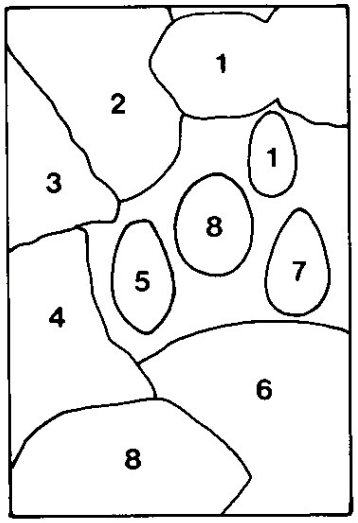
1. Cut pieces and cabochons of opalised wood from the Coromandel Peninsula.
2. Branches from Tinopai in Northland, showing the typical curved broken surfaces and clay-coated exterior.
3. Opalised wood from the Tairua area contains layers of black and orange opal looking like barley-sugar between fibrous layers of poorly preserved wood grain - a specimen that could never be polished.



Return to Contents

Other plant material

Wood is not the only plant material that may be petrified, nor is silica the only mineral that preserves such fossils.
1. Fern stems from Southland; these are fully sificified and take a good polish, if you can find them.
2. A slice from the fern stems found at Port Waikato. Most of the plant material in this area is not good for polishing as it was buried by marine sands, in which lime (calcite) is the mineral most likely to preserve fossils.
3. Peat or other plant debris may be preserved in silica. The example is a chunk of stems, roots, leaves, and so on from Southland, where this material is called "forest floor".
4. In the Coromandel area silicified swamp material is known as Manaia stone; often it has a tan exterior, a white area and a core black with carbon. In this slice from east of KLIaotunu, cross-sections of raupo stems and leaves are visible.
5. A cabochon of colourful Manaia stone.'
6. Some of the East Coast fossil wood is preserved by calcite and bears a rim of calcite crystals. This slice, from Oaro south of Kaikaura, shows black wood with a thin band of agate just inside the calcite rim.
7. A cabochon polished from a similar rim found on wood from the Wairarapa.
8. Some rusty fossil wood from Oaro contains pyrite, iron sulphide, occasionally following the wood grain. However, pyrite decomposes and most of these gems end up as sulphuric acid and bits of charcoal,

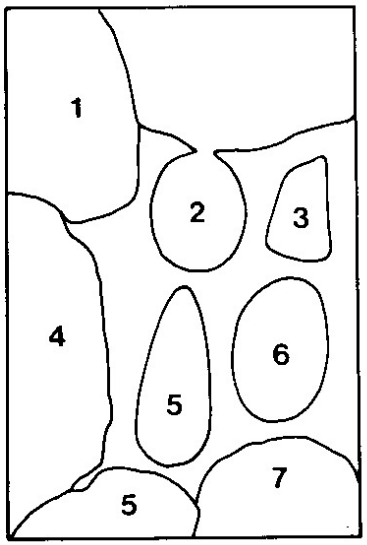


Return to Contents

Gemstones from fossils

The remains of plants and animals that lived millions of years ago may add a special interest to jewellery, but fossils are so valuable for what they can tell us about life in the past that they should never be cut for gemstones unless the material is clearly of-no use to the scientist.

1. Finegrained limestone is quarried for fertiliser. This specimen contains layered algae that are about 25 million years old, from the School Creek Quarry near Murchison.
2. The smaller pink and white algae and tiny black shells in these specimens from the old Tinui Valley quarry in the Wairarapa are somewhat younger.
3. Silicified bryozoan or moss animal from the north Canterbury coast at Motunau.
4. Black limestone from near Reefton, showing the pale outlines of corals that grew about 370 million years ago in the Devonian Period.
5. Bone. The only fossil bones that should be cut are single, waterworn bones found loose on a beach, and most of this bone is too open textured and porous to take a good polish. However, some bones from Oaro contain white agate in the marrow cells, although the bone itself is likely to undercut. It is from marine reptiles related to the dinosaurs and is about 70 million years old.
6, 7. Petrified wood with borings filled with calcite, is generally known as teredo wood. The cabochon (6) is from sandstone from the Mohaka River and the slice (7) from near Colville.

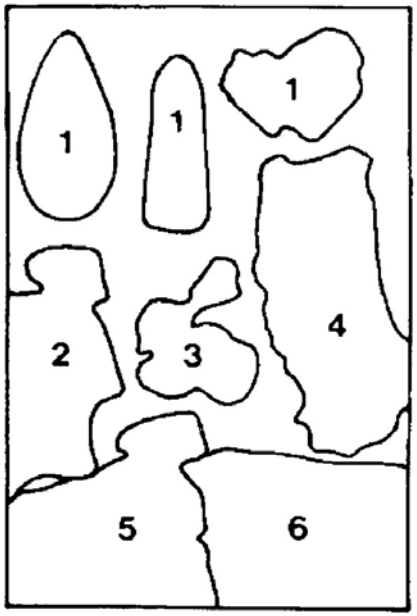


Return to Contents

Calcite

Calcite or calcium carbonate is an essential part of limestones, and crystals within these rocks are generally of this mineral. It is relatively soft and breaks with a flat, shiny surface. A drop of acid on calcite will fizz as carbon dioxide is released. Calcite in its massive form, marble, is a common enough ornamental stone, but its relative softness makes gems cut in it unsuitable for hard wear as they will soon lose their polish or they will break. Calcite gemstones must be hand cut and not tumble-polished.

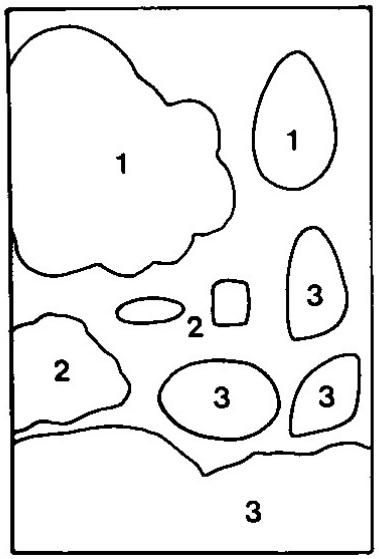
1. Golden calcite, rough and polished, from Cape Turnagain.
2. Lime-green banded calcite cements some of the rocks in Putangirua Stream, Palliser Bay. Their rough surfaces weather pale yellow.
3. Banded calcite or travertine polishes well and is the material marketed as "onyx" from Italy, Pakistan and Mexico.
4. Marble from Takaka Hill is formed of limestone recrystallised to interlocking grains of calcite in shades of grey, green and white. It is quarried for fertiliser and ornamental stone.
5. Dolomite marble with magnesium is quarried at Mt Burnett in Golden Bay for fertiliser and industrial use. The fine-grained material is colourful with some striking patterns.



Return to Contents

Iron and manganese

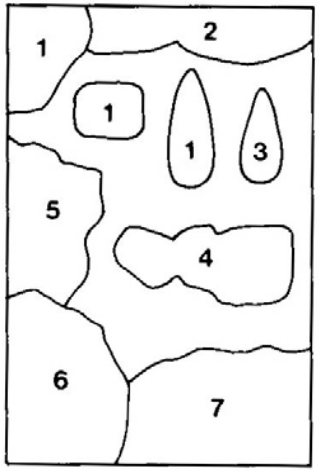
1. Massive nodules or concretions of pyrite, iron sulphide, can be cut and polished. The nodule and the cabochon shown here from a similar stone come from southern Hawkes Bay beaches, Waimarama and Mangakuri.
2. Solid seams of the manganese oxide, psilomelane, occur in North Auckland and can be used to make dark grey cabochons with a metallic mirro/finish. Working with this material will blacken hands and equipment, and much of the stone has small cracks and pits.
3. The finest pink rhodonite, a manganese silicate, comes from Otago and is usually found with a rind of black oxidised material, psilomelane or pyrolusite. At the lower left is a waterworn stone from the dredge tailings in Central Otago. Any really black nodule from this source may have a pink or pinkish-tan core, often with a network of black. The boulder at the lower right is from the coast between Akatore and Quoin Point, south of Dunedin.



Return to Contents

More minor gems and minerals

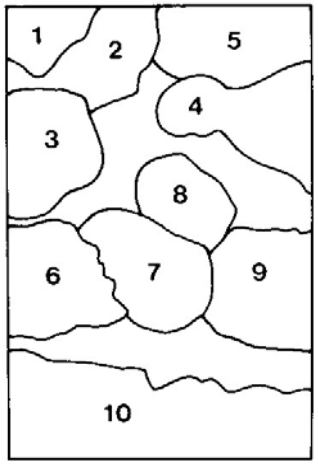
1. Kyanite is a blue mineral which can occur in clear crystals which collectors of rare gems have faceted; but New Zealanders search for the kyanite in schist found in South Westland in the Hunts Beach-Jacobs River area, in rocks containing a mixture of pale, greenish-blue kyanite, dark mica and white quartz, with sometimes an apple-green chrome mica as well. It is beautiful, hard to polish and harder to find.
2. Mica and quartz accompanies the pink manganese mineral piedmontite in the schist used as a decorative stone in Central Otago. Although mica pulls out of most rocks in a tumbler, it can produce a sparkling stone if there is enough quartz holding it in place.
3. Green quartz with mica from the beaches near Takaka. Quartz spangled with mica is called aventurine.
4, 5. Feldspar is a hard silicate most commonly recognised in granites; gems in the feldspar group include moonstones, sunstones and labradorite. A few New Zealand feldspars (4) have a shimmery effect, but most are plain white and pink varieties, while the blue-green microcline feldspar called amazonite has been recently found in Fiordland in small pieces. Deep blue sodalite (5) is a closely related mineral cut as a gemstone, and small amounts have been found in the Haast area. The stone shown here is attached to its igneous parent rock.
6. Peridot is the name given to gem quality olivine, a mineral fairly common in New Zealand basalts but not in, crystals large enough to facet, as seen here in a basalt from near Dargaville.
7. Massive olivine with flecks of black chromium oxide, chromite, from Dun Mountain at the back of Nelson City. Pieces of olivine with a yellow weathering rind can be picked up in the Matai River, but the crystals are opaque and cracked.



Return to Contents

Rock types

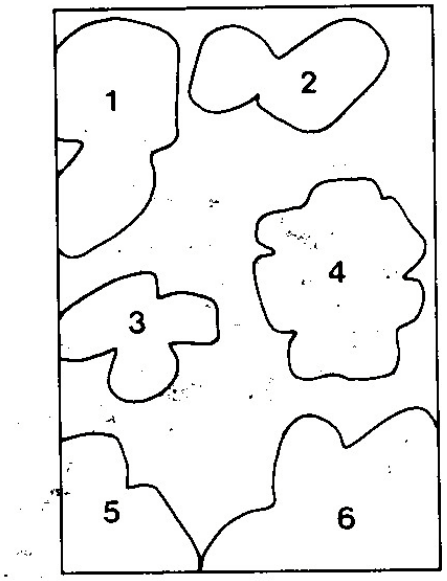
There are three main types of rocks - igneous, sedimentary and metamorphic.
Igneous rocks cool from liquid melted rock.
Volcanic rocks cool swiftly at the surface of the earth and any crystals visible are small and set in a fine-grained mass.
1. Pale rhyolite in a black basalt crust, a volcanic bomb from Mt Tarawera. 2. Andesite with green olivine crystals, from Tongariro. 3. Agate in andesite.
Plutonic rocks are igneous rocks that cooled slowly, deep in the earth, giving the crystals time to grow until all the rock was made of crystals.
4, 5. Pink and white granites (4) are familiar, while black and white diorite and gabbro (5) are less common. They all polish well and make decorative building stones.
Sedimentary rocks are made up of bits of other rocks and organic material cemented together. Few sediments can be polished.
6, 7, 8, 9. Conglomerate (6), angular breccia (7), sandstone with green glauconite (8), and siltstone containing fossils (9).
Metamorphic rocks, have changed their shape. Rocks recrystallise when pressures and temperatures increase, until the atoms in the minerals lose their original bonds and form new partnerships and so new minerals.
10. Schisms are widespread in Outage, the West Coast and Marlborough. Since the new minerals formed under great pressure from rocks on top, the crystals grew in aligned layers. This layering distinguishes schist from igneous rocks with random crystal growth.



Return to Contents

Beach pebbles -- Coromandel

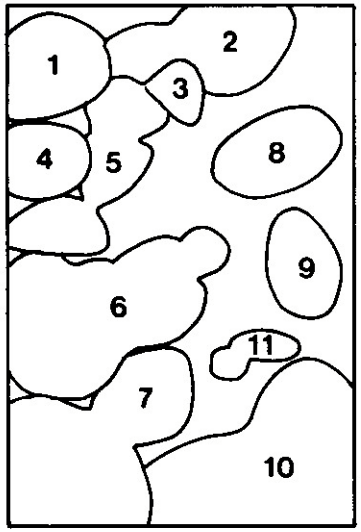
Pebbles on beaches reflect the rock types found up local rivers.
1. Plant material, showing the typical bands of colour - golden outside, then white and a core of black.
2. This petrified wood with good grain is better than much of the porous wood found on the beaches in this area,
3. A few of the many cherts found on Coromandel beaches.
4. Beach agates, once plentiful on the western shores.
5. Two of the more colourful jaspers to be found in this area.
6. Samples of the volcanic rock rhyolite, in a variety where the crystals 'have grown in circular patterns. This spherulitic rhyolite is mostly found on the north side of Paku at Tairua, on the headland rocks and as pebbles in the coves between. Being mostly quartz and feldspar, they polish quite well, although some have a rather open texture.



Return to Contents

Beach pebbles -- East Coast from Hawke Bay to North Canterbury

Rocks in this area are mainly sediments. Stones for polishing are found only in scattered pebbly areas along the whole coast.
1. Silicified mudstone banded with iron stains.
2. Grey limestone with bands of worm trails like rows of arrowheads.
3. Pink limestone. Both 2 and 3 are generally too soft to polish in a tumbler.
4. Some limestones, however contain sufficient silica for tumbling, such as this grey stone with small flint patches.
5. Bluish and tan flints.
6. Flints and mudstones that have been broken and recemented with agate. These are more common in the south from the Ure or Waima River to about Herbertville.
7. Mudstones with agate in the bedding layers. These-are known as zebra stone and are found scattered all up the East Coast.
8 Gabbro, a dark plutonic rock, found on the Marlborough beaches,
9. Yellow jasper, found sparsely all. along this coast.
10. Red jasper is more common in the South Island and about southern Hawke Bay, where it is colourful but often pitted.
11. Grey quartz pebbles, sometimes called "pearl agates".

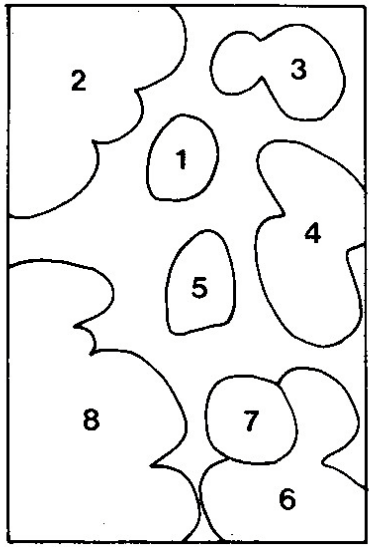


Return to Contents

West Coast beach pebbles

While nephrite jade is the prize on the central West Coast shoreline, the beaches in this area bear a distinctive _assemblage of pebbles from the Buller granites and the Alpine schists in inland rivers.

1. Nephrite jade.
2. Crystalline quartz, with interlocking crystals often clearly visible, in shades of cream and white, stained orange and brown with iron.
3. Not petrified wood but brown schist and translucent quartz, betrayed by small flecks of mica and the lack of end grain.
4. Fine-grained quartz schist will polish well, despite the included flakes of mica.
5. Pale apricot-coloured schists sometimes bear flower-like patterns of black manganese dendrites.
6. Gneiss (pronounced nice) is a metamorphic rock in which higher temperatures and pressures caused the minerals to separate into bands of pale and dark minerals. These mostly pale stones contain bands of minute garnets.
7. A gneiss pebble which is mostly dark red garnet.
8. Granites occur in a variety of colour mixtures of large crystals of clear greyish quartz, pink, cream or white feldspar and shining mica. The bright green is a mineral called epidote, which generally grows later in the rock when the older feldspars start breaking up.



Return to Contents

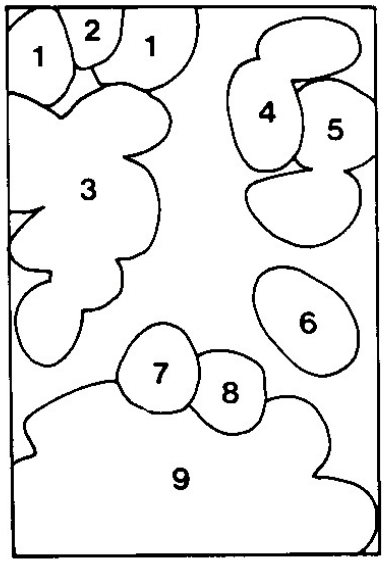
Beach pebbles -- Birdlings Flat

All the stones that come down from the southern rivers of Canterbury tumble along the coastal beaches until they are stopped on Birdlings Fiat by the barrier of Banks Peninsula.

1. Two rhyolites with crystals.
2. An andesite with small agates filling old gas bubbles. 3. Rough and polished agates.
4. Two quartz pebbles.
5. Iron-stained quartzites from Central Otago.
6. Petrified wood with good grain can be found here, but it is not plentiful.

Many of the colourful stones in this area are from seams of quartz in the sedimentary rocks in the main ranges.

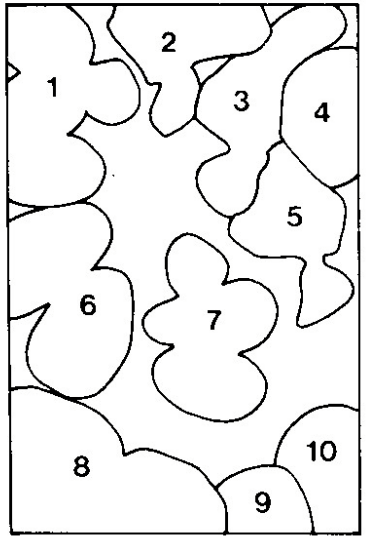
7. Silicified mudstone with its original layers showing.
8. A sandstone with multiple bands of quartz stained with iron.
9. Other stones from such veins. Because these rocks are generally harder than sandstone they survive when the sandstone has been worn away by the wave action.



Return to Contents

Beach pebbles -- Moeraki-Kakanui

Seams of agate run through the volcanic rocks at Moeraki Point, and beach agates are scattered up the coast to the north.
1. Quartz pebbles with their characteristic frosted appearance like waterworn glass. For polishing, pebbles with pits and cracks should be avoided.
2. Chalcedony has an equally characteristic waxy lustre on a recently broken surface. The flat white plate shows a naturally bubbly (botryoidal) surface; the base has the rough texture of the lava in which the layers of chalcedony grew.
3. Chalcedony, showing a white weathering pattern on stones that have been exposed a long time.
4. A large round agate showing a pattern of white, sickle-shaped indentations often found on agates and quartzites that have been pounded by the waves well.
5. A little carnelian is also found on these beaches.
6. A few agates at Moeraki show a peculiar banded effect in weathering. Since this will wear off in a tumbler they should remain unpolished. or be polished without grinding by coarse grits.
7. Agates with black and brown sagenite and dendrites.
8. The larger, rough seam agates have a very pitted surface and many crystal-lined cavities.
9. Green and ochre-yellow jasper is a speciality of this area. 10. Quartzite from Central Otago.



Return to Contents

Beach pebbles -- Slope Point

On the Southland coast between Waipapa Point and Haldane there are a few pebbly beaches visited by fishermen and rock collectors. The cliffs contain layers of conglomerates with pebbles which weather out and collect on the beaches. At first glance they appear dark, but closer examination reveals a multitude of subtle colours and patterns.

1. The prize is petrified punga, found as black nodules barely showing the eyed grain of the fern. Collectors take home any rounded, black woody pieces and dump them in household bleach overnight, after which the grain of wood or punga is revealed. The stone at top left was polished but not bleached like the others.

Igneous pebbles here include the following: 2. Pale granites.

3. Andesite with amygdales of quartz.

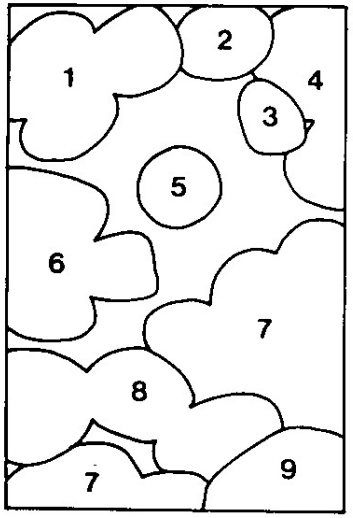
4. Porphyries, which are stones with large crystals set in a fine-grained mass. The lower porphyry contains cream feldspars, while the upper example has pale greenish feldspar and blue quartz, looking like forget-me-nots.

5. Agates on this beach seem to be a greenish mix of quartz and agate. 6. Breccias, a colourful collection of fragments cemented together.

7. Rhyolites are often flowbanded, sometimes with small crystals of quartz or feldspar.

8. "Flower garden" is the local name for rhyolites with white and grey circles and centres, but there are many colours and patterns including the spherulitic stones with their larger rings.

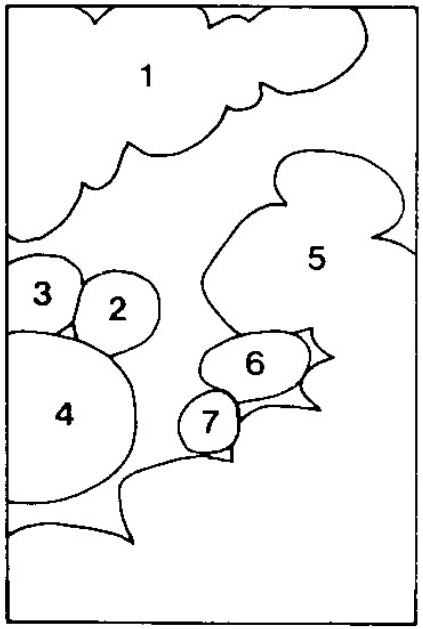
9. Rhyolites with turtle-back patterns are generally fairly dark.



Return to Contents

Beach pebbles -- Orepuki

The beach along the eastern side of Te Waewae Bay receives the altered sediments and plutonic rocks of Fiordland.
1. Some of the many colours of grossular garnet, both polished and heavy, flattened, waxy pieces as found in the rough.
2, 3, 4. Igneous rocks found here include granite (2) and gabbro (3) and an altered volcanic rock with infilled bubbles (4). This is a small sample of the variety to be found. The remaining rocks in this plate are mostly sediments.
5. Those at the top of this group clearly show layers of mud, worm trails and wave ripples, but all these rocks have been hardened and altered and lime-green epidote has grown in many of them.
6. A conglomerate, with red and green jaspers in a dark-green sandstone, found scattered here and down the Kawarau-Clutha valley.
7. Orbicular jasper with metallic hematite,



Return to Contents