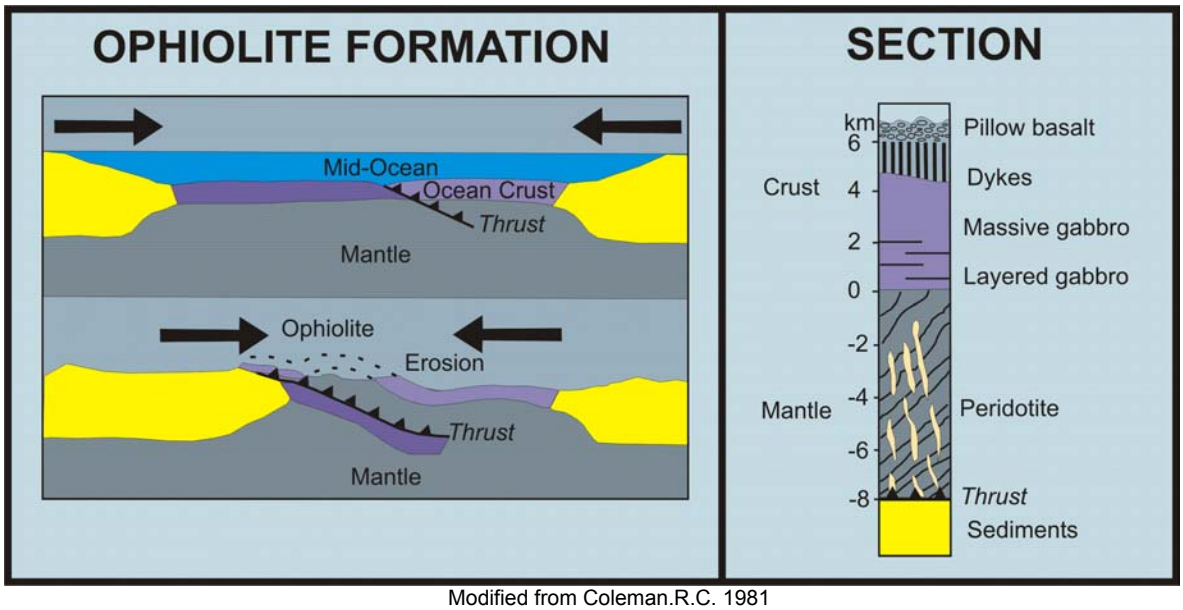
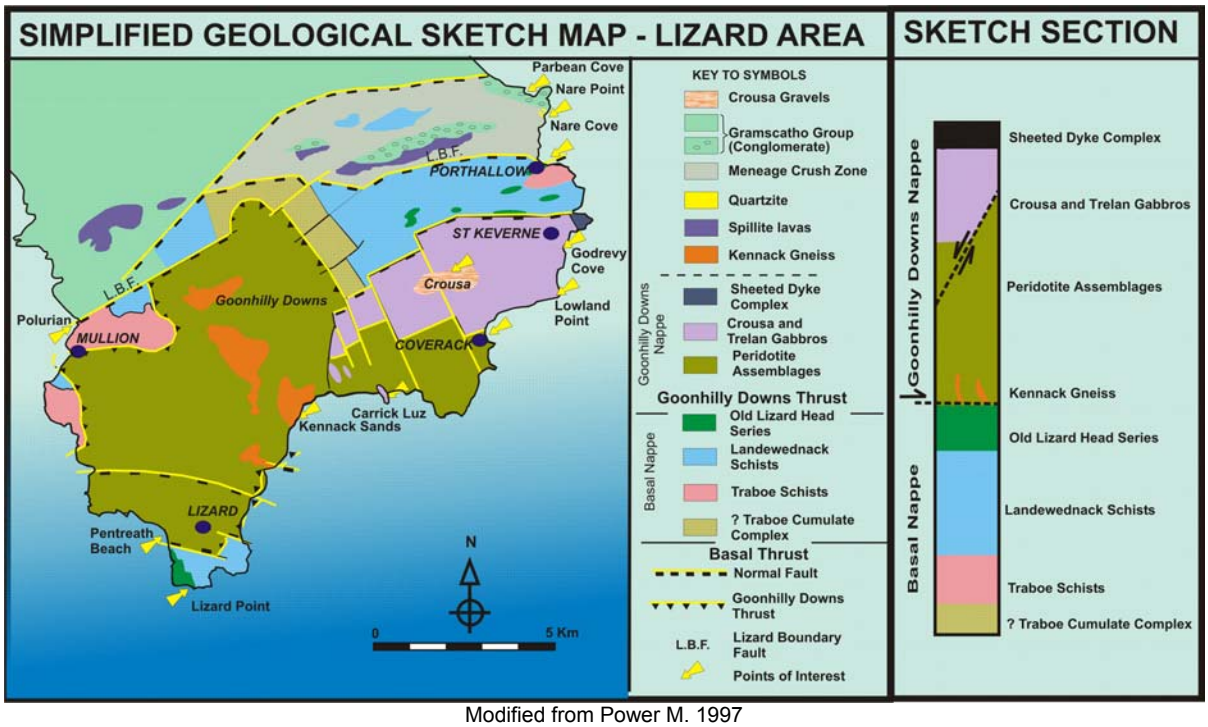
THE LIZARD.

The rocks on the Lizard complex represent a fragment or slice of continental and oceanic components that have been thrust faulted (obducted) over younger rocks. In the case of the Lizard the context would have been a small rift basin similar to the Red Sea or Gulf of California and was formed at the same time as the development of the SW England passive margin during the Early Devonian. This terminated by the onset of convergence between two plates with partial obduction achieved by the Upper Devonian. The Lizard now contains a suite of rocks from the upper surface consisting of sediments, below, pillow lavas, sheeted dykes and then gabbos to layered gabbro followed by ultrabasic rocks of peridotite representing the crust down to, and including, the mantle. Such sequences of rocks are known as an ophiolite complex and the Lizard is one of the best examples in Britain.



Modified from Coleman.R.C. 1981



Modified from Power M. 1997

The Lizard is devoid of strong topographic highs with the landform predominantly an old erosion surface at c.120m above OD. Due to the toxic nature of serpentinite to vegetation the area has a distinctive flora of slow growing plants.

Lizard platform at Black Head

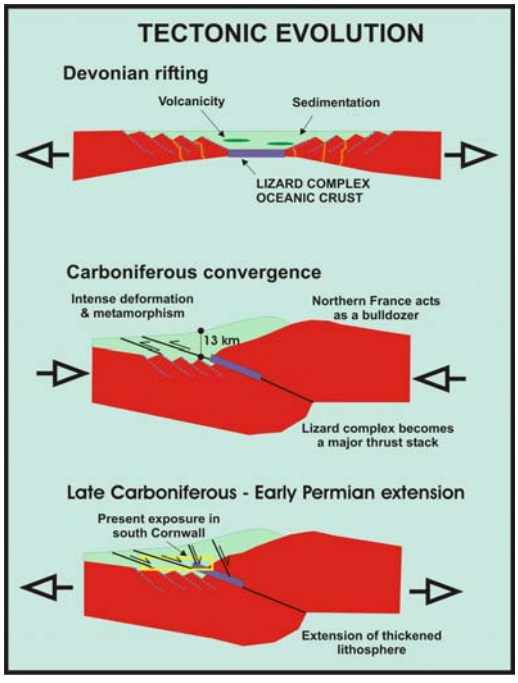

Goonhilly Downs

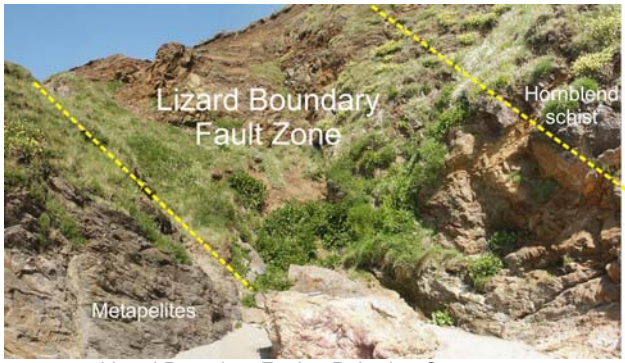

Beach Pebbles – Poltesco

The variety of rock types from gneiss, hornblende schists, basalt, quartzite, peridotite and sepentinite on the Lizard area produces a wide range of colours in beach pebbles.

Polurrian Cove

Areas of interest cover the whole area on the south side of the cove. The initial starting point would be at Polurrian Cove where the Lizard Boundary Fault is exposed in the cliffside with metapelites (continental provenance) on one side and hornblende schist which marks the start of the Lizard complex (oceanic rocks) on the other. This fault zone runs across the Lizard from Polurrian on the south-west to Porthallow on the north-eastern side of the peninsula. This marks the approximate position of one of the thrust faults that obducted the Lizard ophiolite during Carboniferous convergence. These faults have subsequently been reactivated in the Permian.The hornblende schists were once basaltic lavas on the sea floor, which have been metamorphosed, whereas the metapelites were originally Devonian mudstones.





Lizard Boundary Fault – Polurrian Cove

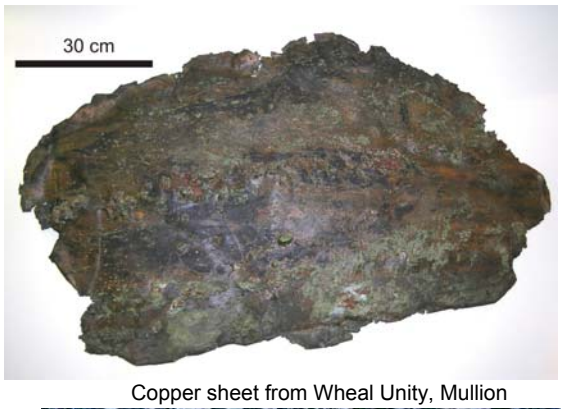

Hornblende schist

Mullion Cove

Mullion Cove

At Mullion Cove another fault marks the contact between hornblende schist and serpentinite. Offshore lies Mullion Island where there are excellent exposures of pillow lavas, cherts and limestones, that may form the upper part of ophiolite rock sequence. Inland of the cove copper mining has taken place from the 1700s to late1800s. One of the native copper sheets from Wheal Unity mine weighed over 700kg and was 9m X 1.4m in size and was shown at the 1851 Great Exhibition in London.


Hornblende schist



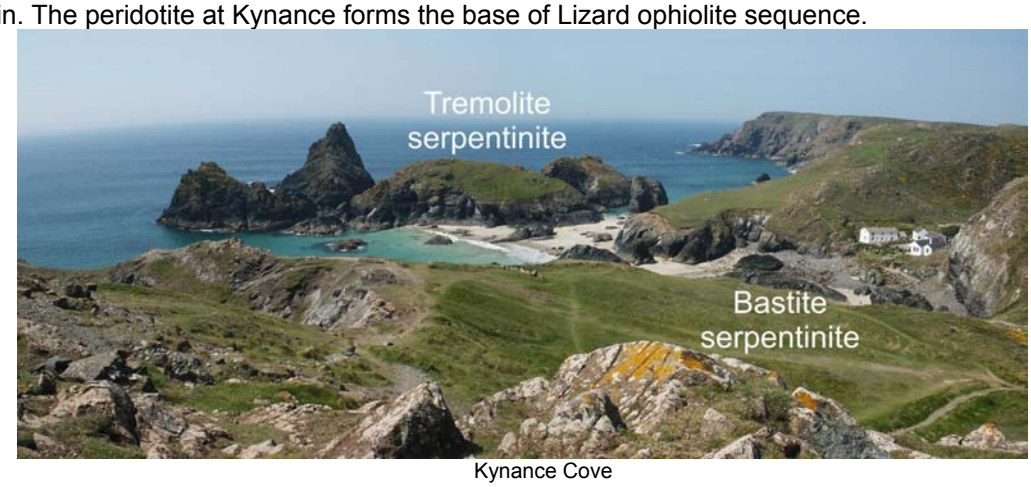
Copper sheet from Wheal Unity, Mullion


Pillow lavas


Limestones in pillow lava

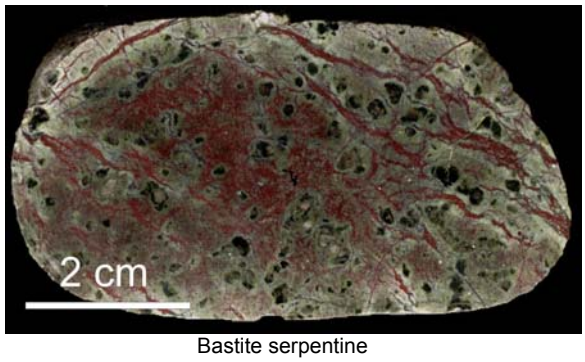
Kynance Cove

Further to the south lies Kynance Cove where two varieties of serpentinite, bastite and tremolite are exposed. The bastite has platelet crystals of enstatite and the tremolite shows foliation.These represent upper mantle peridotites, which have been serpentinized by the process of hydrothermal alteration from percolating seawater in the mantle by which magnesium-rich silicate minerals (e.g., olivine, pyroxenes, and/or amphiboles in peridotites) are converted into or replaced by serpentine minerals. The process of serpentinization produces clay minerals such as lizardite, saponite and chrysotile. Other minerals formed are chlorite, tremolite and talc and are all produced from the breaking down of the ferromagnesian minerals, olivine and pyroxene. Iron derived from the hydrothermal alteration of these minerals forms goethite and hematite. This process produces the multicoloured serpentinites resembling a snake or lizard skin. The peridotite at Kynance forms the base of Lizard ophiolite sequence.



Kynance Cove

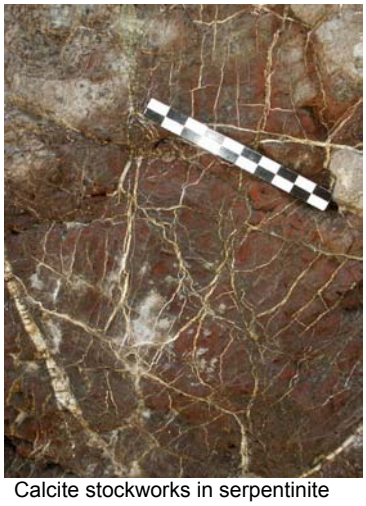

Tremolite serpentine



Bastite serpentine

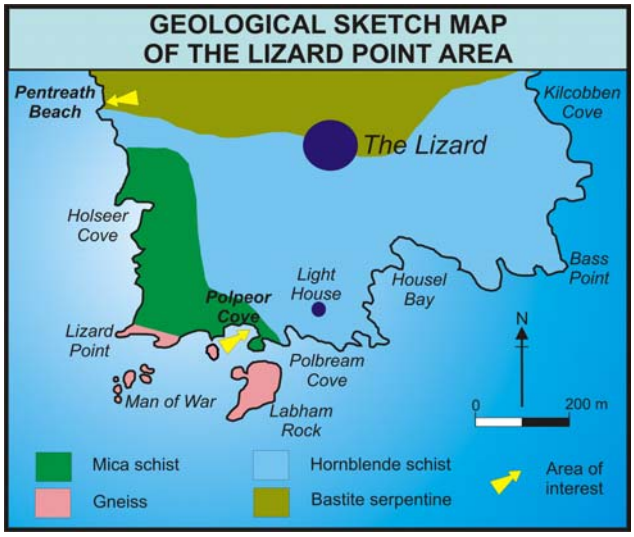
Pentreath Beach

At Pentreath Beach is the junction of serpentinite and hornblende schist. A calcite stockwork in serpentinites is exposed in part of the cliff face illustrating that CO_2 rich fluids have migrated through the fractured rocks.


Calcite stockworks in serpentinite

Lizard Head

Just beyond Pentreath Beach is the Lizard Head where the geology changes from hornblende schist to mica schist and gneiss. Polpeor Cove, above the old lifeboat station, affords the best view of these exposures. The Man of War Gneiss are the oldest rocks on the Lizard representing a metamorphosed granite from the old super continent Gondwanda's collision zone and are some 500 million years old. The mica schists at this point were once mudstones or pelites at the bottom of the ocean with the basalts, now metamorphosed into hornblende schists; these now form part of the ophiolte sequence.

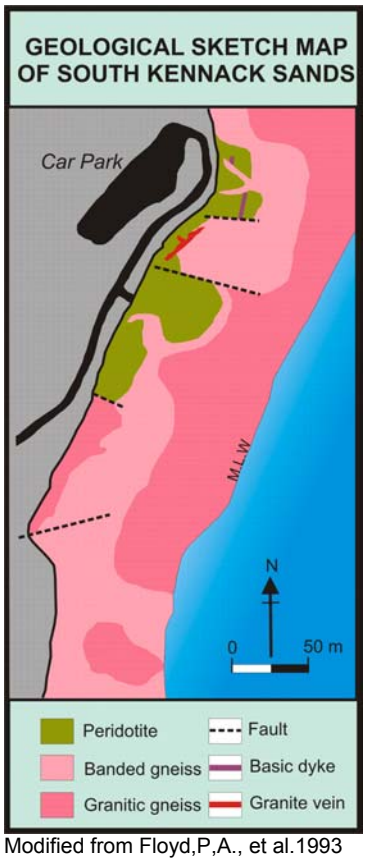


Polpeor Cove and Lizard Point

Mica schist

Man of War Gneiss

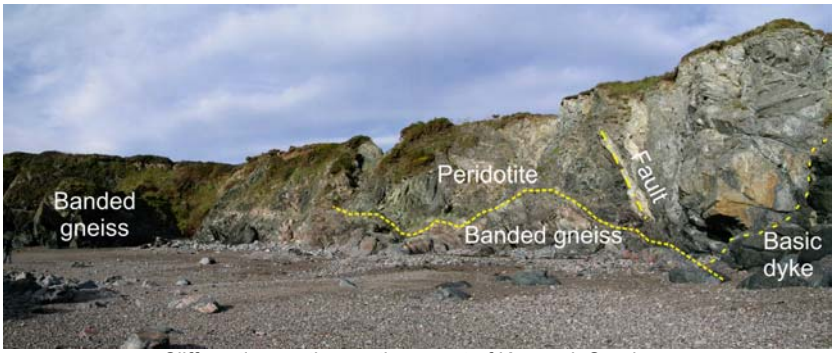
Kennack Sands



Modified from Floyd,P,A., et al.1993

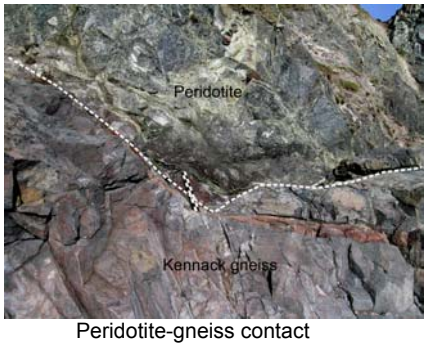
On Kennack Sands, on the southerly side of the beach, the relationship between the peridotites and the Kennack Gneiss is clearly exposed. The peridotite exposed at this location is only partially sepentinised and has a fresh appearance. The gneiss consists of interbedded acidic (granitic) and basic (basaltic) rocks in the lower part of the peridotite. The gneiss is strongly deformed and contacts between it and the peridotite are often strongly altered. In some places granitic and basic dykes cut the peridotites. The more acidic gneiss is younger than the peridotite. At some contacts between the gneiss and periodotite alteration has taken place to form an asbestiform mineral in some cases.


Kennack Sands looking north

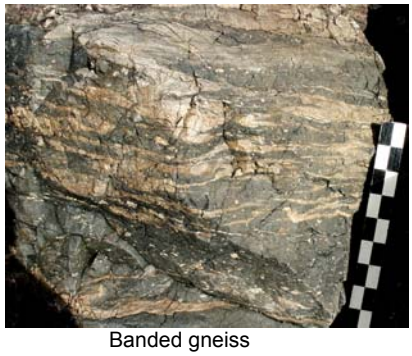


Cliff section on the southern part of Kennack Sands


Peridotite



Peridotite-gneiss contact

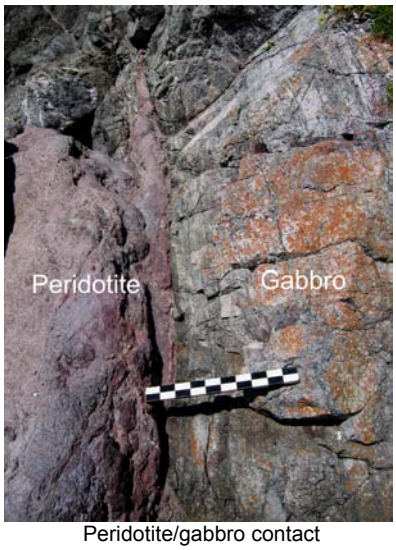

Banded gneiss

Asbestiform mineral

Carrick Luz

At Carrick Luz the rocks are highly sheared and pods or lenses of sepentinised peridotite are incorporated in gabbro. The deformation and shearing here has taken place at very high temperature of at least 600°C. The sheared gabbro displays a strong linear and planar fabrics and alignment of amphibole (after pyroxene) and has an augen texture in places and in others a banded appearance.

Carrick Luz

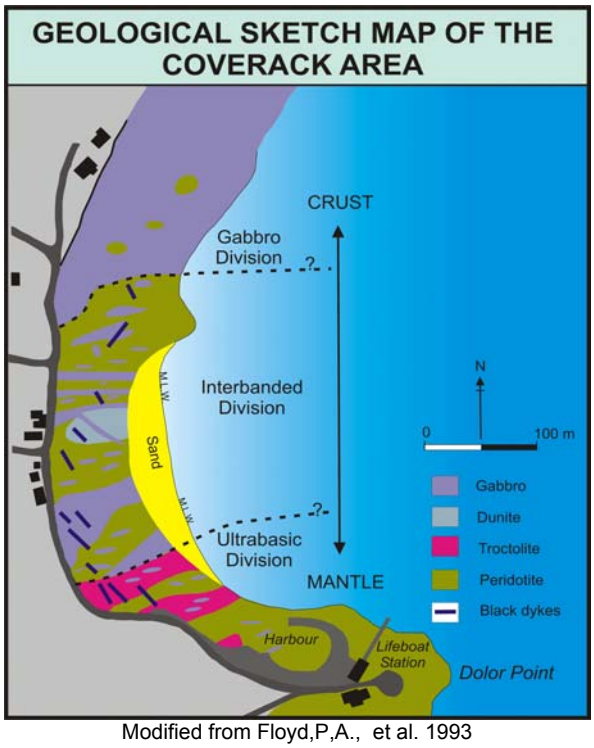


Peridotite/gabbro contact

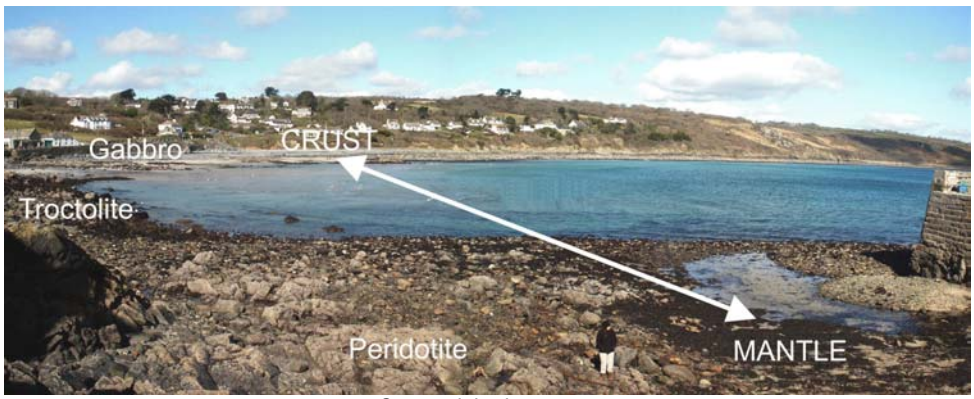
Augen gabbro gneiss

Coverack

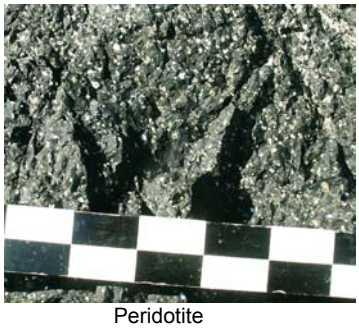
The Coverack area provides a rare opportunity to examine a geological section showing a transition from the oceanic mantle to the crust. Here ultrabasic rock of peridotite in the mantle section is to the south, moving north the rare transition rock type of troctolite is exposed, to eventually basic crustal rocks of gabbro, all cut by basic dykes. This section therefore represents the boundary between upper mantle to oceanic lower crust, and probably corresponds to the moho (Mohorovčić Discontinuity). The discontinuity probably represents a chemical change from basic to ultrabasic rocks, however the discontinuity should be defined by a change in seismic velocity.



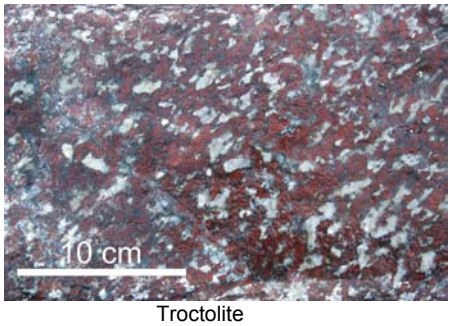
Modified from Floyd,P,A., et al. 1993



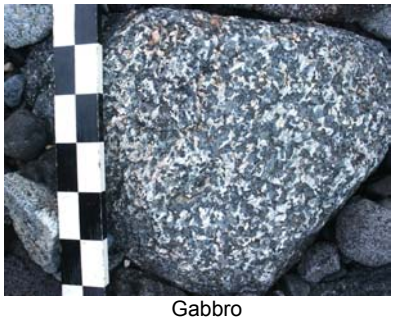
Coverack harbour area



Peridotite



Troctolite

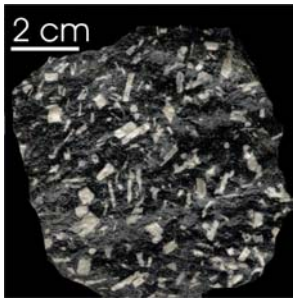


Gabbro

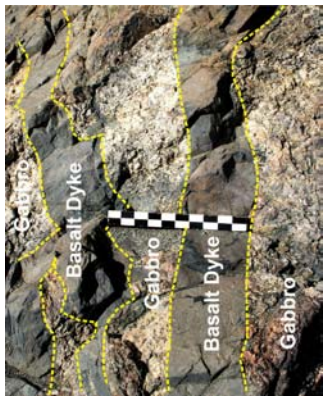
Godrevy Cove

Godrevy Cove to the north of Coverack has exposures of sheeted basic dyke swarms intruded into gabbro. Some of these basaltic dykes exhibit chilled margins. These dykes represent the feeders for basic lavas extruded onto the ancient sea-floor. Spreading sea-floor centres of this type require a 'feed' of magma from below. The site at Godrevy therefore represents a fossil record of feeder dykes for such a spreading centre, which took place during the Devonian Period. This area forms a very important record of geological events leading up to the formation of the Lizard ophiolite sequence.

Godrevy Cove



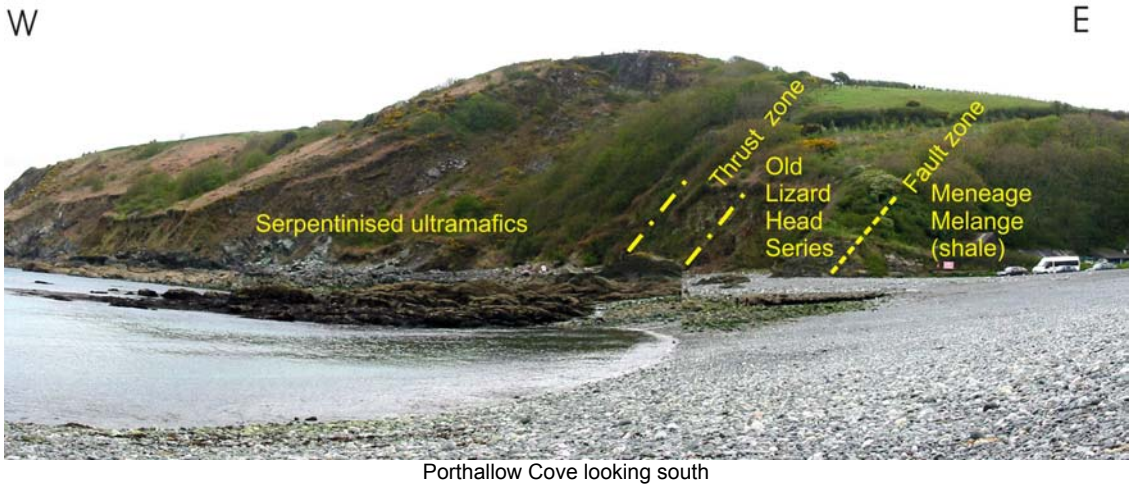
Basalt



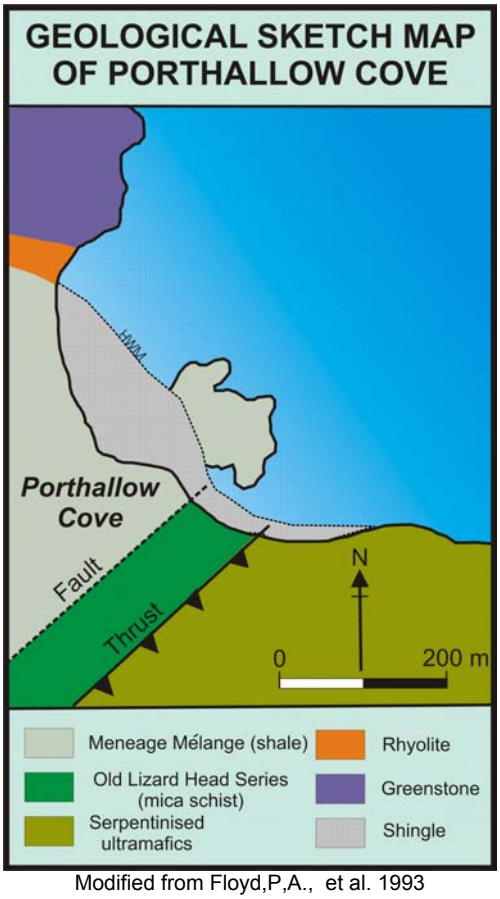
Basalt sheeted dykes

Porthallow

At Porthallow Cove The Lizard Boundary Fault is exposed on the south side of the cove where the Old Lizard Head Series schist is faulted against the Meneage Melange rocks or Roseland Breccia. Further south the schists are overthrust by serpentinized peridotites and gabbro.



Porthallow Cove looking south



Modified from Floyd,P.A., et al. 1993


Old Lizard Head Series schist

Fault zone on south side

On the north side of the cove is the contact between acid rock of rhyolite and a basic rock of basalt or greenstone.

Porthallow Cove looking south

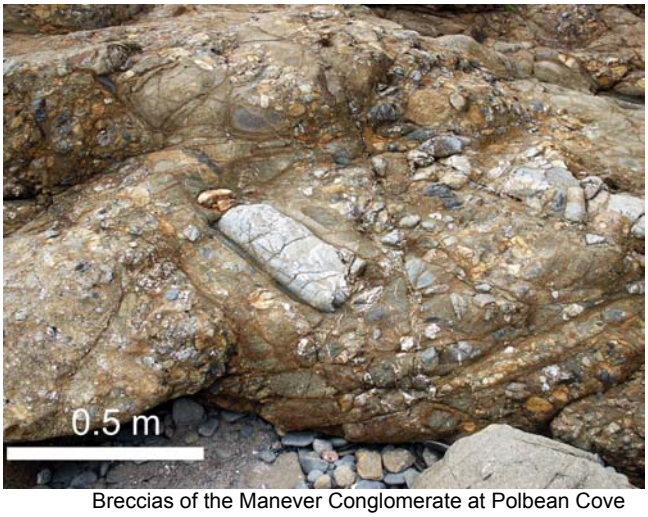
Rhyolite-greenstone contact

Polbean Cove

Around the coast to the south from Porthallow to Nare Head and around Polbean Cove the rocks exposed are part of the Meneage Melange or Roseland Breccia Formation. As the continent of Gondwana advanced it produced by tectonic activity topographic highs that caused slope failure with debris flows. This in turn caused older rocks (Ordovician) to fall into the Devonian marine mudstones. With erosion these are now exposed as quartzite blocks, once sandstones, and the more extensive breccia deposits (Manever Conglomerate) as at Polbean Cove.

Polbean Cove looking west from Nare Head

Quartzite

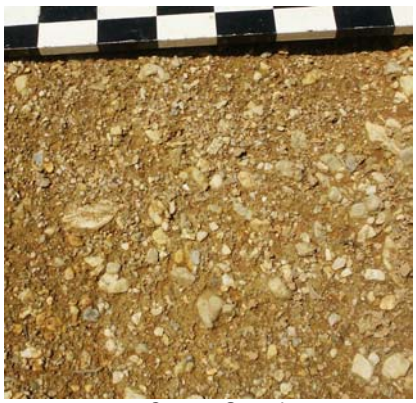


Breccias of the Manever Conglomerate at Polbean Cove

Surficial Geology

There are superficial deposits lying on the Lizard rocks at Crousa Downs, Lowland Point, and as an apron of clay-bound gravels around the coast. Those at Crousa Down represent a Tertiary Age deposit of sands and gravels of probable fluvial origin, which have been derived from the north. These gravels contain traces of cassiterite and gold and would be classified as placers. At Lowland Point is a Pleistocene Age deposit of loess of wind blown silty sediments (this occurs elsewhere on the Lizard) and clay-bound gravels occurring as aprons around the coast of solifluction deposits known as head are also Pleistocene in age. The head deposits sometimes show evidence of frost heave (cryoturbation).


Crousa Gravel deposit


Crousa Gravels

Lowland Point from Coverack

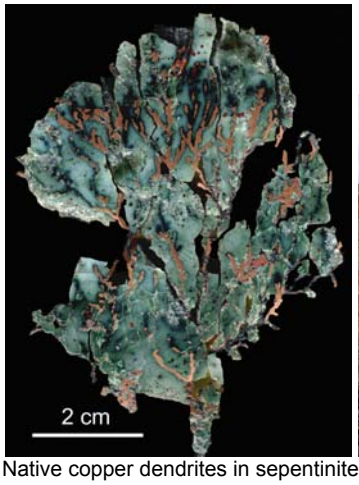
Loess deposit and raised beach at Lowland Point


Head deposit showing cryoturbation


Head deposit

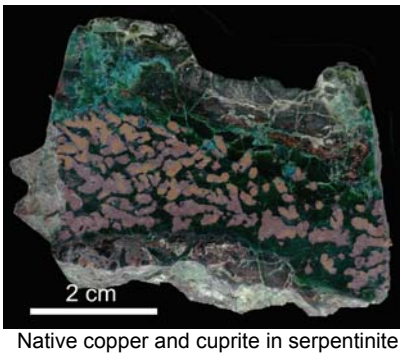
Mineralization

Mineralization and alteration within the Lizard Complex is widespread. Native gold and cassiterite have both been found in the drainage. The gold and cassiterite have probably been derived from areas to the north of the Lizard Complex from around the Carmenellis granite and are probably part of the heavy mineral assemblage left by the erosion of Tertiary gravel deposits. Trace nickel sulphides have also been discovered in certain Lizard rocks. Ilmenite occurs in abundance and vanadiferous magnetite has been recorded by the BGS. The first record of illemenite ($FeTiO_2$), named at the time, manaccanite was from Tregonwell Mill, at Manaccan and was discovered by William Gregor in 1791.Ilmenite is closely associated with the gabbro where it forms a component of the rock. Trace platinum has also been recorded from the Lizard both in alluvial sediments and rocks. Minor chromite is associated with some of the serpentinite. Negligible sulphide mineralization, probably related to cross-course mineralization is noted from a quarry on the north east side of the Lizard. However economic metalliferous mineralization is limited to the exploitation of copper where it has been mined from both adits on the coast and small mines inland. Copper mineralization is mainly limited to both native copper and cuprite (Cu oxide), and infrequently chrysocolla (Cu silicate). Some of the copper may have been derived from supergene enrichment. Mining activity was very insignificant in relation to the rest of Cornwall and ceased at the end of the 19th century.



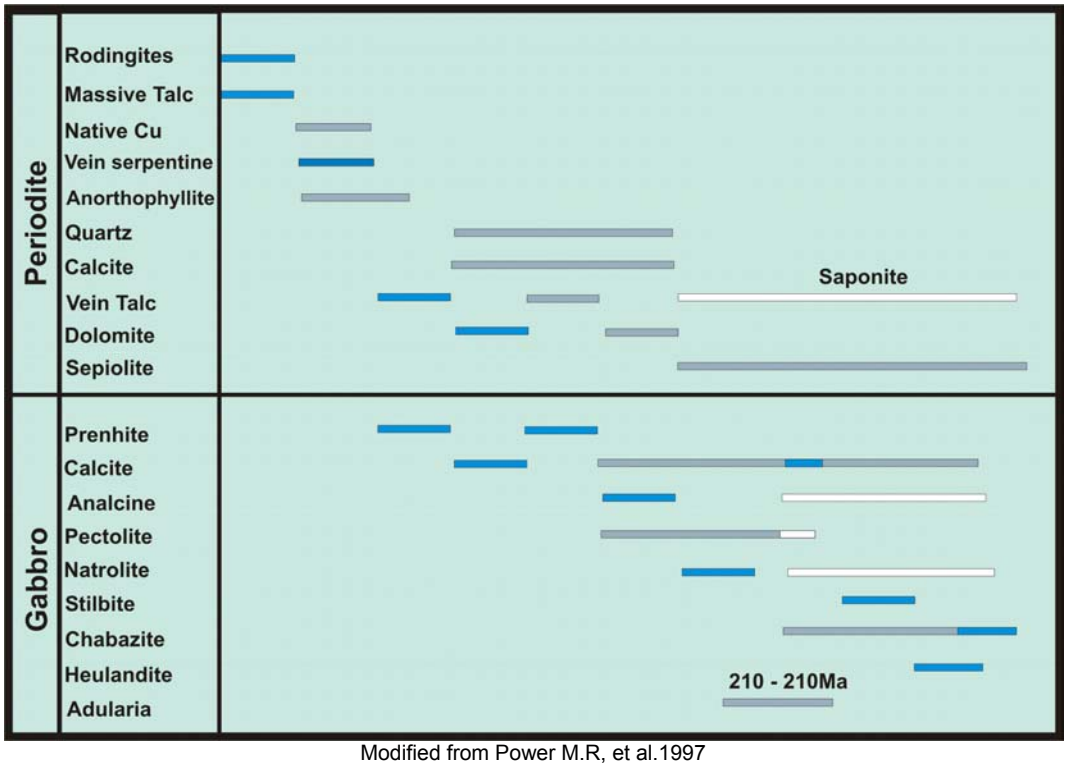
Native copper dendrites in sepentinite


Cliff mining at Beagles Point



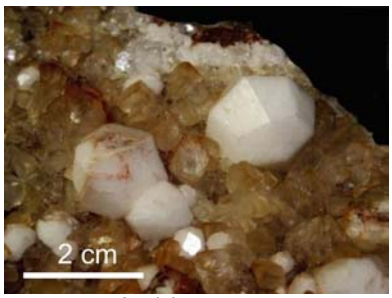
Native copper and cuprite in serpentinite

Evidence for mineralising fluids of a similar age to cross-course mineralization comes from the dating of adularia in veins at 210-220 Ma and forms part of the post-sepentinization fracture-hosted mineralization episode. The paragenetic sequence for mineralization across the Lizard is shown below.

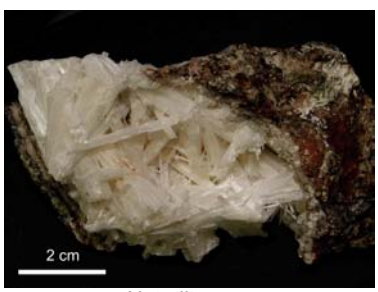


Modified from Power M.R, et al.1997

The Lizard area is noted for the occurrence of zeolites of analcine, pectolite, natrolite, and stilbite, which occur in the gabbros near St Keverne.



Analcine



Natrolite


Pectolite