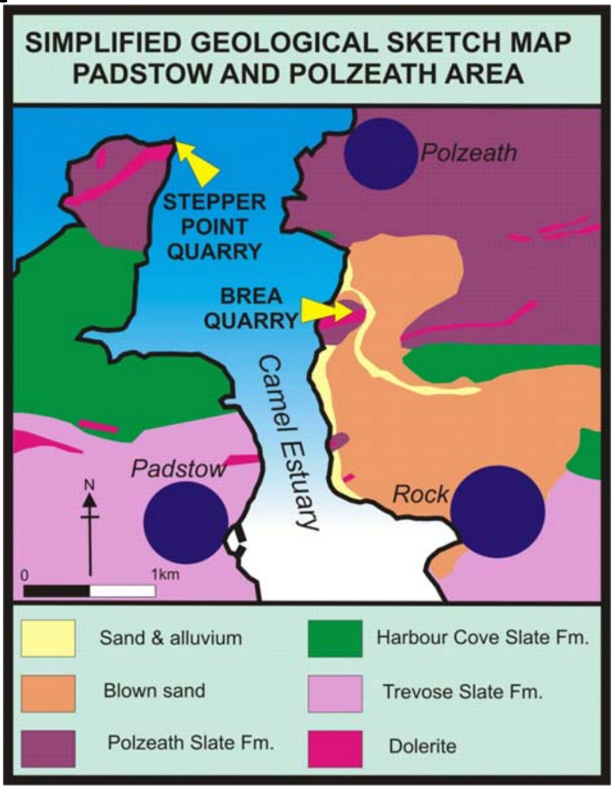
# PART 2 NORTH

## STEPPER POINT AND BREA QUARRIES

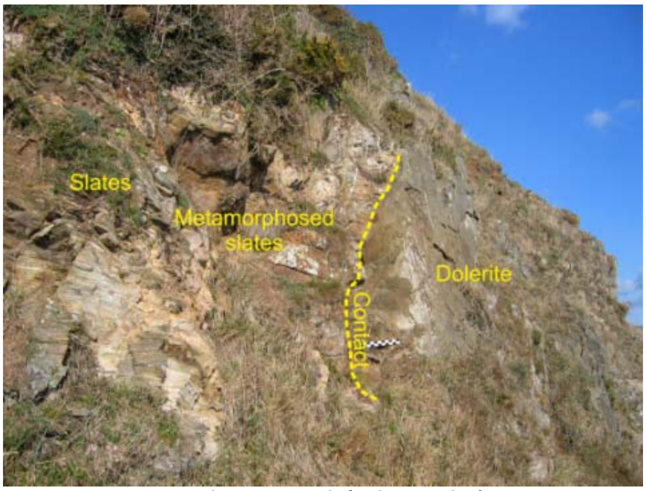



Quarrying activity for hard rocks has occurred on both sides of the Camel Estuary. All quarries are now defunct. The rock being exploited was a “greenstone” or dolerite. Dolerite is similar to basalt in that it is a basic volcanic rock but the crystals are often visible indicating a gradual cooling. Often dolerite has been the reservoir for extrusive basaltic rocks extruded from a volcano. These rocks often have a greenish hue due to the presence of the green mineral olivine. As intrusive rocks they often occur as dykes or sills. The mineral composition is mainly of olivine, augite and plagioclase feldspars, and it has a low silica content.

Stepper Point Quarry looking north

Stepper Point Quarry looking south east

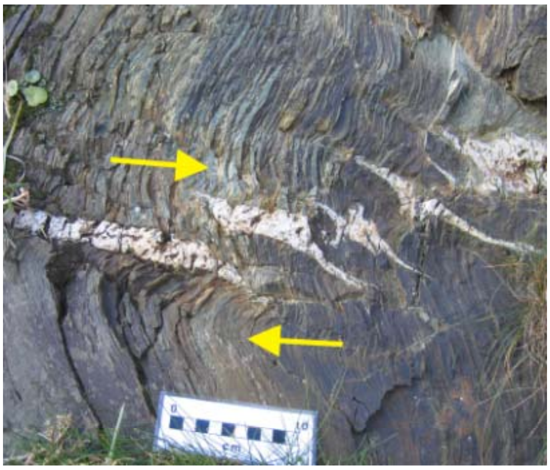
**STEPPER POINT** forms the western side of the mouth of the Camel Estuary, which has several conservation designations, and the coast is part of the Cornwall Area of Outstanding Natural Beauty. AONBs have the same legal protection as National Parks and were set up under the same legislation in the early 1950s.



Contact between dolerite and slates

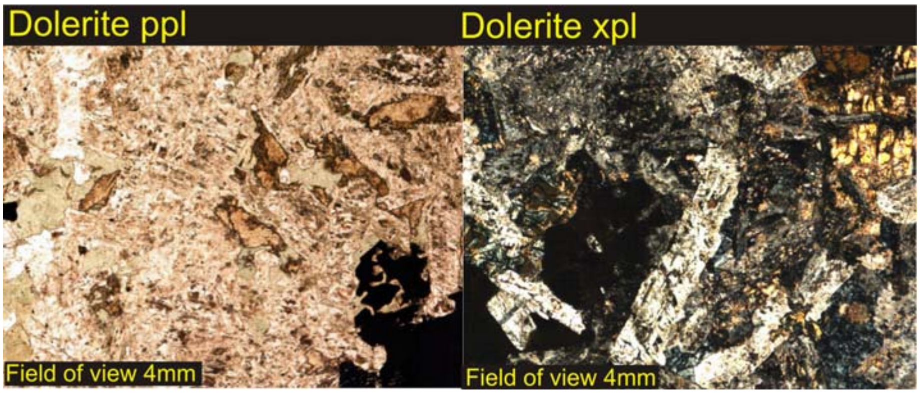
Thus it would be very unlikely that planning permission would be granted today for a quarrying operation in such a position. Though no buildings are visible, the profile of the point is evidently not natural, and this can be seen from many places within the estuary.


View of Stepper Quarry from Daymer Bay

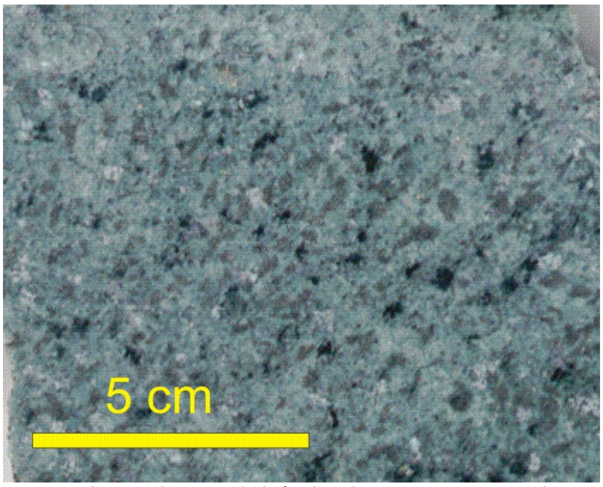

Tension gash quartz veins

The Camel, and its main port of Padstow, provides one of the very few places of safety for ships along the North Cornwall (and indeed North Devon) coast, so many weather-beaten vessels have made a run for the estuary over the centuries. Many of these vessels, escaping winds from south-westerly to north-easterly, have found the safety illusory as once they were sheltered inside Stepper Point they lost the wind and were washed onto the Doom Bar, a vast sand bank which migrates west and east just inside the mouth of the estuary.

The dolerite rock now seen in the quarry was once part of a magma chamber for a sub-sea volcano during the Devonian Period. This basaltic igneous rock has intruded into marine sediments, the contact of which can be seen near the entrance to the quarry. The marine sediments have been folded and metamorphosed into purple and green slates. Evidence of the compression is seen in tension quartz veins that have formed in low-pressure regions. At the contact with the dolerite the slates have been thermally metamorphosed by the hot igneous intrusion. Aggregate from the quarry was used for a local Second World War aerodrome, and no doubt also for roads in the area. Quarrying however had commenced in the early part of the 20th century.




Thin section of dolerite from Stepper Point Quarry



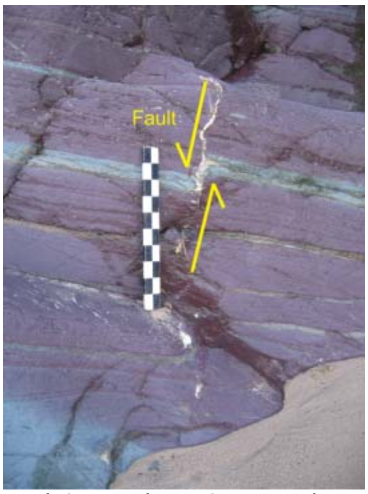

Hand specimen of dolerite from Stepper Point Quarry

**BREA QUARRIES** on Brea Hill were only very small-scale operations. The lower quarry has exposures of dolerite formed from a sub-sea volcano and metasediments (slates) but also along the contact there is evidence that the magma not only baked the country rock but also fluids permeated and changed ('metasomatised') it, so it is difficult in places to pinpoint a boundary between the intrusion and the country rock. The quarry also has two sets of faults, approximately parallel to the side and back walls respectively, and in places slickenlines are well developed.


Brea Hill and quarry

Naturally the best exposures of the geology are near sea level, and it must be stressed that the beach around Brea Hill is covered well before high tide. Around the shore the rock is mostly the distinctive purple and green slates of the Polzeath Slate Formation. Analysis of the rock shows that both purple and green contain around 8% iron oxides, with a split of approximately 5% and 3% iron II and iron III (with iron III – 'ferric' – dominant in the purple rock, and iron II – 'ferrous'-dominant in the green). Whether the original of the banding is primary or secondary (or both) has been the cause of much discussion.


Slickenlines in Brea Quarry

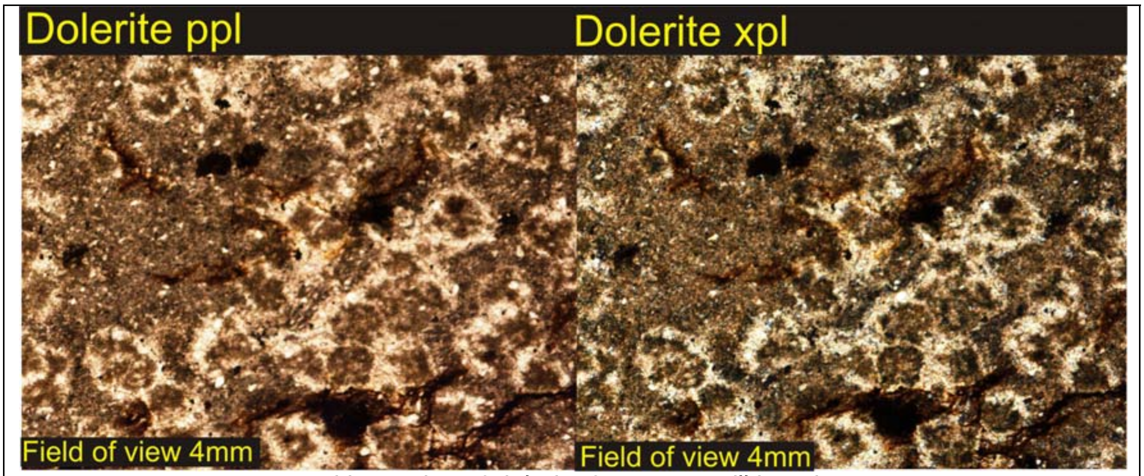



Fault in purple and green slates

The exposure of the dolerite on the beach can be seen from a long way off because not only is the joint pattern different to the slates but the colour also. Close-up the boundary is more difficult to pinpoint both because of later faulting along the contact but also because of the invasion of the country rock by metamorphic hydrothermal fluids. There is also some evidence of very early intrusion into soft sediments. The sea has eroded a small cave along a nearby fault, though miners may have extended this, as there is a fair amount of lead mineralization nearby. The lead ores contained a variable amount of silver. Most of the quartz veins however are unfortunately barren.

Faulted contact between dolerite and slates

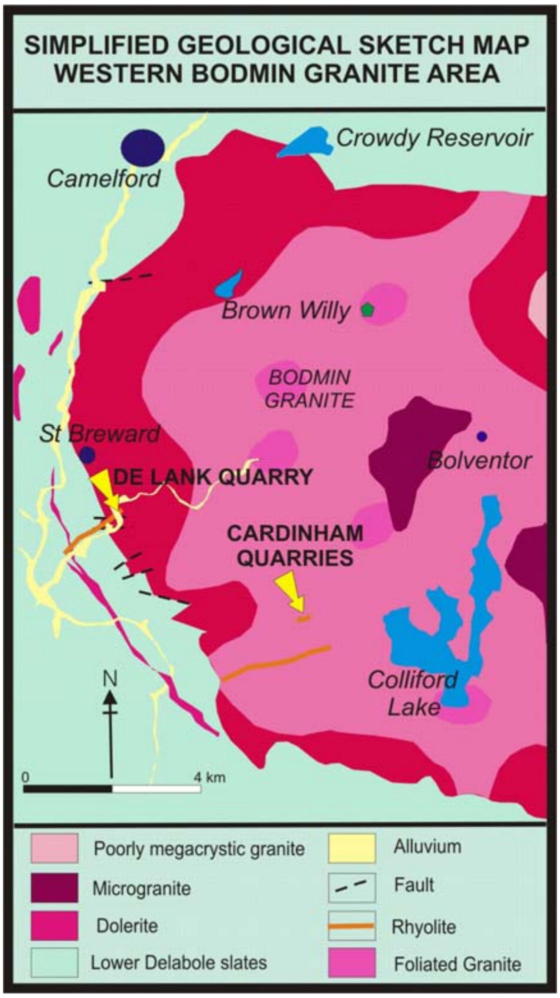

Soft sediment deformation



Thin section of dolerite from Brea Hill beach

## DE LANK AND CARDINHAM QUARRIES

**DE LANK QUARRY**, on the western edge of Bodmin Moor, is well known as a supplier of granite. The De Lank granite is one of the oldest granite bodies in the South West, being intruded around 290 million years ago into Devonian slates. The granite is a weakly megacrystic two-mica granite and is cut by two rhyolite dykes, in Cornwall colloquially called “elvans”. Elsewhere in Cornwall the rhyolite dykes postdate the main granite intrusion by about 20 million years, though the rhyolites at De Lank have not been dated.




De Lank is famous as a supplier of cut granite or dimension stone but in addition in the late c.20th De Lank exploited one small granite quarry for aggregate and had a crushing plant. This could not compete on price with nearby large aggregate quarries, so it soon closed. Earlier, narrow dykes of rhyolite, which cut the granite, had been exploited for aggregate. These form striking linear slits, and often two or more can be seen running parallel. The entrance for vehicles to De Lank Quarry is cut through one of these rhyolite dykes, forming a ‘canyon’. Many of these old rhyolite quarries have been colonised by vegetation and not much rock is visible.


General view of De Lank Quarry

View showing rhyolite quarries

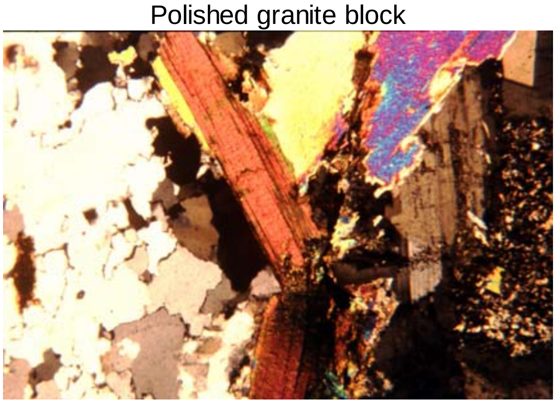
In order to quarry raw material of adequate size for making into slabs and blocks the discontinuities - such as joints and faults – must be widely spaced. For producing aggregate discontinuities cut the cost of working the quarried stone, but they need to be far enough apart to enable the required size of aggregate. De Lank produced aggregate in the past, and indeed the neighbouring (now inactive) Hantergantick Quarry, which also produced dimension stone, had a small operation recently crushing waste for aggregate. De Lank's waste is dumped nearby in the valley but in future crushing the waste for aggregate may be economically viable.

The granite is cut and worked for paving – such as in Trafalgar Square, and Burlington House, or polished as facing on steel and concrete buildings – such as New Scotland Yard. But in the past large worked blocks of De Lank granite were used for many civil engineering works, and because of its strength and lack of flaws these included structures in the most extreme environments such as lighthouses.


Quarry face in rhyolite


Hantergantick Quarry


Polished granite block


Thin section of De Lank granite

## CARDINHAM

The upland of Bodmin Moor is underlain by granite, which is well seen in tors and in the many deserted quarries.

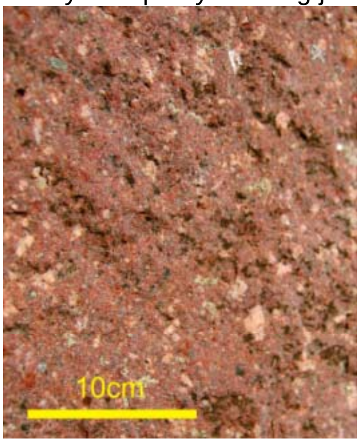
The Cardinham quarries, near Colvannick Tor, on the moor are like slits in the landscape, being far longer than their width. They are cut into a hillside, with a flat floor, which leads straight onto a moorland track. These quarries worked rhyolite, a fine-grained equivalent of granite, which probably formed about 20 million years after the main intrusion and cuts cleanly through the granite. The northernmost quarry has a porphyritic rhyolite with feldspar phenocrysts up to 6mm long, plus fewer quartz and dark mineral phenocrysts. The rock colour varies from almost white through orange-red to brown and dark grey. The orange-red material could potentially be used as an ornamental stone but since the discontinuities are 10-20 cm apart, or less, it could not be used for masonry. The rhyolite – 'elvan' in Cornwall - was probably crushed to provide aggregate for tracks, farmyards and for making concrete.

The track on the moor to the quarries was made using a variety of rocks: granite, rhyolite and schorl (a quartz-tourmaline rock). The main rock in the area is granite and this part of the track material was probably very locally derived.


View of Colvannick Tor


Upper rhyolite quarry

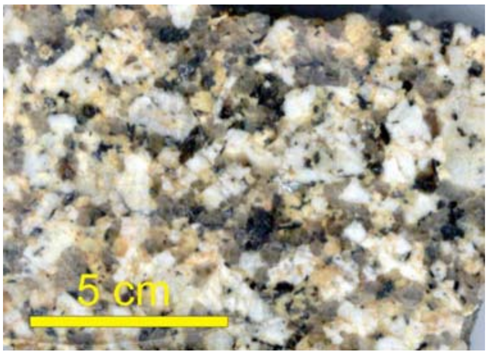

Lower rhyolite quarry showing jointing



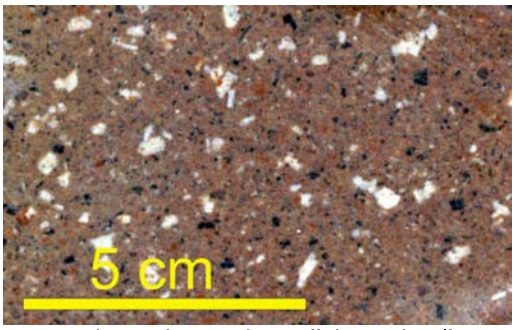
Rhyolite in the quarry face

The southern quarry is larger than the northern one and shows evidence of boreholes so this presumably was worked with explosives. The northern margin is fault-bounded, with slickenlines indicating dipslip. Normal granite is seen on both sides, and the maximum thickness of the dyke is less than ten metres.

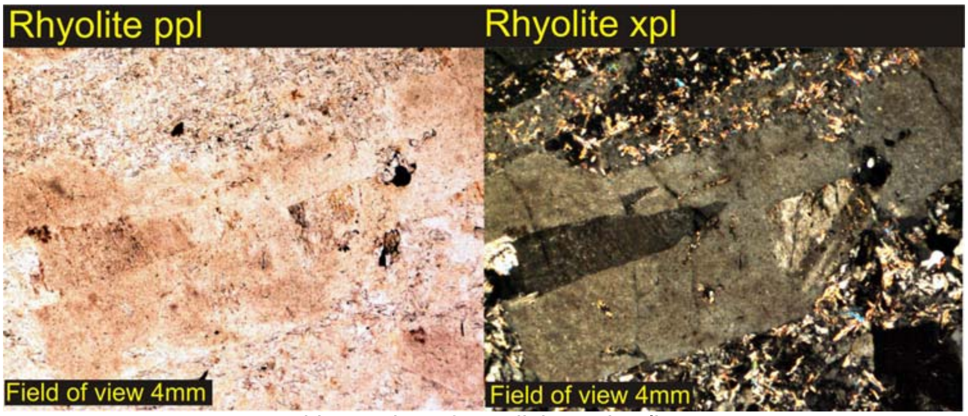
Track from the rhyolite quarries




Hand specimen of Cardinham granite




Hand specimen of Cardinham rhyolite




Thin section of Cardinham rhyolite

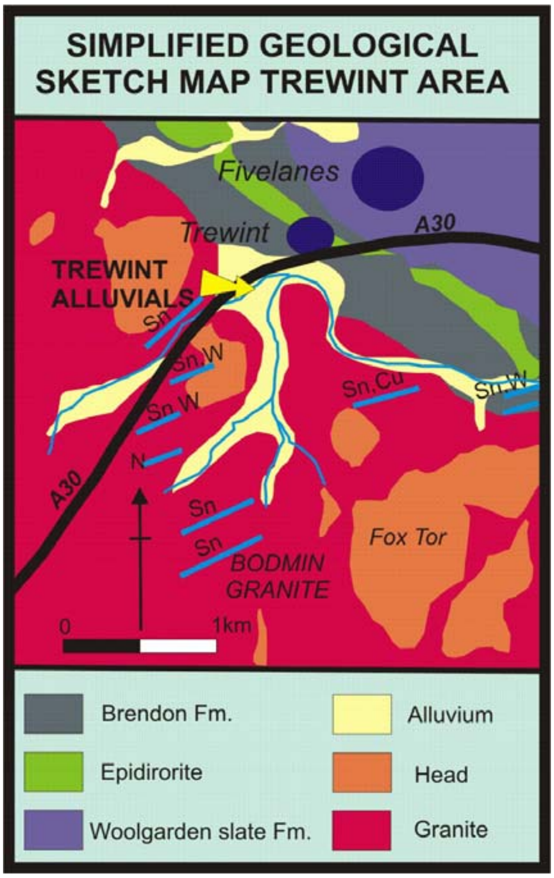
The two rhyolite quarries are on the western edge of the moor on Cardinham Moor, with a track which leads directly to the A30, the longstanding main artery into Cornwall, so it is likely that stone was used for the road back when it was a turnpike.

Fault with slickenlines

Evidence of boreholes

## TREWINT ALLUVIALS

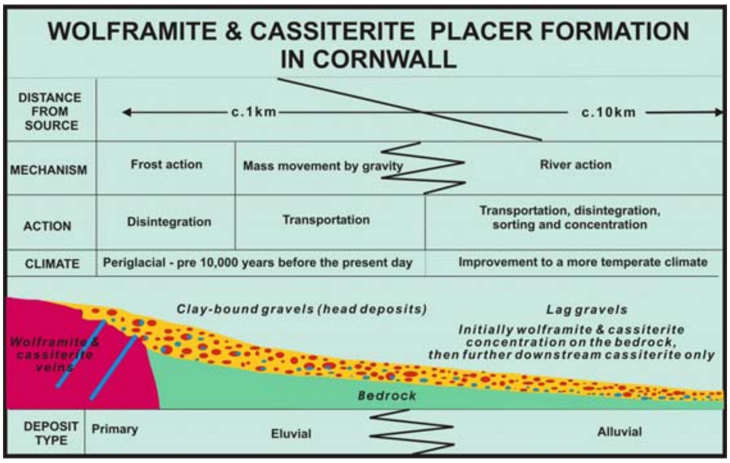
The Trewint alluvials are situated on the eastern side of the Bodmin granite adjacent to the contact with metasedimentary rocks and the main A30 road through Cornwall. The site is at the confluence of two small valleys draining Bodmin Moor, the one to the south having tin and tungsten mineralization in the form of veins or lodes recorded in the area. Sands and gravels have been extracted from the Trewint alluvials for some considerable time, initially as a by-product from alluvial tin working and later from tin and tungsten recovery during the Second World War. In later years the site has been worked for sand and gravel only as a source of aggregate by Bodmin Moor Alluvials.




Sand and gravel recovery operation at Trewint

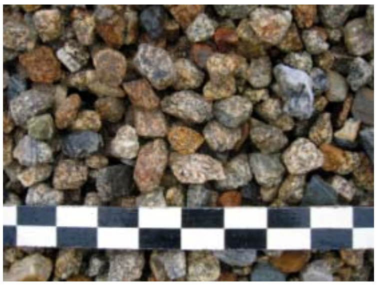
Strictly speaking the deposit is an eluvial deposit. It is a mixture of angular to sub-angular gravels and cobbles in a sandy matrix. Within the sands and gravels both cassiterite (tin oxide) and wolframite (an ore of tungsten) occur in low concentrations. Occasionally these are seen in cobbles. The depth of the deposits varies from 10 to 20 metres to bedrock. The majority of the clasts are granitic with occasional lode or vein material of quartz, sometimes brecciated and occasionally with black tourmaline. The material has been derived from upslope on the moor where during weathering in the Cenozoic an accumulation of resistant lode quartz remained. Later in the early Quaternary during the Ice Age when periglacial conditions prevailed, the granite was broken via the joints by frost action. As the climate improved to a more temperate one, solifluction, caused by freeze-thaw of permafrost, transported the material downslope by the action of gravity to accumulate in valley systems.


Boulders and cobbles





Mineralized cobbles


Gravels

Wolframite in quartz

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