MARAZION TO PORTHLEVEN



This area of Mount's Bay runs from Marazion in the west to Porthleven in the east. Geological exposures and examples range from metasediments, basic intrusions, granite magmatism and mineralization, contact phenomenon, Variscan tectonics and Quaternary geology.

St Michael's Mount

The exposure on the Mount affords one of the best examples of a sheeted greisen vein system hosted mainly in granite in the Cornubian Orefield. Here in the southern portion of granite porphyry hosts a greisen bordered vein system striking east-west up to 50m wide. The granite on the northern side is surrounded by metapelite of Devonian Age.





St Michael's Mount looking west

St Michael's Mount comprises a small porphyry granite intrusion (stock) intruded into Devonian mudstones (pelites). The granite, connected to the batholith at depth, is exposed on the southern side (seaward) and is mineralized as it hosts a greisen-bordered sheeted vein system (endogranitic greisen) which carries tin (cassiterite) and tungsten (wolframite) with accessory minerals of lollingite/arsenopyrite (arsenic minerals). The pelites have been thermally metamorphosed to hornfels and in places are cut by granitic veins illustrating the mechanism of igneous emplacement by stoping. Within the granite the greisen veins have a preferred E-W orientation and are closely spaced. The veins show typical space-filling structures with euhedral, vughy and crustiform (minerals deposited in layers) gangue (minerals of no value-quartz etc.) and ore (cassiterite/wolframite). Accessory minerals occurring in the veins are apatite, beryl, topaz and litha micas. The veins are greisen-bordered with white mica and quartz and the borders vary in width and are tensional structures. Some veins carry sulphides, which were deposited later than the tin and tungsten.



Sheeted greisen veins

Greisen veins



Detail of greisen vein

Wolframite in greisen vein

The St. Michael's Mount granite displays significant textural variation. The major part of the intrusion comprises tourmaline muscovite granite (locally porphyritic), with a change to biotite granite in the marginal areas. Also exposed on the seaward side are comb-layer pegmatites (stockscheider) with curved and branching alkali feldspars, these separate the porphyry granite from two-mica granite, which indicates a multiple intrusion.



Stockscheider Pegmatite

Curved feldspars in stockscheider

Devonian age sediments were subjected to low grade metamorphism by tectonism (Variscan Orogeny) with regional deformation (folding). Granites were emplaced at the end of this phase (magmatic activity) by piecemeal stoping during the late Carboniferous-Permian (300-280Ma), followed by magmatic-hydrothermal tin mineralization.



Cross-cutting relationships

Detail of greisen veins in metasediments

During granite emplacement the sediments were locally thermally metamorphosed to hornfels. On St. Michael's Mount the granite was fractured by hydraulic failure (fluid fracturing of rock) as a consequence of overpressures (where the pressure of the fluids overcomes the pressure of the rock above) generated in magmatic/hydrothermal fluids. These accumulated under the roof (carapace) of the granite due to the crystallisation of the granite, which was impermeable to the fluids.

As the granite was subjected to regional and internal stresses the hydraulic fracturing formed along preferred trends - in the case of St. Michael's Mount these formed E/W sub-parallel veins.

The magmatic (derived from the magma) fluids carried many reactive elements in solution, i.e. fluorine, as well as metallic elements, and were acidic in character. As the fluids escaped through the fractures they altered the granite, the K feldspars were replaced by quartz and white micas (muscovite), this process is called greisening. Tin and tungsten minerals were deposited in the quartz veins. The fluid temperatures ranged from 340-400[°] C. Greisens are specific to cupola zones of highly differentiated (S-type) granites.

These fractures remained open to convecting exogranitic (outside the granite) hydrothermal fluids which later overprinted the veins with sulphides - in the case of St. Michael's Mount these are of chalcopyrite (copper iron sulphide) and stannite (copper tin sulphide), fluid temps 280-300^oC. The stannite has weathered in exposed sections to varlamoffite, a hydrous tin oxide.



Stannite vein

Stannite altering to varlamoffite

Venton Cove

Just to the NE of St Michael's Mount on the shoreline east of Marazion in Venton Cove are interesting geological exposures. A rhyolite contact with metasediments has a rather irregular contact and in places incorporating enclaves of the country rock. Nearby is a small exposure mapped as a hyrothermal breccia. The breccia fragments are cemented in a rock flour formed by the explosive spalling of the sidewalls by sudden decompression and fluidisation. Crosscutting the metasediments is a low temperature, probably, epithermal quartz vein striking approximately NNW-SSE. The vein is characterised by the repeated banding and 'cockscomb' nature of the quartz.



Northern end of Venton Cove

Rhyolite metasediment contact



Hydrothermal breccia outcrop

Epithermal quartz

Basore Point

To the south of Venton Cove more basic rocks are exposed which are mainly gabbroic in character. These gabbroic rocks are considered to be of the same age as the pillow lavas occurring elsewhere and are probably contemporaneous with the Devonian sediment deposition. Boat Cove has an excellent example of Pleistocene periglacial head produced by the downslope movement of gelifracts and clay; this often forms an apron draping the hardrock around the coast. The head lies on a basement of gabbroic rock.





View from Basore Point towards St Michael's Mount

Boat Cove showing periglacial head overlying gabbro







Cudden Point and Mount's Bay

The headland around Cudden Point is of Devonian dolerite and gabbro, a contact between this and the sediments can be seen at Piskies Cove where it occurs as a flat lying sheet.



Dolerite sill contact with metasediments, Piskies Cove



View of Keneggy Sands looking East

At Kenneggy Sands a large lode structure is exposed on the beach, part of the copper mining activity in the area, evidence of which is seen further on the beach by green staining. Hydrothermal mineralization associated with the granite intrusion leached copper and other heavy metals from the country rocks to deposit them in lode structures as fissure veins. The larger banded quartz veining may represent a later overprint by a lower temperature mineralization phase, possibly associated with cross-course mineralization.



Lode structure on west side

Intense folding in the cliff exposure

Intense chevron folding of the Devonian sediments, formed during deformation during Carboniferous convergence, can be seen in cliff exposures as well as extensional faults from the period of Late Carboniferous-Permian extension. A hydrothermal breccia is also exposed in the cliff near the copper mineralization outcrop.



Copper mineralization



Extensional faults



Hydrothermal breccia



Raised beach

A raised beach exposure demonstrates variations in sea levels during the Quaternary. These occurred during Pleistocene interglacials with high still stands and occur around the coast at various elevations.

Praa Sands

Coastal erosion has exposed Quaternary Age peat deposits overlying a paleosol of silt with gravels and cobbles on the beach, all overlain by wind blown sand. This probably formed in a swampy valley during a period of a lower sea level during the Neolithic some 4500 years BP.



Peat and paleosol

View of east end on Praa Sands

To the east of the beach is the contact between Godolphin-Tregonning granite and sediments. Granite sheets or veins crosscut the metasediments and pegmatites and aplites have formed in roof zones. The exposure illustrates the invasion of the granite into country

rocks by stoping and the formation of comb layer pegmatites and aplites. These were formed as stoped blocks fall and there is a corresponding pressure change leading to the 'freezing' of the intrusive magma. As well as sill like sheets there are examples of bridging veins. Further examples of this are exposed at Rinsey Cove and Megiliggar (see field excursion Tregonning-Godolphin granite coastal exposure).



Granite vein in hornfelsed metasediments

Pegmatite-aplite

Porthleven Northwest

On a wave cut platform to the northwest of Porthleven lies a glacial erratic of gneiss known as the Giant's Rock. This was probably the result of an iceberg stranded on the platform at a high tide during the Pleistocene.



Glacial erratic