

Field excursion to the Gramscatho Group of south Cornwall, 5th January 1991

R.K. SHAIL

Camborne School of Mines, Redruth, Cornwall TR15 3SE



The purpose of this field excursion was to provide an outline of the style of sedimentation within the Gramscatho Basin during the Upper Devonian, the subsequent Variscan deformation, and to relate this to current ideas as to the tectonics of the area. In the limited time available, the most favourable locations to achieve this objective are those to the north of the Lizard Complex in the Meneage area of south Cornwall (Fig. 1). The intrepid party assembled at the Crossroads Hotel, Scorrier, with the warnings of storm-force westerlies and reports on local radio of gusts over 100 mph already being recorded by the Falmouth coastguard. The locations are described in order below. The stratigraphic terminology is largely after Holder and Leveridge (1986).

Jangye-ryn (SW 6580 2070)

The prevailing meteoric conditions precluded close inspection of the lithologies at the first locality. Cliff exposures of SSE dipping medium- to thinly-bedded turbidites of the Portscatho Formation were viewed by the party from a safe distance. Fossil wood fragments (*Dadoxylon hendriksi*) retrieved from this locality by Hendriks provided an early indication of the likely Middle-Upper Devonian age of the Gramscatho sediments (Lang 1929). More recent work at this locality by Le Gall *et al.* (1985) established a Frasnian age on the basis of palynomorph assemblages. Immediately to the SE, a steep S-dipping ?normal fault (SW 6596 2060) brings the Came Formation into contact with the Portscatho Formation.

Church Cove (SW 6610 2040)

The party walked 250m wouthwards past Gunwalloe Church and took shelter in the NW side of the cove. Access to the exposure was again restricted by large waves, however, medium- to thicklybedded turbidites of the Came Formation were observed at one of the few localities in Gramscatho Basin where sole structures are preserved. Flute marks and grooves can be seen on the inverted limbs of mesoscopic S plunging isoclinal F1 folds that face NW.

Rare examples of isolated sandstone lenses are present within mudstone-rich horizons and indicate slumping of partially consolidated sediment. The distinction between the Portscatho and Came Formations is on the basis of the higher sandstone:mudstone ratio and greater mean bed thickness of the latter. In common with many outcrops along this coastal section, there is evidence of late or postorogenic extension along a combination of moderately-dipping bedding parallel, and more steeply-dipping normal faults.

Menaver Beach (SW 7955 2493)

The cars were parked at Lestowder farm (with the prior permission of the owner), and we walked a short distance to Menaver Beach. Here the party examined exposures of medium- to thickly-bedded normally-graded pebbly sandstones within the Came Formation, interpreted as the deposits of high-density turbidity currents. At the eastern end of the beach, erosive contacts indicated a 2m thick channel-fill rudite containing large angular cobbles at its base. Above the channel-fill, thin medium- to coarse-grained sandstone laminae in a mudstone matrix were interpreted as channel overbank deposits. A wide range of clast types were identified in the rudite, including granite, quartzite, vein quartz, mica-schist, sandstone and mudstone (see Flett 1946; Barnes 1984). In addition, rare large clasts of limestone were found (by Kevin Page, NCC Stratigraphy Branch) containing fossil orthocones; these do not appear to have been previously described in the literature for this locality. After a brief discussion of sediment provenance studies, the party enjoyed a lunch of modest proportions at "The Five Pilchards", Porthallow.

Nelly's Cove (SW 7975 2350)

We walked 150m northwards from the car park at Porthallow Cove to the large outcrop of altered felsite present in the cliff at Gallentreath (SW 7971 2337) and from there onwards to the greenstone outcrop on the south side of Nelly's Cove. Relict pillow structures were locally observed by the faithful and the the

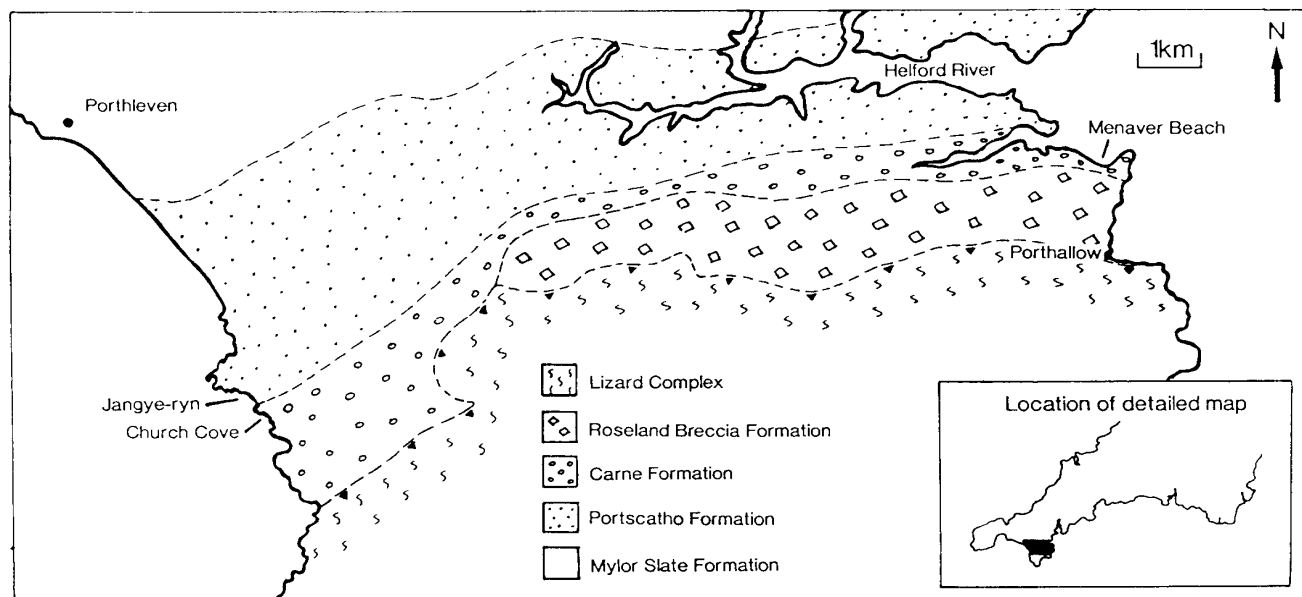


Figure 1. Simplified geology of excursion area modified after Holder and Leveridge (1986).

contact relationships between the greenstone body and its mudstone matrix were considered. On the west side of Nelly's Cove, superb examples of siltstone and sandstone clasts are contained in a mudstone matrix and flattened in the plane of the moderate south-easterly dipping S1 cleavage. Isolated folded chert beds that yielded a middle Devonian ostracod fauna to Cooper (1987) were also observed; it was suggested, however, that these were present as olistoliths and did not represent the true depositional age of the unit. Lambert (1965) used this locality to propose a sedimentary origin for this unit (the Roseland Breccia Formation of Holder and Leveridge, 1986) which had previously been interpreted as a fault breccia (Meneage Crush Zone). The complex association of clasts varying in size from several millimetres to tens of metres and set in a mudstone-rich matrix, was interpreted in terms of a submarine debris flow, although it probably also acted as an important shear-zone during later deformation.

South side of Porthallow Cove (SW 7985 2320)

After retracing our steps, we proceeded to the south side of Porthallow Cove. The first outcrops encountered were of thinly-bedded siltstones. Further eastwards, a relatively steep south-easterly dipping faulted contact with fine-grained mica schists is observed. This was interpreted as the contact between the Roseland Breccia Formation and the Old Lizard Head metasediments of the Lizard Complex. To complete the story, the party continued another 100m or so eastwards until a low angle fault was inferred to place serpentinitized peridotite over the Old Lizard Head metasediments. After a summary of the day's geology, the party returned, somewhat weather-beaten to the Porthallow car park.

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Field excursion to the Lizard Complex, 5th January 1991

A.V. BROMLEY

Wilson Way, Pool, Redruth, Cornwall TR15 3RS

The Lizard Complex is thought to be part of a dismembered Variscan ophiolite which developed in a back-arc basin environment during Lower Devonian times. The exposed parts of the complex comprise three tectonic units separated by subhorizontal thrust planes. Thrusting took place in the oceanic environment, close to the site of generation of the ophiolite, because a granulite facies, dynamothermal metamorphic aureole underlies each thrust plane.

Only in the highest (Crousa Downs) tectonic unit is part of the largely undeformed ophiolite preserved. In excellent coastal sections between Kennack Sands and Porthoustock it is possible to trace the sequence from mantle peridotites (harzburgites and dunites), through gabbros, into the root zone of the sheeted dyke complex, with associated minor plagiogranites.

Elsewhere, in the lower tectonic units, mafic rocks (gabbros, sheeted dykes and perhaps lavas) have been converted to granulites and amphibolites. Minor amounts of pelitic schist are thought to be derived from thin oceanic sediments. The Kennack "Gneiss" is believed to have been formed by melting of ocean sediments and lavas beneath the sole of the in-oceanic thrust underlying the middle (Goonhilly Downs) tectonic unit.

The obduction of the ophiolite across Devonian sedimentary rocks involved only local retrogressive metamorphism near the boundary thrust plane.

In atrocious weather an enthusiastic party of about 20 first examined the classic exposures of the Coverack shore. Beginning at the northern end of the bay, they studied the gabbro, gabbro pegmatites, various minor basic intrusions and the capricious nature of the hydrothermal alteration. To the south rotated ultramafic xenoliths appear in the gabbro and these increase in size and frequency towards the village. Ultimately the ultramafic rock can be shown to be *in situ* and cut by many sheets and dykes of gabbro and gabbro pegmatite. Near the harbour, below a new retaining wall which has concealed critical exposures, the party examined the complex relationships between the ultramafic rock, troctolites and gabbros. The troctolites have often been assumed to be disrupted cumulates, though the group noted that they carry the same tectonic fabric as the peridotite, and that this quite definitely pre-dated the emplacement of the gabbros.

In gale-force winds and a ferocious hail-storm the party visited Carrick Lûz. The magnificent flaser gabbros, with huge, deformed and serpentinitised xenoliths of peridotite, have usually been interpreted in terms of a large dyke. A new and more plausible explanation was offered that Carrick Lûz represented a down-warp, essentially a syncline, in the deformed MOHO.

After a welcome lunch and shelter from the weather the group visited the root zone of the sheeted dyke complex between Manacle Point and Porthoustock. They recognised that all the dykes are not of the same age and that some, in the classic manner of ophiolites, have only one chilled margin. The party spent some time studying the plagiogranite breccias which are intruded along some of the dykes. The group crossed to the north side of the Porthoustock valley to see the same assemblage of rocks (gabbro - dykes - plagiogranites) in a highly deformed state in the middle tectonic unit of the ophiolite.

The excursion ended with a brief visit, in fading light and against a rising tide, to Kennack Sands. The party examined critical exposures of the "Gneiss" on the foreshore where undeformed metadolerite, with xenoliths of gabbro and peridotite, is cut by a net-vein complex of microgranite. It was deformation of the net-vein rock which produced the more typical banded Kennack Gneiss.