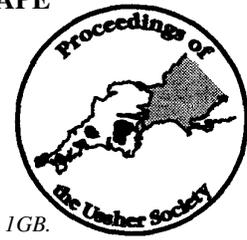


FIELD EXCURSION TO EXAMINE THE GRANITES IN THE AREA BETWEEN CAPE CORNWALL AND PORTH NANVEN, WEST PENWITH, 3RD JANUARY 1999.

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INTRODUCTION

On the day before the excursion the 'leader' visited Cape Cornwall to find westerly gale-force winds hammering the coast. Waves of 15 to 20 feet processed into Priest's Cove, drowning all of the exposures under fathoms of foam and flotsam. As the majority of the localities it was intended to visit were at sea level, the prospects did not look good. So it was with some trepidation, but with the morning's forecast ("Rain and gales easing") in the back of our minds, that a stalwart group met at the National Trust carpark at Cape Cornwall on the day of the excursion. Fortunately, the elements had by now relented a little and we were able to go ahead more or less as planned.

The purpose of the field excursion was threefold: firstly, to examine some of the variety of granites present within the Land's End Granite pluton; secondly, to demonstrate the variety of emplacement styles in this area and lastly, to show, through study of cross-cutting relationships and evidence of physical states of magmas, how a chronology of granite emplacement can be developed. The stretch of coast between Cape Cornwall and Polpry Cove (Figure 1) was chosen for the excursion because it is very informative in terms of our understanding of how the Land's End Granite pluton developed. There are few comparable areas, where such a variety of granite types can be easily examined and the contact and age relationships between them discerned. The area amply demonstrates the composite nature of the Land's End pluton and the sheet-like nature of many of the component intrusions.

PRIEST'S COVE

The party walked down into the cove and stopped first at the foot of the slipway to examine the country rocks, which are deformed Upper Devonian metasediments and metabasites of the Mylor Slate Formation (Goode and Taylor, 1988). Well-developed south-east-verging folds that are associated with a north-west-dipping cleavage were interpreted as having developed during D3 deformation. It has been suggested (e.g. Rattey and Sanderson, 1984) that similar F3 folds along the northern margin of the Land's End Granite generally verge to the northwest, and formed in response to the diapiric ascent and forceful emplacement of granite magma into the country rocks. However, more recent work has indicated that F3 folds verge predominantly to the south-east and may have formed in response to the extensional reactivation of Variscan thrust faults, prior to granite emplacement, (e.g. Alexander and Shail, 1995; 1996).

On the rocky foreshore a series of planar fine-grained (Dangerfield and Hawkes, 1981) granite sheets were observed intruding the metasediments. The angular nature of the sheets indicates that, at this structural level, the granite was emplaced passively by stoping and crack propagation. The majority of sheets strike approximately east-west, but a rare earlier north-south striking set is indicated by cross-cutting relations (as ably demonstrated by Keith Menadue). These observations suggest either successive pulses of granite emplacement, or successive and punctuated crack propagation in response to the emplacement of a single body of magma.

On the southern side of the cove the party examined the faulted contact between the slates and a body of porphyritic fine-grained granite (the Carn Glouce FGG). The contact is marked by an adit and further mine workings in the hillside above, indicating that it had been mineralised. Nearby, the party observed a narrow granite dyke intruding the Carn Glouce FGG. From the inner edge of a marginal zone, feldspar crystals extend inwards, normal to the sheet margin. The planar nature of this dyke and the fact that it cuts feldspar

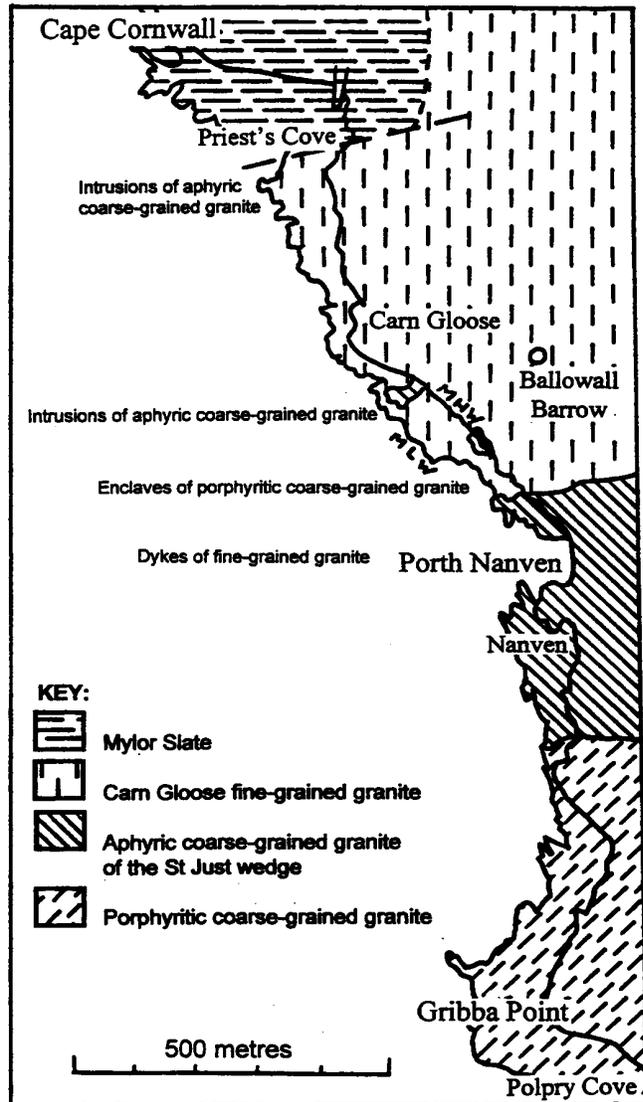


Figure 1. Simplified geological map of the coast between Cape Cornwall and Polpry Cove.

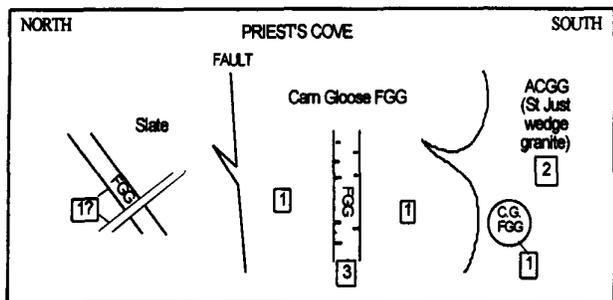


Figure 2. Schematic representation of contact and age relationships in Priest's Cove. Order of granite emplacement (numbers in squares): 1) Carn Gloose fine-grained granite (C.G.FGG) and associated dykes (1?); 2) aphyric coarse-grained granite of the St. Just wedge; 3) dyke(s) of fine grained granite.

phenocrysts in the surrounding FGG, indicates that the Carn Gloose FGG was crystallized to such an extent (although probably not completely solid) when the dyke was emplaced that it was behaving as a solid and fractured in a brittle fashion (see Salmon, 1994, for a brief discussion of the physical behaviour of magmas). The party then moved towards the seaward edge of the platform, where the Carn Gloose FGG is invaded extensively by veins of aphyric coarse-grained granite (ACGG). This granite makes up most of the "St Just wedge", a large and significant body of granite which separates the two main lobes of the pluton postulated by Chen *et al* (1993), the northern "Zennor lobe" and the southern (younger) "St Buryan lobe". The contact relationships here were very instructive. The party was able to observe contacts which are undulose or lobate and vary from sharp to fairly sharp. Numerous FGG enclaves, which are generally sub-rounded, occur within the ACGG. The nature of the contact relationships indicate that the Carn Gloose FGG and the ACGG were present as coexisting magmas, with the FGG being in place first (Salmon and Powell, 1998). As the contacts show that both of the coexisting magmas were still behaving in a 'liquid', rather than solid, fashion, the contact relationships indicate that the dyke of fine-grained granite seen a little earlier must postdate the ACGG (Figure 2).

To round off the morning session, the party examined a number of interesting features within a large dyke in the country rocks to the west of the slipway. This dyke consists predominantly of fine-grained granite which is, in parts, sparsely porphyritic. It contains a number of phenomena which suggest that it is a composite intrusion. These include: truncated banding; irregularly-shaped granitic enclaves and pegmatite stringers which cut earlier features. Towards the eastern end of the dyke the party observed large (up to 7 cm), elongate feldspar crystals with a branching habit growing normal to the margin of the dyke. The feldspars have not nucleated on the actual slate contact, but on the inner edge of a narrow fine-grained selvage. Further evidence for the composite nature of the dyke is provided by another zone of elongate, branching feldspars, approximately 30 cm below the upper margin of the dyke. An earlier pulse of granite magma had clearly crystallized to such an extent that, when a further pulse came in the feldspars were able to nucleate on the planar contact between them. Tourmaline-rich areas or enclaves within the dyke suggest that boron-rich fluids collected beneath the country rock carapace prior to the dyke propagating and were then funnelled up into it along with the granite magma.

PORTH NANVEN

Following an ample lunch in The Wellington Hotel, St Just, the party mustered once again at the seaward end of Cot Valley, which is known as Porth Nanven (Figure 1). Overlooking the beach and foreshore on the northern side of Cot Valley is a very spectacular raised beach. Some of the contents of this caused quite a furore a few years ago when displaced rounded boulders were removed from the foreshore and transported "up country" to become ornaments on the

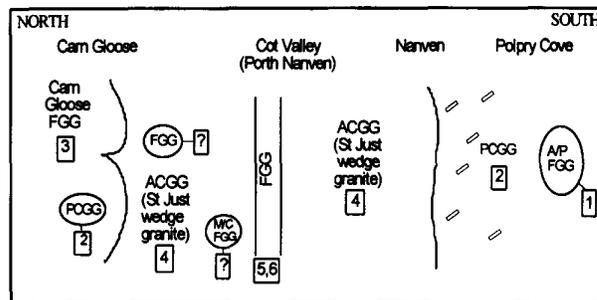


Figure 3. Schematic representation of contact and age relationships around Porth Nanven. Order of granite emplacement (numbers in squares): 1) enclaves of abundantly porphyritic fine-grained granite (A/P FGG); 2) porphyritic coarse-grained granite (PCCG); 3) Carn Gloose fine-grained granite; 4) aphyric coarse-grained granite (ACGG) of the St. Just wedge; 5 and 6) fine-grained granite (FGG) dykes, order of emplacement uncertain; ?) enclaves of porphyritic and non porphyritic fine-grained granite, position in overall chronology uncertain.

promenade at Morecambe, Lancashire. The raised beach contains boulders up to 2.5 m across and is overlain by equally spectacular head deposits. The raised beach is stratified, with a layer of very large boulders a third of the way up to cliff marking the base of one distinct unit. The rock upon which the raised beach rests is the ACGG of the "St Just wedge".

The party walked northwards (keeping a wary eye on the gathering swell and incoming tide) along a narrow concrete path covering an active sewage pipe until the southern margin of the Carn Gloose FGG was reached. The contacts here were again observed to be irregular or undulose. Enclaves of Carn Gloose FGG, together with enclaves of aphyric FGG are present in the ACGG. Just north of the contact, two rounded enclaves of porphyritic coarse-grained granite (CGG) were observed within the FGG.

Returning to the mouth of Cot Valley, a vertical dyke of porphyritic fine-grained granite intruding the ACGG in the cliff-face immediately north of the raised beach was examined. This dyke is c. 2 m wide and has slightly finer, darker marginal zones. Contacts with the ACGG are planar and fairly sharp, indicating that the ACGG was substantially crystallized when the dyke was emplaced. Just north of the dyke, a small sub-rounded fine-grained granitic enclave with feldspar megacrysts was observed within the ACGG. At the seaward end of the outcrops just south of the stream, another dyke of porphyritic fine-grained granite cuts the ACGG, but the sea-state prevented the party from approaching this.

From Cot Valley the ACGG continues southwards for approximately 400 metres to where its southern margin is in contact with a body of porphyritic CGG, which itself extends southwards into Polpry Cove (Figure 1). Conditions again prevented the party from examining this contact at sea level. On one face, the contact is gradational over c. 2 or 3 cm and discordant to the alignment of feldspar phenocrysts in the CGG (see Powell *et al*, 1999, Figure 2), indicating that the ACGG post-dates the CGG (Figure 3). The party walked southwards along the coastal footpath until the contact zone was reached. Although the broken and lichenous nature of the outcrops prevented examination of the actual contact, it could be ascertained from our position that the contact is broadly planar and sub-vertical. The party was able to examine outcrops of the porphyritic CGG and noted that it is very similar to the two rounded porphyritic CGG enclaves observed in the Carn Gloose FGG to the north of Cot Valley, confirming the age relationships described above. In Polpry Cove, beyond the limit of our excursion, enclaves of abundantly-porphyritic FGG occur within the porphyritic CGG and on the southern side of Polpry Cove are further intrusions of ACGG. As in Priest's Cove, the nature of the contacts between the various granites present in the Porth Nanven area allow an emplacement chronology to be constructed and this is summarized in Figure 3.

ACKNOWLEDGEMENTS

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