

SUPPLEMENT

Axel MÜLLER¹, Christopher HALLS¹, Reimar SELTMANN¹,

**IGNEOUS LAYERING AND TEXTURAL MODIFICATION IN
THE LAND'S END GRANITE, CORNWALL**

INTRODUCTION

The purpose of this contribution is to present new data relating to the Land's End Granite (Cornwall, United Kingdom) which focus upon the nature and origin of magmatic fabrics in general, and of the intra-granular structure of phenocrysts in particular. The Land's End Granite with an age of 277-274.5 Ma (Chen et al. 1993) is the youngest of the major plutons of the Cornubian Batholith in SW England. The Land's End Granite occupies the majority of the peninsula of West Penwith and intruded into Devonian metasediments associated with metavolcanics of the Mylor formation.

The Land's End Granite is composed of a number of intrusive sub-stages made up by porphyritic two-mica granite containing K-feldspar megacrysts up to dm size, together with equigranular two-mica granites and tourmaline granites. There is little chemical variation between the megacrystic granites, but differences in size and abundance of K-feldspar phenocrysts and the grain size of minerals in the groundmass provide criteria for distinguishing the separate intrusive entities. Detailed mapping of coastal cliffs at Porth Ledden and Pellitras Point permit tomographic definition of individual granite intrusions which form mainly sub-horizontal sheets of decimeter- to decameter-scale cut by dykes of granite porphyry and irregular bodies of tourmaline granites.

PORTH LEDDEN

At Porth Ledden there is evidence for a number of magma batches emplaced sub-parallel to the contacts with the host Mylor Slate Formation. This is governed by the dip of foliation which forms the shallowly dipping segments of the contact (<35°). Along the contact, in chronological order, the following intrusive sequence was observed, in part previously described by Charoy (1979) and Halls (2002): 1) fine-grained porphyritic two-mica granite (occurring only as enclaves), 2) medium-grained porphyritic biotite-granite, 3) coarse-grained porphyritic

¹ *The Natural History Museum, Dept. Mineralogy, Cromwell Road, London SW7 5BD, UK,*

biotite-granite, 4) layered biotite-granite with aplite, unidirectional solidification textures, and stockscheider along the contact. Plagioclase mantled K-feldspar phenocrysts (rapakivi-texture) in the coarse-grained granite (3) may indicate magma mixing in the former magma reservoir.

This first main sequence composing an outer carapace is followed by the intrusion of tourmaline-muscovite-granite and metasomatic formation of the tourmalinite. The tourmalinite represents a late- to post-magmatic texturally and chemically modified tourmaline-muscovite granite. The feldspar of the former granite is replaced by quartz and secondary tourmaline at temperatures below 550°C resulting in tourmalinite. The youngest intrusive stage is a sparsely porphyritic two-mica granite with a finer grained equigranular matrix and a buff colour (granite porphyry).

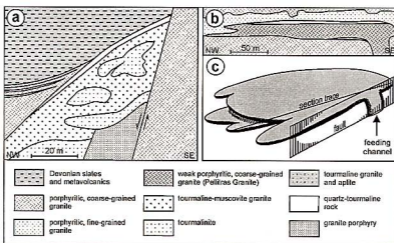


Fig. 1 Interpretative sections of suggested emplacement styles (a) at Porth Ledden and (b) at Pellitras Point. (c) Three-dimensional shape of the Pellitras Granite intrusion.

PELLITRAS POINT

At Pellitras Point the porphyritic fine-grained two-mica granite is dominant, being the first stage of intrusion observed at this locality. Contacts with the slightly younger coarse-grained porphyritic two-mica granite are rheomorphic and smoothly lobate. Contact relationships between the two granites are typical of those commonly found between coexisting magmas, but there is no field evidence that mixing took place between them. The coexistence of the two granites may be caused by the difference in effective viscosity. Alternatively the high viscosity of the two magmas may have been sufficient to inhibit mixing in the absence of any strong convective stirring (Salmon 1994).

The up to 30 m thick, sub-horizontal sheet of equigranular to weakly porphyritic two-mica granite (Pellitras Granite) shows progressive changes in the abundance of phenocrysts and enclaves suggestive of gravitative sinking of crystals and enclaves within the granite melt. The contact relationships to the upper porphyritic fine-grained granite and to the lower porphyritic coarse-grained granite support that, although the upper and lower porphyritic granites were not solid when the Pellitras Granite intruded. At its south-eastern end the Pellitras Granite dips away very steeply to the south-east into the coarse-grained porphyritic two-mica granite (Fig. 1).

In the latest stage sub-horizontal layers of mica-free, tourmaline-bearing leucogranite emplaced along the upper contact of the earlier Pellitras Granite.

CONCLUSIONS

Generally, the SW part of the Land's End granite is formed by a complex sequence of intrusive units mainly composed of decameter thick, sub-horizontal granite sheets. Generally, three main intrusion stages are distinguished: (1) porphyritic two-mica granites, (2) equigranular tourmaline granites, and (3) granite porphyries. The different magmas intruded into each other by joint-controlled passive emplacement and were subsequently differentiated *in situ*.

The two oldest varieties of porphyritic granites (1) which form the main part of the Land's End pluton, show large-scale magma mingling textures. At the Pellitras Point the younger Pellitras Granite was emplaced along the subhorizontal contact between the two older porphyritic granites. Generally, large-scale intrusions (>300 m) form sheets with a lateral extension of several hundred meters and with a vertical extension of several decameters. Small-scale layering in these granites (<5 m) has developed beneath structural traps where volatiles accumulated during granite solidification. The tourmaline granites (2) form relative small irregular bodies (<300 m) along the contact between the Land's End pluton and the Mylor slates. Late- to postmagmatic metasomatism caused the textural and chemical modification of tourmaline granites and of porphyritic granites as well. Finally, the sequence was intruded by steep-dipping dykes of granite porphyry (3).

The field observations described above form the basis of ongoing studies on the micro-fabric of the Land's End Granite and on the chemistry of rock-forming minerals.

REFERENCES

- Chen Y., Clark A.H., Farrar E., Wasterneys H.A.H.P., Hodgson M.J. (1993), J. Geol. Soc., London 150, 1183-1191.
Halls C., Jinchu Z., Yucheng L. (2002), Geosc. in SW England, 221-222.
Charoy B. (1979), Mem. Sc. Terre, Nancy 37, 364 pp.
Salmon S. (1994), Proc. Ussher Soc. 8, 219-223.

The research work was supported by the DFG (MU 1717/2-1).