

TEXTURAL FEATURES OF SOUTH-WEST ENGLAND GRANITES: A REINTERPRETATION

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The granite plutons of South-West England are individually distinguished on the basis of their coarse grained textures, designated here as primary texture granite units. The Carnmenellis, Bodmin and St Austell plutons each have one such primary texture unit whereas Lands End has two and Dartmoor three. In addition granites distinguished as two-phase granites are interpreted as magmatic breccias, derived from the primary texture granite units, with which they have textural affinity. These rocks are characterised by megacrysts of feldspars, quartz and biotite, within a fine-grained groundmass of aplitic appearance. They occur as a well-defined central core in the Carnmenellis Granite, but in the Dartmoor, Lands End, Bodmin and St Austell granites they form extensive but poorly defined areas of outcrop. The textural features reported here are similar to those established for the granites of the South-East Asian Tin Belt. One of us has also observed identical patterns of textural variation in South-East China, and in the Eskdale and other granites of the British Caledonides. It is proposed that such variations are a normal feature of highly evolved granites.

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INTRODUCTION

The textural features of south-west England granites considered in this contribution, were first recognised by Hall (1974). He demonstrated a sequence of textural evolution from coarse grained granites with complex grain boundary relationships, through porphyritic variants containing lithic granite fragments and megacrysts of quartz, K-feldspar, plagioclase and biotite in a fine-grained groundmass of aplitic aspect, to microgranites with few megacrysts. He interpreted these features as having resulted from a sudden loss of pressure at an advanced stage of crystallization. Later authors (e.g. Hawkes and Dangerfield, 1978; Stone, 1975; Exley *et al.*, 1983; Chen *et al.*, 1993; Salmon, 1994; Salmon and Powell, 1998; Pembroke and D'Lemos, 1996; Powell *et al.*, 1999) have not followed Hall (1974) in their interpretation of the textures. However, a similar interpretation to that of Hall (1974) was subsequently applied to the granite plutons of the South-East Asian Tin Belt (Cobbing, 1987, 2000; Cobbing *et al.*, 1986, 1992; Pitfield *et al.*, 1990), i.e. an origin resulting from a series of decompression events.

Accordingly a reconnaissance visit to Devon and Cornwall was made during May 2002 with a view to establishing the patterns of textural variation within the granite plutons of South-West England. It was found that granitic textures distinguished in South-East Asia as being of both primary and two-phase origin are present in all the mainland plutons of South-West England.

TEXTURAL FEATURES OF SOUTH-EAST ASIAN GRANITES

The paucity of outcrop in jungle terrain required a systematic but flexible scheme for the field description of granite exposures. It was found that each pluton in the batholiths of South-East Asia was distinguished from all others by the distinctive nature of their coarse grained crystalline textures, which were generally allotriomorphic. Granites with such textures were informally designated as 'primary texture granites', since these textures formed the basis for the field distinction of

plutons within the batholiths. Most plutons comprised only one primary texture unit, but some had two or three.

Many plutons were additionally characterised by granites of finer grain size, carrying megacrysts of K-feldspar, plagioclase, quartz and biotite, together with clumps of these minerals, which are granite fragments. These features were considered to have resulted from the disaggregation of the coarse granite by loss of pressure and the disruptive intrusion of later fine-grained granites. Granites with these characteristics were distinguished as 'two-phase granites' or 'disequilibrium texture granites'. In what follows the textural features of the granites of South-West England are considered in terms of a simple textural progression similar to those developed in the granites of South-East Asia, (Cobbing, 1987, 2000; Cobbing *et al.*, 1986; 1992).

GRANITE TEXTURES

Primary (equilibrium) textures

The distinguishing features of primary texture granites result from the progressive crystallisation of minerals from a melt, to form a rock with interlocking grain boundaries. These boundaries develop complex shapes, determined by the continuous growth of crystals until further growth is impeded by the progressive 'locking up' of the system as the available space is filled. The growing crystals coalesce to form a holocrystalline texture with complex grain boundary relationships. In tonalites and granodiorites the earlier crystals, such as the mafics and plagioclase, which are euhedral and are evenly distributed, provide a partial framework within which later quartz and K-feldspar may be located. In these rocks the textures are dominated by plagioclase, which forms a framework of interlocking tabular crystals with interstitial spaces in which the mafics, quartz and K-feldspar are located (Byron *et al.*, 1995, 1996).

The textures of monzogranites and the more acid granodiorites differ, in that the crystal framework is dominated by quartz and K-feldspar, both of which tend to form allotriomorphic grain boundaries. These crystals commonly form an interlocking mosaic of quartz, K-feldspar and plagioclase, which may be