

The Variscan Granites of south-west England: additional information

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Information additional to that given in a previous paper (*Proc. Ussher Soc.*, 4, 158; 1978) is provided concerning the field characteristics of the main and some minor granite types. A proposal is made to replace the term "mesocrystic granite" used in that account, with "megacrystic granite: small megacryst variant". The paper gives an extended classification which now includes two medium-grained biotite-granite varieties. The distribution of rock-types within the Bodmin, Carnmenellis, Isles of Scilly and some minor intrusions is briefly described, and an enlarged and revised distribution map for all the plutons presented. The occurrence of late-stage veining, foliation and shearing within some granite masses is also recorded. An important general conclusion is that relationships between the coarse granite types are gradational.

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Introduction

A previous progress report (Hawkes and Dangerfield 1978) included generalised descriptions of the principal granite types and contained a map showing their approximate distribution. With the completion of the field programme, surveys have been extended to the Bodmin, Isles of Scilly and Carnmenellis granites and to other smaller intrusions not covered earlier. Observations now made at a total of about 3000 localities require some minor extension of the rock-type classification and modification to the distribution map.

Rock types

In the 1978 account, the main granite types were classified on the basis of field characteristics and mean matrix grain sizes as follows:

coarse granite	{	megacrystic types
		mesocrystic types
medium-grained, lithium-mica granite		
fine granite	{	megacryst-rich types
		megacryst-poor types

Recent work indicates that the previous general description of the mesocrystic granite needs broadening. Because rocks of this sort are, in fact, megacrystic, the term 'mesocrystic' is inappropriate and should be replaced by 'megacrystic granite (small megacryst variant)'. Although cumbersome, the term can be abbreviated to 'Gm' in text, using 'GM' for megacrystic varieties.

The bulk of the Gm granite contains feldspar megacrysts ranging from 15mm (lower limit defined by the mesh-size of the counting grid used throughout the work) to about 40mm in length (average 20mm) and forming approximately 1-5 per cent of the rock by volume. The matrix consists of quartz, feldspar and biotite with a mean grain-size above 2mm. However, in some places, Gm granite apparently passes gradationally into material in which the feldspar megacrysts are somewhat larger (range 15-45mm, mean length 21mm) and more abundant (5-9 per cent by volume). Gm granite also grades very locally into poorly megacrystic granite. At peripheral and probable roof contacts, the rock commonly shows a marked fall in mean grain size, with megacrysts accounting for perhaps less than 1 per cent by volume.

In two particular places, there are extensive outcrops of biotite-bearing granite of medium matrix grain-size (1.0-2.0mm). These rocks resemble the fine granites in their general style of occurrence, but are visually quite distinctive. As they clearly differ from the GM and Gm granites, we are tentatively adding a medium-grained group (not to be confused with lithium-mica granite) to the classification. Medium-grained granite in one of the occurrences contains 2 to 5 volume per cent of feldspar megacrysts 15mm and longer and these average 21mm in length. Feldspar megacrysts are rare in the other medium-grained rock and generally only about 10-15mm long. Those 15mm and above account for less than 1 per cent by volume.

A revised classification is shown in Table 1.

Table 1. Revised classification of the Variscan Granites of south-west England.

coarse granite	(>2.0mm)	{	megacrystic types small megacryst variant
medium-grained, lithium-mica granite	(1.0-2.0mm)		non megacrystic varieties
medium granite	(1.0-2.0mm)	{	with few megacrysts megacrysts very rare
fine granite	(<1.0mm)	{	megacryst-rich types megacryst-poor types

Figures in parenthesis denote approximate mean matrix grain-size. These figures differ significantly from those given in Hawkes and Dangerfield (1978), because of a more satisfactory method of measurement

Distribution

Bodmin, Isles of Scilly and Carnmenellis plutons

The Bodmin and Isles of Scilly granites consist chiefly of the small megacryst variant (Gm, 1-5 per cent feldspar megacrysts), although gradations into the megacryst-enriched variety (Gm, 5-9 per cent) and into poorly megacrystic material (GM 1-5 per cent) are locally visible. Finer grained rock appears particularly along the northern and southern margins of the Bodmin mass. Similar material occurs not only on some of the north-western Scilly Isles (e.g. Mincarolo), but is fairly common on most of the main islands, suggesting general proximity to the roof.

In the Carnmenellis Granite, megacryst-enriched material (Gm, 5-9 per cent) is the most abundant variety, its distribution coinciding with the granite outcrop designated Type I by Ghosh (1934). Ghosh's Type II granite is normal Gm material, with feldspar megacrysts forming 1 to 4 per cent by volume and averaging about 19mm in length. Carn Brea consists of megacryst-enriched Gm; Carn Marth of normal Gm. Poor exposure obscures knowledge of marginal developments, but finer granite certainly appears as surface debris.

Medium-grained, biotite-granite forms most of the area on the Scilly Isles shown as fine granite on the 1:50,000 Geological Survey Map. It is the type with very few feldspar megacrysts and apparently passes transitionally into fine granite which may show both sharp and gradational contacts with the main Gm granite.

The other area of medium-grained (megacrystic) granite occurs in the Carnmenellis Pluton, coinciding with Ghosh's central Type III outcrop. Contacts seen in a small quarry (SW 7222 3615) near Stithians Dam are sharp. However, because debris from mines within the

outcrop region contains some coarse Gm granite, this body of medium-grained material may exist in the form of a large roughly fiat-lying inclusion. We agree with Al Turki and Stone (1978) that Ghosh's granite Types I and II are difficult to separate on general petrographical and chemical grounds, but that the statistical differences they found for the Type III rock are real.

The areas of fine granite shown for the Bodmin and Carnmenellis plutons (Fig. 1) are all composed of megacryst-poor varieties. In contrast to the situation observed in the megacrystic Land's End, St Austell and Dartmoor granites, megacryst-rich fine-grained material is comparatively rare in these intrusions and in the Scillies Mass.

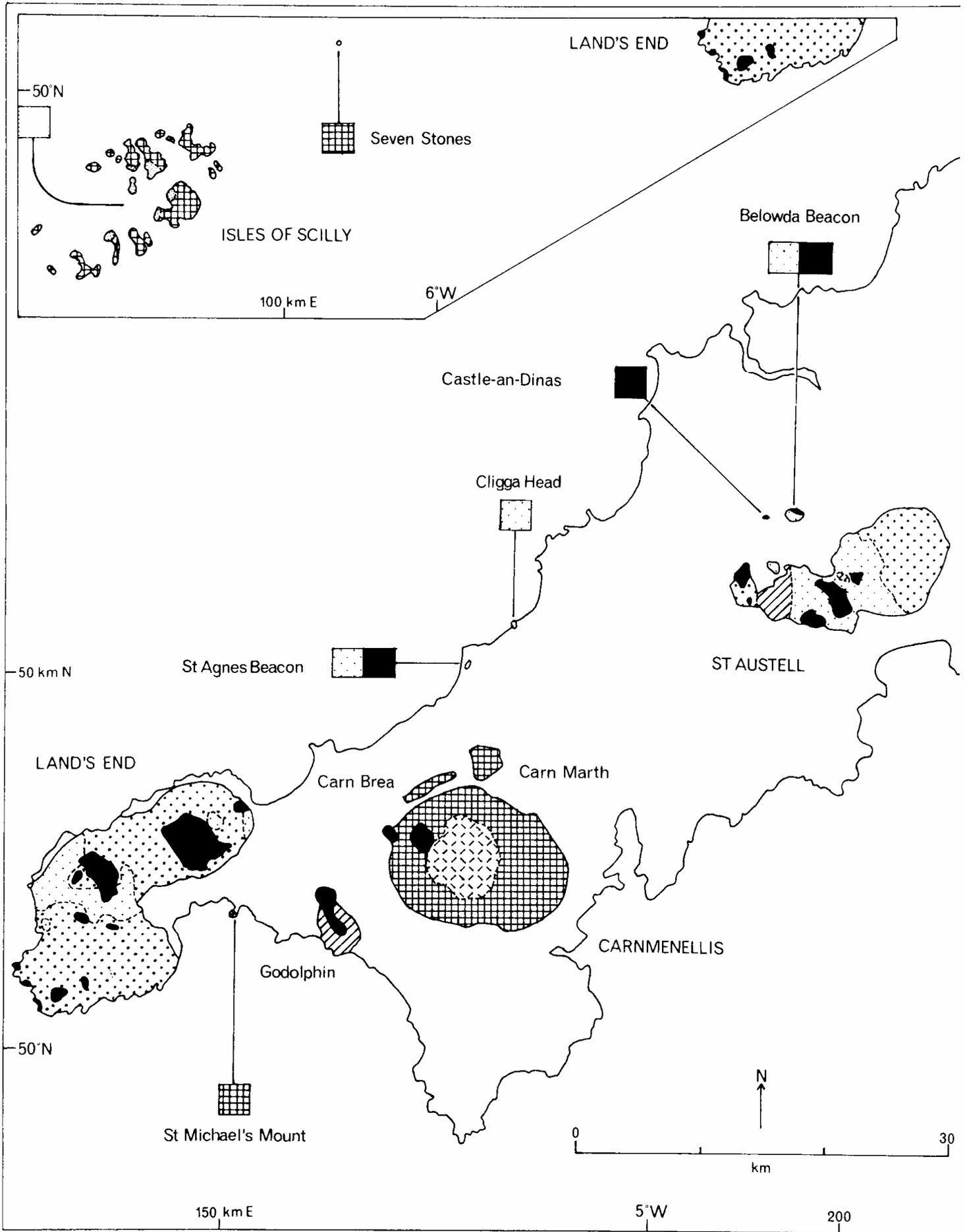
Minor plutons

Provisional classifications were made for the 1978 map on the strength of brief visits and, or specimens in the IGS Collections. Some amplification and revision is necessary.

a) Cligga Granite. This body consists of a poorly megacrystic material showing a firmer texture like that typically developed along the southern contact of the St Austell granite, at Belowda Beacon and on parts of Hingston Down.

b) St Agnes. Present day exposures are very poor but there is abundant surface debris. A majority of the fragments are greisenized fine granite, chiefly of the megacryst-rich type. Blocks of megacrystic (GM) granite seen in dump material indicate that this textural variant may constitute the interior regions of the intrusion.

c) Seven Stones. Although previously designated poorly megacrystic (GM) granite, re-examination of specimens in the collections suggests that the reef may be composed of a contaminated marginal facies of the smaller megacryst (Gm) variant.



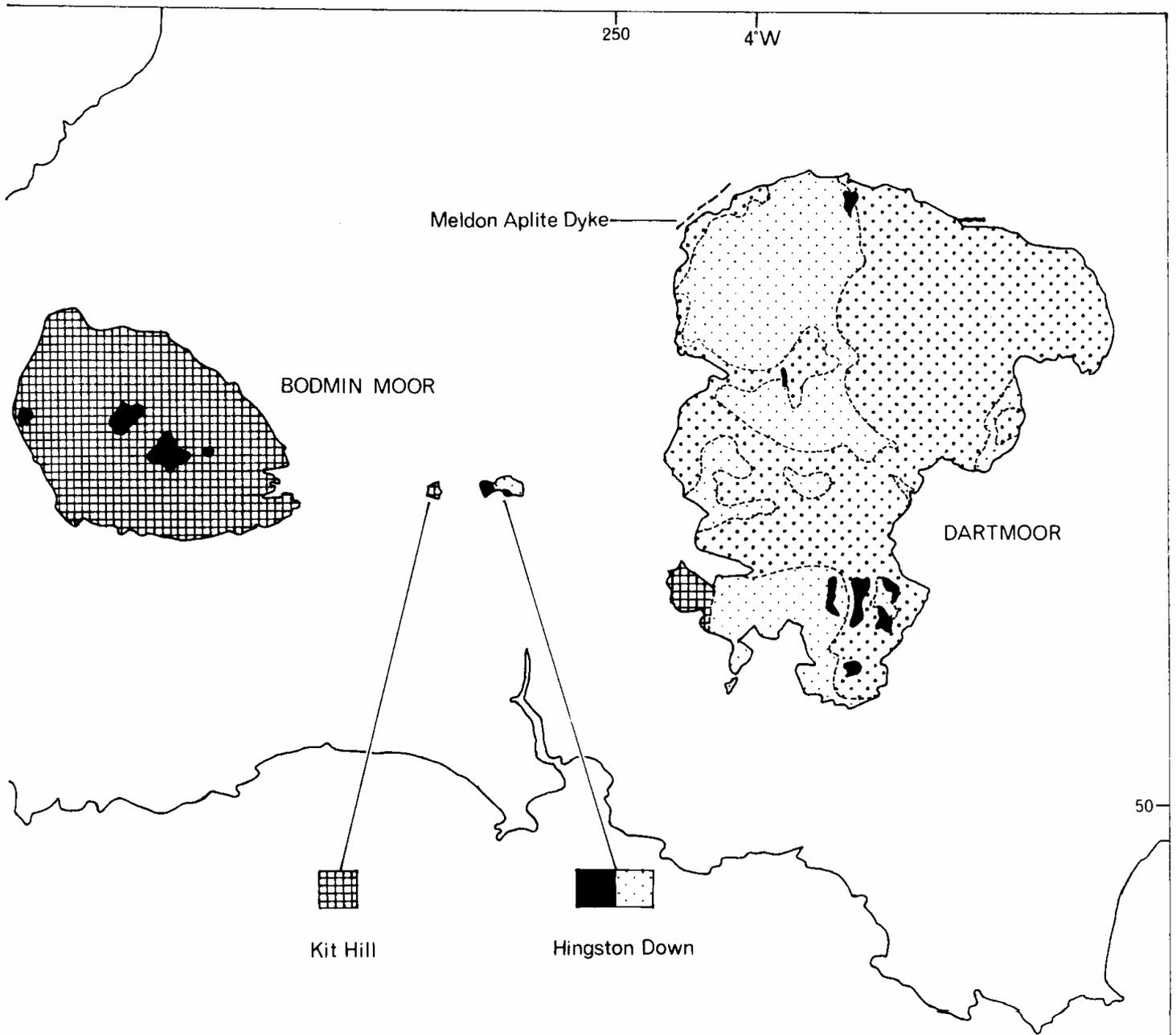
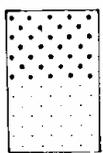


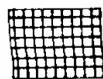
Figure 1

GRANITES OF SOUTH WEST ENGLAND

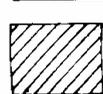
(Provisional map)



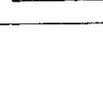
Coarse-grained megacrystic granite



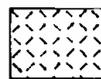
Coarse-grained poorly megacrystic granite



Coarse-grained megacrystic granite
-small megacryst variant



Medium-grained non-megacrystic
lithium-mica granite



Medium-grained granite
with few megacrysts



Medium-grained granite
-megacrysts very rare



Fine-grained granite
-megacryst rich and megacryst poor

Additional features

Late-stage veining

Cross-cutting fine granite veins, some with pegmatite margins, and varying from one to about 150cm in width, are particularly common in the north-western Scilly Isles (e.g. Round Island, White Island near Sampson, Mincarolo and Illiswilgig). Their abundance here is probably a fact of the excellent exposure. In the other two Gm granite plutons, similar veins are known from a few exposures and scattered debris. Veining of this type seems to be less common in the megacrystic (GM) granites.

Foliation

One feature which occurs in each of the main intrusions of Gm granite is foliation. This is defined by a generally planar disposition of feldspar and mica due perhaps to a tectonic cause rather than magmatic flow. Within the Bodmin Granite foliated material is well displayed in the working quarries of De Lank (SX. 1010 7550) and Hantergantick (SX 1034 7569), and in general in a band adjacent to the north and north-west margins of the mass. The full width is difficult to map due to poor exposure and a gradational relationship with the normal unfoliated granite southwards. The strike generally parallels the granite margin and the dip is 40°-50° towards the margin. Foliation is more pronounced on some of the Scilly Isles. Because of excellent exposure a belt about 500 to 800m wide from north to south and some 5.5km in extent can be traced intermittently from White Island near St Martins to North Bryher. The strike of this foliation is broadly E-W, paralleling the presumed granite boundary and the dip is variable. In the extreme south-west foliated granite forms the isolated reefs of the Crebinicks (SV 8097 0593) and Bishop Rock (SV 8071 0645), where the strike is NNW-SSE. A less well defined area of similar material occurs on the Carnmenellis granite south of Ponsanooth (SW 758 374). Here the foliation strikes about 140° and dips 300-35° to the north east.

Shearing on the Scilly Isles

Associated with and included within the foliated belt described above are intermittent sheared zones. The most prominent of these, which crops out on White Island (approx. SV 922 178) near St Martins, has been described as a schist and interpreted as a part of a roof pendant (Barrow 1906, pp. 13-14). In fact the material is schistose granite formed along a zone, exposed for about 100m, in which quartz and tourmaline were subsequently developed. This zone re-appears on Pernagie Isle (SV 9173 1747) where it strikes about 140° and dips 40°-50° eastwards. A similar structure developed along a greisen line near Gimble Point, Tresco (SV 8807 1630), strikes about 065° and dips 45° south east.

Conclusion

In the past textural variation in coarse granite phases within the plutons has been used to suggest the possibility of complex multiple intrusion. However, in the case of the coarse granite types, an important general conclusion is that their relationships are everywhere gradational. A fuller account dealing with the other types will appear elsewhere.

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