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Spherically arranged inclusions in post-tectonic garnet porphyroblasts: a comment

HARVEY and Ferguson (1973) described spherically arranged inclusions in garnet porphyroblasts in a schist from Connemara. The interpretation of this textural feature is accepted but comment on other relationships bear on another important question. They considered that the evidence was 'compatible with a mechanism whereby the garnets both displaced the matrix around them, and replaced the matrix as they grew, in a manner similar to that envisaged by Misch (1971)'. They stated (ibid., p. 87) that 'it is not possible to reconcile these observations with tectonic deformation of the matrix around the garnets'.

The evidence against the hypothesis that a porphyroblast is able to push aside the adjacent schistosity was summarized by Spry (1969, p. 149) and the interpretation of Misch (1971) that Harvey and Ferguson (1973) supported was shown to be open to doubt (Shelley, 1972; Spry, 1972).

The textures described by Harvey and Ferguson (1973) can be interpreted satisfactorily using orthodox chronological analysis of deformation and crystallization based on criteria established in the literature.

As has been stated elsewhere, the importance of the argument of displacement versus replacement is that the displacement hypothesis (or a combination of displacement and replacement) implies a simpler metamorphic history than replacement alone and thus may prevent recognition of the true complex polymetamorphic nature of such rocks.

The significant criteria listed (ibid., p. 87) are: (1) the phyllosilicates of the matrix abut against the garnets; (2) the foliation in the matrix bows around the garnets; (3) some ilmenite plates, continuous with the external schistosity, are enclosed in garnet; (4) some chloritoid is partially enclosed by garnet, some is moulded around it and shows undulose extinction and some is discordant and contains helictitic structure; and (5) the matrix immediately adjacent to the garnet is relatively rich in muscovite and poor in chlorite.

Cruse and Leake (1968) considered that the rocks at Connemara had undergone at least three periods of metamorphism and five periods of deformation. The complex polymetamorphic nature of the schists is thus established even if most crystallization is related to only F_2 and F_3 as suggested by Harvey and Ferguson (pers. comm., 1973). Some important interpretations included the crystallization of garnet during F_2 (and to a limited degree in F_3), a period of static post-tectonic crystallization involving growth of chloritoid, and recrystallization of muscovite and chlorite during F_3 and F_4. Harvey and Ferguson (pers. comm., 1973) do not agree in detail with this history.

No attempt is made here to interpret these complex rocks, but the evidence presented by Harvey and Ferguson (1973) alone can be interpreted to mean that garnet and some chloritoid crystallized at an early stage (post-tectonically to $?F_1$ but pre-tectonically to F_2, which gave rise to S_2) followed by syntectonic crystallization of matrix phyllosilicates (in F_2), which wrapped around the garnet (cf. criterion 2). Some chloritoid was bent against the rigid garnet during this episode. Post-tectonic metamorphism of a static annealing kind was accompanied by growth of a second generation of chloritoid and recrystallization of the micas so that they locally abut the earlier garnet and chloritoid (cf. criterion 1). This metamorphism might be the post-deformational thermal metamorphism referred to by Cruse and Leake (1968, p. 27) but the phyllosilicates in the photomicrographs (ibid., figs. 1 to 4) resemble late, post-tectonic (or inter-kinematic) micas common in many schists.

Fig. 1 of Harvey and Ferguson (1973) taken together with Cruse and Leake's (1968, p. 8) statement that some garnet has been converted to chlorite is good evidence that some, at least, of the chlorite formed after the garnet and hence could not have been pushed aside by garnet growth.

Criterion (3) as stated above would favour 'displacement'. However, a close examination of excellent photomicrographs kindly provided by Harvey and Ferguson favours the view that the ilmenite plates project into chlorite that was derived from the garnet, and that this chlorite passes off into that of the dominant foliation; thus the evidence is compatible with the orthodox explanation.

It is concluded that the 'displacement' hypothesis must still remain unproven.

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