A preliminary structural profile through the Western Gneiss Complex, Sognefjord, southwestern Norway

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Preliminary structural mapping along the north shore of Sognefjord, western Norway, has revealed that the Precambrian migmatite complex of the inner parts of the fjord becomes progressively Caledonized towards the west (increasing heterogeneous shearing and polyphase folding).

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Preliminary structural mapping along the northern shore of Sognefjord has been carried out as part of an on-going 'geotraverse'-like effort across the Caledonides of southwestern Norway (Valdres – Jotunheimen – Sognefjord). The Sognefjord part of the project crosses the whole of the Western Gneiss Complex (WGC) (Bryhni 1966, Carswell 1973, Cuthbert et al. 1984) and took as its starting point two facts about the Complex which have become well established in recent years:

(a) The granitic-migmatitic zone along the southeastern side of the WGC (e.g. innermost parts of Sognefjord) represents a mass of un-Caledonized Precambrian basement (Priem et al. 1973, Corfu 1980, Koestler 1983, Milnes & Koestler, in Gee & Sturt 1985). In this basement, Caledonian effects are limited to localized shearing, mainly concentrated towards the major Caledonian thrust zone which frames it to the east.

(b) The strongly folded gneisses along the western margin of the WGC (e.g. outermost parts of Sognefjord) are strongly Caledonized, i.e. have suffered intense, polyphase deformation of Caledonian age associated with at least two phases of high-grade metamorphism. The evidence for this comes from the fact that the gneisses are interfolded with metasediments of presumed lower Paleozoic age (e.g. Furnes et al. 1976) and from extensive radiometric and petrologic data which have proved, for instance, that eclogite pots within them are of Caledonian age (e.g. Griffin et al., in Gee & Sturt 1985).

Since the shores of Sognefjord provide continuous outcrops of both the above zones (regime 1 and 3 respectively in Fig. 1) and of the intervening transition (regime 2, Fig. 1), this cross-section of the WGC seemed the best one along which to study (1) the detailed structural and metamorphic histories of known Caledonized and un-Caledonized parts of the complex and (2) the way in which progressive Caledonization takes place, in this case, from east to west. At the time of writing, two summers of field mapping have been completed and supported with concomitant thin-section analysis. A final field season is being planned to fill in the remaining gaps and to make detailed structural studies of critical areas. The Precambrian age of the inner granitic-migmatitic zone (regime 1) will be checked with coordinated radiometric dating. An unexpectedly young (i. e. Caledonian) intrusion age for the granites in regime 1 will have no effect on the descriptive part of our work (the structural cross-section), but will, of course, affect the interpretation and will be hard to reconcile with the definitive studies on which our present working hypothesis is based (e.g. Corfu 1980).

Although the geometrical analyses of the complicated structural relations are not yet complete, a clear qualitative picture of progressive overprinting from east to west has emerged (Fig. 1). The main rock type encountered in *regime 1* is a migmatitic gneiss which grades into or is cut by granitic bodies (e.g. Høyanger granite) and numerous pegmatitic veins. The post-migmatitic pegmatites are undeformed except where they are occasionally cut by discrete, east-dipping shear zones. These are probably the only Cale-

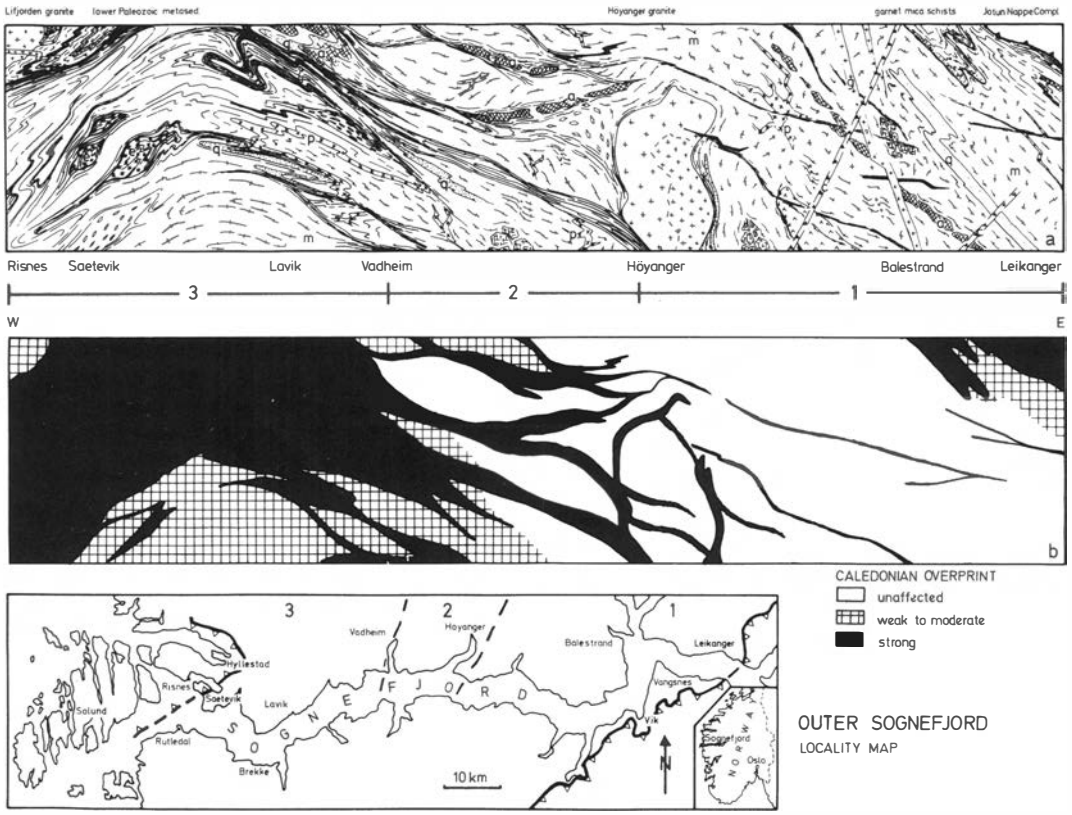

Fig. 1. Schematic cross-sections along Sognefjord showing: (a) Main lithological and structural relations (a = amphibolite lenses/dikes; c = cataclasite zone; e = eclogite lenses; g = granitic dike; m = migmatites; q = quarzite; p = pegmatitic veins). (b) Degree of Caledonian overprinting (white = un-Caledonized Precambrian basement; cross-hatched = weak to moderate Caledonian overprinting; black = strong Caledonian overprinting), late fault/cataclasite zones omitted.

donian effects outside the wider zone of post-migmatitic overprinting immediately underlying the major thrust zone at the base of the Jotun nappe complex (Fig. 1a). *Regime 2* is dominated by large-scale heterogeneous shearing, with mylonitization and penetrative ductile deformation concentrated in zones around large lenses (10–100 m) of undeformed or slightly deformed protolith similar to the granitic-migmatitic rocks of regime 1. There are indications that this shearing event is not the same one as that in regime 1 (which seems to decrease in effect westwards), but it is clearly post-pegmatitic, the deformed zones containing abundant isoclinally folded and boudinaged pegmatite veins as the overprinted relics of the discordant pegmatites in the undeformed lenses. This heterogeneous shearing now increases in importance westwards and the mylonitic foliation becomes the main foliation in *regime 3*, where undeformed remnants no longer occur. The main foliation, associated with isoclinally folded pegmatites and other compositional markers, is deformed by two phases of later folding, often quite intensely. Several eclogitic pots and lenses occur in the outer parts of the fjord, strongly retrograded to amphibolites towards the margins and 'flowed around' by the main foliation. Since the eclogites are now considered to be Caledonian (Griffin et al., op. cit.), all the structures and the amphibolite facies metamorphism in the surrounding gneisses are Caledonian or younger. Throughout regime 3 and in the shear zones of regime 2, no cross-cutting pegmatites have been observed, whereas in the undeformed parts of regime 2 and regime 1 they are ubiquitous. Hence, whatever the absolute ages of the rocks involved are, the relative ages of the main events described above is now quite clear.

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