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STRUCTURAL EVOLUTION OF THE KOLAR SCHIST BELT, SOUTH INDIA;

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The small-scale deformational structures in the banded ferruginous quartzite near the western margin of the Kolar schist belt indicate four generations of folding episodes (F_1-F_4). The F_1 and F_2 folds are very tight to isoclinal with long, drawn-out limbs and sharp hinges of insignificant areal extent. The F_1 folds affect only the well preserved bedding planes whereas the F_2 folds affect F_1 axial planes and related foliation as well as bedding planes. However, in a major part of the area the F_1 axial plane foliation is not well developed in the scale of outcrop though it is clearly seen under microscope. Consequently, the F_1 and F_2 folds are largely indistinguishable from each other in the field unless both the sets are present in the same exposure and, therefore, they have been grouped together as early folds.

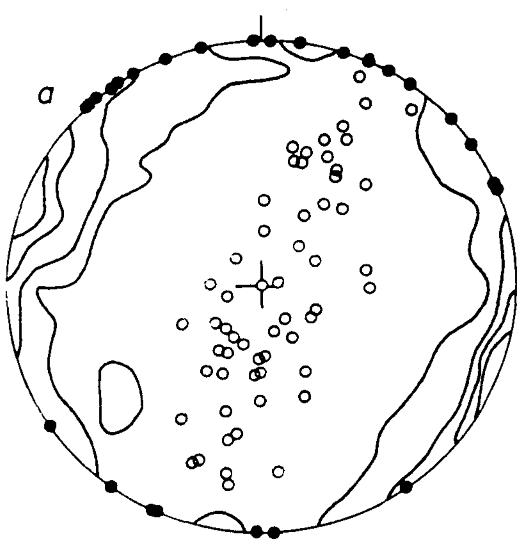
The F_1 and F_2 folds are nearly coaxial resulting in a type 3 interference pattern. Their axial planes are also effectively parallel except at the hinges of F_2 folds where they are at high angles. The north-northeasterly striking early axial planes usually dip very steeply whereas the axes show wide variation in plunge from subhorizontal to vertical with more or less constant NNE-SSW trend (Fig. 1a). The overprinting relation is such that both the F_1 and F_2 folds are plane noncylindrical except at the hinges of F_2 folds where F_1 folds are nonplane noncylindrical. Disharmony at the fold hinges, combination of class 1C and class 3 types of folds in alternate competent and incompetent layers in a multilayered sequence, thicker bands showing folds of larger wavelength, and parasitic folds at the hinges of folds of larger order indicate that the early folds were initiated by buckling (layer parallel compression). However, high amplitude to wavelength ratio and boudinage, pinch-and-swell structures and rod-like structures lying parallel to the axial planes point to importance of post-buckle flattening in shaping the folds.

The folds of the third generation (F_3) are a set of open and recumbent or gently plunging reclined folds with axial planes dipping gently towards ESE or WNW and axes trending in NNE-SSW direction. These folds have developed due to gravitational collapse of the subvertical foliation planes under their own weight. The F_4 folds are of the nature of warps sporadically becoming tight with vertical axial planes striking from NE through E to SE (Fig. 1a). The axes of F_4 folds plunge down the dips of local foliation planes which are usually steep. These folds have developed in response to a longitudinal shortening at the waning phase of folding episodes. The F_3 and F_4 folds affect each other and at places F_3 folds are dominant. Elsewhere F_4 folds are stronger indicating that these two fold systems are broadly synchronous. However, the only effect of these two sets is seen in minor modification in orientation of early structures and they are unimportant in large scale.

Mesoscopic ductile shear zones, subparallel or at low angle to foliation planes, are uncommonly well preserved in the ferruginous quartzite. Within the shear zones foliation planes, early axial planes and layerings are sygmoidally curved from which sense of movement can be easily determined. Both sinistral and dextral shear zones have been noted. A new set of steeply plunging and asymmetrical S- and Z-shaped folds with axial planes at low angle to the early axial planes have developed in shear zones. Subhorizontal striations and mineral lineations on shear surfaces are deformed by later folds indicating that the shearing movement is pre-F_3 in age. Steeply dipping shear zones, which are often conjugate, are also present in the Peninsular gneiss on either sides of the schist belt. The modal strike direction of sinistral shear zones is N335° and that of the dextral shear zones is N35° (Fig. 1b). These two orientations form a conjugate pair, the bisectors of which give horizontal maximum and minimum compressions in N95° and N5° directions respectively with the intermediate compression direction being vertical (Fig. 1b). As the shear zones on either sides of the schist belt give similar orientation of compression directions separately, it may be concluded that the same movement was responsible for the development of shear zones in the ferruginous quartzite also. The early folds became noncylindrical largely due to this shearing movement.

The deceptively simple map pattern of this schist belt with N-S linear disposition of major lithological boundaries, therefore, conceals two phases of coaxial isoclinal folding in large scale and a shearing movement subparallel to the axial planes.

It is suggested that a subhorizontal and nearly E-W simple shear acting on subhorizontal bedding planes resulted in isoclinal and recumbent/gently plunging reclined folds with NNE axial trend. The F_2 folds with NNE trending axes, which coaxially refold F_1 folds, formed in response to a pure shear in the same direction. Continued compression tightened the F_2 folds into isoclines and when they could not be flattened any further shearing movement was initiated. As the nearly E-W compression direction was at a high angle to the steeply dipping foliation planes the shear zones have preferentially developed subparallel to them. The large-scale structural features in this area, therefore, can be explained in terms of an E-W compression acting over a protracted period of time.



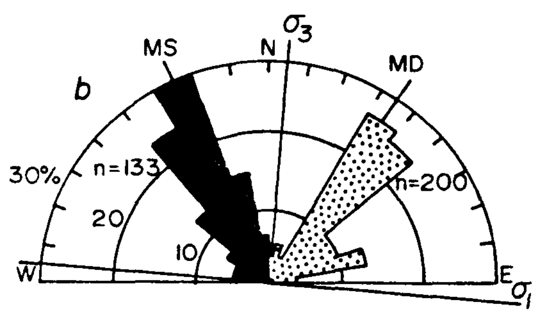


Fig. 1 a 78 poles of axial planes of early folds, contours: 0·5-5-10-15% per 1% area. o: Axes of early folds (6 vertical). ●: Poles of axial planes of F_4 folds. b. Rose diagram of strikes of subvertical shear zones from Peninsular gneiss, MS: modal sinistral, MD: modal dextral, n: no. of data