Deformation of a High-Grade Gondwana Fragment, Sri Lanka

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Abstract

The Sri Lankan Gondwana fragment is a high-grade gneiss terrain consisting of at least three crustal units, namely the Wanni Complex (WC), the Highland Complex (HC) and the Vijayan Complex (VC), which were juxtaposed during the Pan-African collision. At least six phases of ductile deformation were recognized in the smallest Gondwana fragment, Sri Lanka. There is microscopic and mesoscopic evidence for a first deformation (D_1), which occurred during prograde metamorphism but before the main granulite facies metamorphism. This first deformation is represented by straight to curved and crenulated inclusion trails in garnet porphyroblasts, microfolds in some metapelites and quartzo-feldspathic gneisses and by a S_1 foliation preserved in crenulation folds and some rootless intrafolial folds. D_2 has two main stages, of which the second phase is the most intense and dominant deformation which produced most part of the major composite and transposed compositional layering as well as the prominent stretching lineation (L_2). The first stage of D_2 may have been responsible for the formation of a crenulation cleavage of S_1, as seen in garnet porphyroblasts in some metapelites. The compositional layering (S_2) in metapelites and metasemipelites appears to have formed through the development of a crenulation cleavage. F_2 folds are mesoscopic, isoclinal, rootless and occur as intrafolial folds, and their limbs are highly attenuated. Major part of the deformation during the latter stage of D_2 was non-coaxial. Many minor and large scale recumbent isoclinal folds (F_3) were produced during D_3. Both D_2 and D_3 were coeval with the peak conditions of granulite facies metamorphism. D_4 produced very large, gentle, nearly E-W upright folds probably during the beginning of uplift of the entire high-grade assemblage from deeper crustal levels, still under granulite facies conditions.

D_5 is the second strongest deformation and was responsible for the large-scale upright folds (F_5), which control the present map pattern of Sri Lanka. The superimposition of D_5 folds on D_4 folds gave rise to a large-scale type I fold interference pattern of Ramsay (1967). D_6 deformation caused local refolding of the F_5 folds and was accompanied by amphibolite facies conditions during uplift. The deformation represented by the majority of vein-type structures, such as patchy charnockite veins, cordierite-bearing veins and graphite veins clearly post-date D_5. It is argued that the WC, the HC and the VC in Sri Lanka may be three distinctly different Proterozoic crustal units, brought into contact by tectonism in late Proterozoic at two different stages.

Key words: Deformation, structure, microstructure, layering, shear zones.