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Regional slaty cleavage formation and fold axis rotation by re-use and reactivation of pre-existing foliations: the Fiery Creek Slate Belt, North Queensland

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Abstract

A deformation history, comprised of six separate deformation events of differing intensity, has affected the rocks of the South Palmer River region of the the Hodgkinson Province, north Queensland. Within this region, a zone of pervasive slaty cleavage, herein termed the Fiery Creek Slate Belt, has developed as a result of the superposition of fabrics formed during several of these events. The most important processes in the formation of this composite cleavage were the re-use and reactivation of the favourably oriented, steep, N–S-trending S_2 foliation by the intense fourth deformation event, D_4. This produced micro-, meso- and macroscopic folds in an originally shallow S_3 foliation, produced during the intervening D_3 deformation, with an axial planar S_2–S_4 foliation. The D_4 stretching lineation, L_4^4, plunges subvertically to steeply north and indicates that shear during D_4 was oriented steeply north–south. In the Fiery Creek Slate Belt, D_2 fold axes are interpreted to have formed in much shallower orientations than their present moderately N–S-plunging to subvertical orientations. We consider this to be a result of D_4 shear, which caused variable degrees of rotation of D_2 fold axes toward the D_4 stretching lineation due to subparallelism of the bulk shortening directions of the D_2 and D_4 events. Near-total destruction of the pre-D_4 foliations during slaty cleavage formation has produced a misleading impression of a simple deformation history. There is no relationship between metamorphic grade and intensity of slaty cleavage development.

1. Introduction

Slaty cleavage may be defined as a planar secondary rock fissility with a cleavage plane spacing of less than 0.5 mm (Kisch, 1991). It is one of the most common fabrics in deformed terrains, and a very large amount of geological literature has been devoted to it. Commonly, slaty cleavage is the first recognizable penetrative fabric in the structural history of a deformed area and its formation is attributed to the processes associated with a single deformation event (e.g., Soper and Roberts, 1971; Borradaile, 1972; Holeywell and Tullis, 1975; Beutner, 1978; Piqué, 1982; Winsor, 1983; Sample and Moore, 1987; Ishii, 1988; and many others). Similarly, the rotation of contemporary fold axes toward the stretching lineation during a single progressive deformation (Sanderson, 1973; Bell, 1978; G.D. Williams, 1978; Patrick, 1988; Alsop, 1992a) is well accepted, whereas the literature is relatively devoid of examples of fold axes formed in previ-

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