# STUDIES IN THE GEOMETRY OF FOLDING AND ITS MECHANICAL INTERPRETATION

by

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This thesis contains no material which has been accepted for the award of any other degree or diploma in any university and to the best of my knowledge and belief contains no copy or paraphrase of material previously published or written by another person except where due reference is made in the text of the thesis.

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## ABSTRACT

Analysis of thickness variation of folded layers in terms of apparent flattening indicates the relative "viscosities" of the layers, and hence modes of deformation. Orthogonal-thickness ratios, which are unique for each percentage of flattening, are convenient indicators of the equivalent flattening of an initially concentric profile. Axial-thickness ratios, intrinsically more sensitive, are less useful because there is a spread of values for each percentage of flattening.

Measurements of fold profiles from diverse sedimentary, diagenetic and low-grade metamorphic environments show that the higher the temperature and pressure at which the rocks were deformed the smaller the range of fold style. At Port Moresby, Papua, progressive syntaphral sliding has folded Eocene cherts and less competent argillite in a complex polyclinal style. Individual layers, then groups of layers up to one metre thick, and finally slip sheets tens of metres thick slid towards the west-southwest.

Structural analysis of linear and planar fold elements in diagenetic or low-grade metamorphic environments in Tasmania leads to the conclusion that cleavage developed contemporaneously in both sandstone and slate as a planar feature. The cleavage

in the slate is penetrative to the scale of detrital grains, but non-penetrative in the sandstone where pelitic ribbons anastomose through the rock enclosing non-cleaved lenses of normal greywacke fabric. The most satisfactory hypothesis to account for the observed mesoscopic configurations is that the cleavage formed during deformation as pelitic deposits in channels along which excessive water was forced out of the rock at very high pore pressures.

The ratio between pore pressure and confining pressure is a significant parameter determining fold style. Heterogeneities necessary for concentric folding are effective where the pore pressure is relatively low, and the fold style is similar where the pore pressure approaches the pressure on the grain fabric. Pore-pressure ratios are most readily varied in superficial deposits, and many different fold styles occur in the intrastratal contortions in the terrestrial, Pleistocene, proglacial deposits in Tasmania, and in the intraformational slumps of the Pleistocene Lisan Formation in Israel. Irregular "flow" folds in the contact aureoles of two intrusive bodies in Tasmania grade outwards into more regular, concentric and disjunctive folds. Both the folding and the variation in fold style may have been caused by water pressures approaching the lithostatic load in the intrusions, and decreasing outwards.

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