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# Character and kinematics of faults within the turbidite-dominated Lachlan Orogen: implications for tectonic evolution of eastern Australia: Discussion

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The discussion concerning the character and kinematics of faults within the turbidite-dominated Lachlan Orogen by Taylor and Cayley (2000) and the reply (Gray and Foster, 2000) do much to focus attention on critical issues concerning the geodynamic significance of deformation and metamorphism in the Lachlan fold belt (Gray and Foster, 1998). The range of models advocated however is rather too narrow and simplistic, in particular the “progressive thickening of an accretionary wedge” model considered by Gray and Foster (1998, 2000). Modern orogens are often considerably more complex, and it is difficult to understand why this would not also be the case in the Lachlan fold belt. Preliminary application of modern tectonic concepts to the Lachlan Orogen has led to a significant debate, but this is not yet over. There is still much that needs to be understood.

Gray and Foster (2000) assert that the turbidite-dominated Lachlan Fold Belt has a different overall style of deformation to other orogenic belts. In the sense that other orogenic belts are often well exposed, this appears to be true, but there are elements in common with other terranes in which accretionary prisms have been involved in orogenesis. It is difficult to argue that the Lachlan fold belt is unique, except in the sense that (like sedimentary basins) every orogen has its own distinctive characteristics. But there is not much point in listing how many orogens an individual author has visited (or driven through) as part of a scientific argument.

Gray and Foster (2000) have advocated a particular model, and now attempt to polarise further discussion. They state that Taylor and Cayley (2000) are interested in “pushing a model of intra-plate collapse of a marginal sea, driven by outboard convergence” and secondly that Taylor and Cayley (2000) want to apply a model in which there are “discrete orogenic pulses that were formerly defined by both regional and local unconformities”. Gray and Foster (2000) criticise Taylor and Cayley (2000) for having “taken the

liberty to fit a regional tectonic interpretation onto (their) model”. Instead they should applaud these two young geoscientists for their contribution to the intellectual debate, and encourage further effort. We are still a long way from being able to convincingly demonstrate the model of an “imbricate fan geometry...involving tiered detachments” postulated by Gray and Foster (2000). It is an interesting hypothesis, but it is not yet proven. Taylor and Cayley (2000) propose a model that resembles subduction-related convergence in a SW Pacific setting, and their model begins to take into account the types of complexities that can result in such a setting.

This is an important development. The Gray and Foster (2000) model advocates periodic failure in a thickening accretionary prism, and makes the claim that it is “obvious” that the orogen has been affected by “progressive deformation”. These authors emphasize that they “have always attempted to interpret the Ar–Ar data in terms of deformation of a wedge”. However why is it so that this interpretation is intuitively “obvious”? The  $^{40}\text{Ar}/^{39}\text{Ar}$  apparent age spectra published by Bierlein et al. (1999), Bucher et al. (1996), Foster et al. (1998) and Foster et al. (1999) can be reinterpreted using the method of asymptotes, and such an analysis supports the conclusions that the rocks have been subject to distinct episodes of deformation and recrystallization as indicated by Taylor and Cayley (2000). This is very much in keeping with what is observed in modern orogens, where distinct episodes related to orogen-scale events are not uncommon. Gray and Foster (2000) advocate “progressive deformation in a wedge”. Taylor and Cayley (2000) advocate episodic behaviour in a SW Pacific setting, where every large thrust is not synonymous with a subduction zone. There are many features that are to be found in such environments that do not fit well with the simple “progressive thickening of a wedge” model, and I can only encourage Taylor and Cayley (2000) in their efforts.

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