A lower Paleozoic trench-fill sequence, New World Island, Newfoundland: Discussion and reply

Discussion

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INTRODUCTION

McKerrow and Cocks (1978) described the stratigraphy and sedimentology of the Ordovician and Silurian rocks on northeastern New World Island. Their description of these rocks, particularly the recognition of Silurian olistotrome deposits, is certainly a useful addition to the literature; however, there are several aspects of the proposed model for the depositional environment of these sediments that we find distressing. In particular, their model is (1) inconsistent with models of sedimentation and deformation developed for modern trench-accretionary prism systems (for example, Karig and Sharman, 1975; Seely and others, 1974), and (2) incompatible with the regional geology of north-central Newfoundland as it is now known.

THE MODEL

The Piper and others (1973) facies model upon which the analysis by McKerrow and Cocks is based describes the lateral distribution of sedimentary facies in the undeformed trench-floor sequence that occurs adjacent to, and on the immediate seaward side of, the inner trench slope in the Aleutians and many other trench systems. The boundary between these undeformed trench-floor sediments and the deformed material underlying the inner trench slope represents a deformation front, such that accretionary prism melange (the deformed equivalent of the trench-floor sequence) occurs immediately on the *landward* side of the undeformed trench-floor sediments. Therefore, if the sediments on New World Island that are equated directly with the undeformed trench-floor sequence of Piper and others (1973) were actually deposited over a west-dipping subduction zone, we would expect to find highly deformed accretionary prism melange on their landward or *west* side. In fact, this is precisely opposite to the actual outcrop pattern. The Dunnage melange, which is suggested by McKerrow and Cocks (1978) to be a tectonic melange related to subduction, occurs on the *east* side, and in apparent stratigraphic continuity with the proposed trench-floor sequence. Also, the fact that the Dark Hole Formation conformably overlies the Dunnage melange (Horne, 1970) is inconsistent with its proposed origin as a distal trench-floor or "overbank" deposit (Piper and others, 1973, unit B). In actualistic models for modern trench systems, such deposits are eventually incorporated into the accretionary prism melange, but they can never overlie it depositionally. Sediments depositionally overlying accretionary melange are by definition lower-slope deposits (Karig and Sharman, 1975).

In modern trench systems, sediments deposited on the trench floor are continually being accreted onto (or into) the inner trench slope. Given present subduction rates, the residence time for such sediments prior to deformation is at most a few hundred thousand years. If one assumes that subduction in the New World Island area occurred actively until Middle Devonian time, as suggested by McKerrow and Cocks (1978), then any undeformed trench-floor deposits in the area would have to be Middle Devonian in age. All older trench-floor material would have already been incorporated in the accretionary prism melange. It is therefore unreasonable to suggest that the Dark Hole–Milliners Arm–Big Muddy Cove sequence, which is Middle Ordovician to Early Silurian in age, is such a preserved trench-floor sequence. Furthermore, the actual age range of this conformable sequence is several tens of millions of years, and therefore several orders of magnitude too large to represent a single stratigraphically continuous trench-floor deposit.

REGIONAL CONSIDERATIONS

The depositional facies model proposed by McKerrow and Cocks (1978) is predicated on the assumption that a west-dipping subduction zone existed beneath the New World Island area until Middle Devonian time, the surface expression of this zone being the Dunnage melange. If this were the case, then the Dunnage melange should (1) separate distinctive pre–Middle Devonian lithologic sequences, (2) separate distinctive pre–Middle Devonian faunal provinces, and (3) probably (although not necessarily) contain blueschists and ophiolite blocks. Dean (1977, 1978) has pointed out that the Campbellton Sequence, occurring immediately to the east of the Dunnage melange, is virtually identical to the Middle Ordovician sequence in the Badger Bay area well to the west (including the existence of manganiferous cherts separating mafic volcanic rocks below from quartz-bearing turbidites above. Also, graptolite-bearing Caradocian black argillite occurs on both sides of the Dunnage melange and in both areas appears to occupy the same position in lithologically similar sequences (Dean, 1978). Moreover, conodonts recently collected from Middle Ordovician

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limestones in the Davidsville Group on the east side of the Dunnage melange are indistinguishable from those in the Cobbs Arm Limestone to the west (S. Stouge, 1978, personal commun.). Finally, no blueschists or demonstrably ophiolitic blocks have ever been reported from the Dunnage melange. There is therefore no compelling reason to suggest that a trench ever existed in the New World Island area. We admit that the data do not preclude the possibility of such a feature existing there prior to Caradocian time (as suggested by Kidd and others, 1977); however, they definitely do preclude the possibility of post-Caradocian subduction. Given that the sediments in question range in age from Caradocian to Llandoverian, they therefore could not possibly have been deposited in an active subduction zone.

In view of these difficulties, we are skeptical of the suggestion that the sediments exposed on northeast New World Island are analogous to modern trench-floor deposits.

Reply

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In the time since our paper (McKerrow and Cocks, 1978) was submitted (1976) we have done further field work in New World Island. While we stand by our field observations (McKerrow and Cocks, 1978) and our interpretation of the Reach fault as the Iapetus suture (McKerrow and Cocks, 1977), we agree with Nelson and Kidd that perhaps there are other interpretations of the New World Island lower Paleozoic succession than the trench-fill model.

Faunal differences suggest that the rocks of New World Island accumulated to the west of the oceanic suture; thus, if there was subduction westward (under New World Island) along the Iapetus ocean margin during the final stages of closure (in Silurian and Early Devonian time), the Dunnage melange and the beds above it would have been deposited on the landward side of the trench. Such a thick sequence could not have been deposited on the oceanic plate and then accreted onto the continental plate without imbrication of the beds; we are therefore considering other models.

The Campbellton Sequence (which apparently underlies the Dunnage) and the overlying Caradocian black argillites show that the Dunnage and its time equivalents are part of a sedimentary succession that extends for tens of kilometres westward from the Reach fault. The presence of this succession does not preclude westerly post-Caradoc subduction (the Micmac and Buchans volcanic rocks suggest some post-Caradoc subduction westward from the Iapetus suture), but it does suggest that this thick and extensive succession was not part of an imbricate accretionary prism and that it was thus not directly related to subduction.

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