Reply

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We welcome Murphy et al.'s (2002) interest in our paper (McNamara et al., 2001) and are pleased to see that they agree with our interpretation of the paleomagnetic data that place Avalon at a latitude of 34° in the latest Precambrian. They do not agree, however, that these data necessarily imply proximity of Avalon to West Africa at this time, and they retain their preference for a peri-Amazonian location for Avalon in the latest Precambrian. Murphy and colleagues raise three points regarding the evidence for an Avalonian connection with either Amazonia or the West African craton. We address these points here.

PALEOMAGNETIC CONSTRAINTS ON NEOPROTEROZOIC RECONSTRUCTIONS

There is a relative paucity of paleomagnetic data for the major continents during the Neoproterozoic, a point we made in our original paper, and we would dearly like to see more data become available. Our paper was a contribution toward remedying this situation. We specifically, rather than tacitly, stated in our original paper that we use proxy poles from Laurentia to define the position of Amazonia at ca. 580 Ma and, hence, the likely positions of the other Gondwana fragments. The validity of using Laurentian poles to position Amazonia depends, of course, depends on the interpretations that (1) Amazonia is the conjugate margin to North America and (2) the age of Iapetus rifting and opening along the Appalachian margin is known. Contrary to what Murphy and colleagues imply, the data of Wingate and Giddings (2000) pertain to the breakup of Rodinia along the present-day western margin of North America and the separation of the eastern Gondwana elements from Laurentia. Breakup and separation along the present-day eastern margin of North America are significantly younger, at ca. 570 Ma (e.g., Cawood et al., 2001). Thus, our use of Laurentian paleomagnetic data as a proxy for the rifted conjugate margin at 580 Ma seems justified. What is at issue is whether Amazonia was indeed that conjugate margin. The data of Lowey et al. (2000) do not preclude this possibility, given that they pertain to a specific Laurentia-Amazonia fit, in which a Scottish promontory was linked to the Arica embayment (Dalziel et al., 1994) (Fig. 1A of Murphy et al., 2002). Other fits, such as that of Hoffman (1991), remain possible, and recent paleomagnetic data from Amazonia offer a new perspective on Amazonia-Laurentia connections in Rodinia (Tohver et al., 2002).

LOCATION OF OAXAQUIA, YUCATÁN, AND CHORTIS BLOCKS

We did not include the Oaxaquia, Yucatán, and Chortis microcontinental blocks in our reconstructions as we consider their locations to be poorly determined at present. They may well have been situated between Amazonia and Avalonia, but this possibility does not bring Avalonia close to the margin of Amazonia. Rather, the fixed constraints of the paleolatitude of Avalonia (34°) and the position of Laurentia move the margin of Amazonia to a location even farther away, to make room for these intervening crustal blocks.

1 Ga SIGNATURES IN WESTERN AVALONIA

We agree with Murphy et al. that crust-derived Neoproterozoic–Silurian felsic igneous rocks in western Avalonia are characterized by positive initial ε_{Nd} values and depleted-mantle model ages between 1.1 and 0.8 Ga, which indicate a juvenile (ca. 1 Ga) basement beneath the Avalon terrane, as stated in our original paper (McNamara et al., 2001, p. 1169). We note again, however, that these isotope data do not offer any unique constraints on the paleogeography of Avalonia, given that the isotope data record geologic rather than geographic processes. The euhedral nature of the Grenville detrital zircons in western Avalonia likely indicates a local provenance, which militates against their source's being in the Tocantins province of Amazonia; indeed the inclusion of the Oaxaquia, Yucatán, and Chortis blocks next to Amazonia requires the Tocantins province to be even farther away from Avalonia than in the reconstructions we presented (see Fig. 1, A and B, of Murphy et al., 2002).

TOWARD A RESOLUTION

As Murphy and colleagues have already argued, it is clear that more paleomagnetic data are required from Amazonia, West Africa, and Avalonia, and from possible intervening terranes such as the Oaxaquia, Yucatán, and Chortis blocks, before we can arrive at robust models for late Precambrian paleogeography. Such data need to be integrated with zircon-provenance studies, basement isotopic signatures, and stratigraphic studies. We look forward to further contributing to these advances in Precambrian paleogeography, which represents a challenging and exciting frontier in past plate reconstructions.

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