Forum

Anomalous cold in the Pangaean tropics: COMMENT

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Soreghan et al. (2008) present the hypothesis that glaciation existed to near sea level in the tropical region of Pangaea in late Paleozoic time. Their most important evidence for this comes from Unaweep Canyon, a wind gap that crosses the Uncompahgre Plateau, (Colorado, United States). The canyon is carved through Mesozoic formations and the western portion is incised deeply into Precambrian crystalline rocks. Soreghan et al. claim that the original erosion of the canyon occurred in late Paleozoic and the canyon was occupied by late Paleozoic glaciers. This hypothesis requires that the canyon was subsequently filled with >700 m of late Paleozoic and Mesozoic sediment, exhumed by Cenozoic rivers, and then partially re-filled by young alluvium.

Soreghan et al.'s hypothesis of late Paleozoic glaciation in Unaweep Canyon rests mainly on their interpretation of two diamictites within the canyon (one in an outcrop and one at the bottom of a well) as being late Paleozoic. Their age interpretation of the diamictites is based primarily on the observation that the two units contain no Mesozoic clasts and contain Paleozoic palynomorphs. However, Quaternary alluvium directly above the exposed diamictite also contains Paleozoic palynomorphs, as do post-Oligocene lake beds which overlie the diamictite within the well (Soreghan, et al., 2007). Moreover, all of these deposits also contain modern pollen (Soreghan, et al., 2007). Soreghan et al. (2008) interpret the Paleozoic palynomorphs in the lake beds and Quaternary alluvium to be reworked, which we agree with. They interpret the modern pollen in the buried diamictite to be "infiltrated." If there are reworked Paleozoic palynomorphs present in these deposits, it is more likely that the Paleozoic palynomorphs in the diamictites are reworked and that the Quaternary pollen in the diamictites indicates their true age (Quaternary).

If Unaweep Canyon was eroded in the late Paleozoic and partially filled with Mesozoic strata, these deposits should thicken in the vicinity of the canyon. There is no thickening of Mesozoic strata as the canyon is approached, indicating that there was no paleotopographic depression during the Mesozoic. If this area were a mountain range with high enough elevations to support glaciers down to a tropical sea, there should have been other late Paleozoic canyons in addition to Unaweep Canyon. There are two other large alluvial fan deposits (San Miguel, Piedra) in the Permian-age Cutler Formation, in addition to the one near the mouth of Unaweep Canyon (Campbell, 1980), yet these other fans show no evidence of deep canyons. Why should only one Paleozoic canyon be preserved? The presence of a single canyon is more consistent with a fluvial origin for the canyon during late Cenozoic by superposition of the ancestral Colorado and/or Gunnison Rivers across the Uncompahgre Plateau.

Soreghan et al. (2008) present a gravity profile that they interpret to indicate a U-shaped valley of glacial origin. The shape may support a glacial modification of the western end of Unaweep Canyon, but it certainly does not indicate a Permian age. Cole and Young (1983) pointed out the glacial-like features of the western canyon where the profile is located, and suggested glacial modification of this area of the canyon. These features are sharp and well-defined, which is inconsistent with a late Paleozoic origin because the area was subjected to significant erosion prior to deposition of the Triassic-age Chinle Formation atop the Precambrian. The low relief on the unconformity between the Precambrian and Chinle Formation argues for erosional flattening of the area, not preservation of relict glacial topography. Other geophysical work suggests that the eastern, upstream end of the canyon is V-shaped (Oesleby, 1983), which is inconsistent with this end of the canyon being higher in the ancestral Rocky Mountains and nearer the ice source. The evidence that Soreghan et al. present concerning polyphase deformation of the diamictite and high grain-to-grain stress on quartz grains, which they interpret as being consistent with glacial activity, could just add support to Cole and Young's (1983) earlier suggestion that Cenozoic glaciation modified the canyon.

There is considerable, and in our view compelling, evidence that Unaweep Canyon is of Cenozoic age. The canyon planform geometry is influenced by the Laramide-age faults, so it could not have existed prior to that time. If the Laramide arching of the Uncompahgre Plateau is removed, the long profile of the canyon is bowl shaped and presents an impossible configuration for a river or glacier (Aslan et al., 2008; Hood, 2009). If Unaweep Canyon cannot be used as evidence for Paleozoic glaciation, the argument for an extremely cold climate at the equator during this time cannot be supported.

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