COMMENTS AND REPLIES

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Comment

COMMENT: "Late Oligocene–early Miocene Grand Canyon: A Canadian connection?"

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In the past, Thomas C. Chamberlin's (1897) "The Method of Multiple Working Hypotheses" was required reading in many geology graduate programs although published reports suggest the method is rarely applied. For example, "Late Oligocene–early Miocene Grand Canyon: A Canadian Connection?" (Sears, 2013) proposes that a north-oriented late Oligocene–early Miocene river flowed from the southern Colorado Plateau to the Labrador Sea and suggests "standard" tests to verify the hypothesis. No multiple working hypotheses are mentioned, much less considered. The described valleys exist, and the hypothesis merits consideration. However, to correctly apply the method of multiple working hypotheses, the north-oriented river hypothesis needs to be compared with other logical and reasonable working hypotheses explaining the same evidence.

An alternate to a north-flowing river is a south-flowing river. If evidence is looked at using what might require a different time frame, continental ice sheet meltwater flowing in a southerly direction could erode the described valleys and also provide the immense volumes of water required to erode the Grand Canyon and other Colorado Plateau landforms. Further, McMillan's (1973) pre-glacial Bell River does not the support the north-flowing river hypothesis because it defies common sense logic by requiring continental ice sheets to daintily tiptoe across pre-glacial valleys carved in easily eroded materials (see White, 1972). While evidence for the Bell River drainage system exists, alternate working hypotheses to explain that evidence need to be considered.

Massive meltwater flow reversals during late stages of an Antarctic-sized (or larger) North American ice sheet meltdown can explain the Bell River evidence, especially if the ice sheet weight and erosive activity created a deep "hole" in which the ice sheet was located. Why would south-oriented meltwater floods reverse flow directions? Ice sheet melting would open up space in the deep "hole," and south-flowing meltwater would eventually find shorter routes to coastlines by crossing the deep "hole" floor. Weight of the Antarctic-sized ice sheet and meltwater erosion and deposition would also provide mechanisms to trigger tectonic and igneous activity as south-flowing meltwater rivers crossed the western United States. And such tectonic activity would contribute to deep "hole" formation and meltwater flood flow reversals.

Gravenor (1975), Sugden (1976), and other authors firmly rejected White's (1972) proposal of an ice-sheet–eroded deep "hole," and geologists have since ignored a logical and reasonable working hypothesis. What evidence along and near Sears' (2013) proposed river route suggests that south-oriented meltwater floods reversed flow direction to enter an ice-sheet–created deep "hole" and flow across a decaying ice sheet floor? The Big Hole River and other streams flow in southerly directions to enter the north-oriented Beaverhead–Jefferson–Missouri River valley. The Snake River flows in a southerly direction before turning northwest to enter Idaho, where it turns southwest and then west, before turning to flow through the north-oriented Hells Canyon, which required tremendous quantities of water to erode. To the east, the Wyoming Wind River flows in a southeasterly direction before abruptly turning north to cross the Owl Creek Mountains in Wind River Canyon. And numerous other examples could be listed.

The yet-to-be-reviewed Missouri River drainage basin landform origins research project systematically studied detailed topographic maps of all drainage divides within and surrounding the entire Missouri River drainage basin. Project research notes (E. Clausen, 2009 to 2013) consist of 550 essays (currently publicly available to all interested persons for review and comment at geomorphologyresearch.com) demonstrating how south-oriented meltwater floods from an Antarctic-sized ice sheet (located in an ice sheet–created deep "hole") explain many thousands of drainage divide, elbow of capture, barbed tributary, water gap, wind gap, mountain pass, through valley, and other landform origins.

The purpose of this comment is to suggest that the proper tests for the proposed late-Oligocene–early Miocene north-flowing river hypothesis are not the "standard" tests Sears (2013) suggests but a comparison with every other working hypothesis able to explain most or all of the pertinent evidence. The south-flowing meltwater hypothesis is offered here as an alternate working hypothesis, which also explains much of the western United States erosional landform evidence, but which requires a major revision of Cenozoic history interpretations. The north-flowing river hypothesis (Sears, 2013) is consistent with Cenozoic history interpretations but leaves numerous erosional landforms poorly explained. The two working hypotheses and perhaps others need to be compared to determine not which hypothesis agrees with existing interpretations, but to determine which hypothesis best explains the actual landform evidence.

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