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Memorandum (0008paleo)

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From: Brooke Blades
To: Frank McManamon
Subject: Comments on Columbia Plateau paleogeography and paleoenvironment

The following summaries, comments, and observations address general and specific concerns related to reconstructions of paleogeography and paleoenvironment along the Columbia River and more broadly in the Columbia Plateau region. These reconstructions focus upon the Holocene epoch, although some data do focus attention back to the terminal Pleistocene.

Floods on the Columbia River

The late Pleistocene landscape on the Columbia Plateau was dramatically different from the one that presently exists. A series of four glacial lakes extended from western Montana to near the mouth of the modern Columbia River along the Pacific Coast. (That coast was, it will be remembered, approximately 25 miles farther west due to lower sea levels during the Ice Age.) The series of glacial lakes was not continuous, as northern Washington State was covered by a continental ice sheet (Allen *et al.* 1986:80).

It is widely acknowledged that the Pleistocene terminated with a series of spectacular floods of glacial meltwater from the continental ice sheet and from Glacial Lake Missoula in modern-day western Montana (Allen *et al.* 1986:80, 102). These floods scoured eastern Washington State, creating the Channeled Scabland landscape of coulees and other distinctive topographic features. Forty or more floods are estimated to have moved through the region and along the Columbia River between 15,000 and 12,800 BP (Waitt 1980; Allen *et al.* 1986:103).

The portion of the Columbia River Valley near the confluence of the Snake River (i.e., the location of the Kennewick remains) witnessed dramatic geographic changes during the period between 15,000 and 9000 BP, or from the latest Pleistocene to the early Holocene. The tri-cities area that includes Kennewick was submerged by some accounts to a depth of 800 feet beneath the surface of Glacial Lake Lewis (Allen *et al.* 1986:129). Waitt has counted 40 rhythmites deposited during separate fill and draining sequences of Glacial Lake Lewis; the glacial lake was filled once every 55 years between 15,000 and 12,800 BP (Waitt 1983, 1984; Allen *et al.* 124). A double layer of volcanic ash has been identified in the upper portion of the rhythmite sequence in the Walla Walla Valley; the ash layers are associated with an eruption of Mt. St. Helens about 13,000 BP (Allen *et al.* 1986:124,125).

Huckleberry and Stein (1999) described upper and lower Columbia River terraces at the find site of the Kennewick remains. The upper terrace was interpreted as reflecting a glacial outburst flood along the Columbia dating no later than 13,000 BP. The lower terrace was inset into the older upper one. This lower terrace postdated the last Missoula flood and was created by the Columbia during "the deglaciation in the northern Cordillera." The Kennewick remains, which have been radiocarbon dated to between 9500 and 9000 BP, were associated with this lower terrace. Thus, the occupation of the Kennewick individual was separated from the dramatic floods and glacial lake filling-draining sequences by at least 3500 years–or in human terms by 140 generations, assuming a span of 25 years for each generation. The landscape that the Kennewick individual and his group experienced was very different than the one of late glacial floods and lakes.

That landscape of the Kennewick individual also differed from the modern one, although the differences are certainly less dramatic when compared with the late Pleistocene. Chatters and Hoover (1992:52) and Chatters (1998:42-48) have prepared detailed reconstructions of paleoenvironmental conditions since the early Holocene, drawing upon data from a wide range of botanical, geological, and archaeological sources. (Note: the temporal frameworks in these two articles are difficult to reconcile; adding 1950 years or 1200 years does not help. I have used the BP framework presented by Chatters and Hoover (1992) but have drawn some data from the "Environment" article (Chatters 1998) in the *Plateau* volume in the Smithsonian's *Handbook of North American Indians* series):

10-9 Ka (or thousand years ago): cold winters, hot summers; spring? precipitation; grass steppe vegetation; **flood potential minimal** due to low sedimentation rates and limited winter precipitation; fauna: open environment types such as elk, bison, deer, mountain sheep, and pronghorn; evidence of salmon exploitation at Five Mile Rapids. **Note: the Kennewick individual would have occupied the region during or at the end of this period.**

9-8 Ka: warmer winters, hot summers; winter precipitation; transition from grass steppe to shrub (sagebrush, etc.) steppe vegetation; **flood potential increased** due to precipitation during warmer winters and soil exposure from declining grass vegetation; fauna: pronghorn increase relative to elk in the eastern Columbia Basin.

8-4.4 Ka: warm winters, hot summers; low winter precipitation; shrub steppe vegetation; **flood potential minimal:** sediment exposed and available but insufficient flood runoff due to limited precipitation; ashfall from Mt. Mazama eruption (modern Crater Lake, Oregon) at 6850 BP may coincide with major change in flora; reduced stream flows suggest that salmon runs would have been substantially lower than during historic periods; pit houses emerge during this period.

between **7.8-6.5 Ka:** intervening cooler, moister period with greater soil mobilization and thus **increased flood potential**; coincides with emergence of pit houses?

4.4-3.9 Ka: warm winters but cooler summers; denser shrub vegetation, forests expanding to modern ranges; **floods frequent** since vegetation not stabilized; pit houses abandoned or reduced in number at end of period? (Blades- possible reflection of increased frequency of mobility within more closed enviroments with fewer concentrations of subsistence resources. Chatters (1989, 1995) argued for influence of cooler, wetter Plateau envrionment after 3.9 Ka in abandonment of pit houses.)

3.9-2.4 Ka: cold winters, cool summers; high levels of winter precipitation and dense steppe vegetation; **flood potential low** since soils anchored by dense vegetation while colder temperatures reduce rain-on-snow occurances and retard melting of snow in spring; conditions good for intense but abbreviated (due to colder water) fish runs; pit house occupancy reduced or abandoned and then reemerges?

2.4-1.8 Ka: warmer winters and summers; declining winter precipitation and vegetation density; **floods increase** due to reduced vegetation and increased rain-on-snow runoff in winter; **emergence of modern conditions.**

This paleoenvironmental summary reveals that variations in the timing and amounts of precipitation, coupled with changes in temperature and vegetation cover, have resulted in a cyclical pattern of high and low flood potentials during the Holocene. Indeed, Chatters and Hoover (1986:318) calculated that mean flood frequencies in the last 2000 years continued to reflect this cyclical pattern: AD 120-1020 (1880-980 BP): once every 84 years; AD 1020-1390 (980-610 BP): once every 30 years; AD 1390-1948 (610-50 BP): once every 142 years. In other words, virtually every generation that occupied the Plateau during the 400-year period between 980-610 BP would have experienced a dramatic flood, although one that hardly compared with those at the end of the Pleistocene. Therefore, floods have been common experiences during certain periods on the Plateau.

Flora and Fauna in Changing Environments

Variations in temperature and amounts of rainfall through time have resulted in environmental shifts during the Holocene (Chatters 1998:46-48). The Southern Columbia Plateau experienced a transition from a grass steppe to a shrub steppe during the period 9,000-8,000 years ago. The plant names that Hunn (2000:10,11) cited as indicative of continual occupancy of the Plateau, such as those for the genus *Lomatium* or the genus *Salix* (willow), are indeed associated with plants on the shrub steppe (Chatters 1998:35).

However, shrub vegetation did not become fully established on the Plateau until c.8000 BP. The Kennewick individual, who occupied the region approximately 1000-1500 years earlier, would have encountered an open grass steppe which may have reflected some elements of shrub vegetation. He could have hunted a range of relatively mobile fauna, including elk and deer (Chatters 1998:43). Terms for animals that would have been present on the grass steppe, such as pronghorn, various deer species, and mountain sheep, are found in Sahaptian (Hunn 2000:10). On the other hand, these species may still be found in the Plateau region, reflecting varying degrees of habitat tolerance (Chatters 1998:37,38).

The Sahaptian terms for bison are borrowed from Cree and Flathead, and Sahaptian vocabulary lacks a term for caribou (Hunn 2000:10), which may reflect the extensive time period since (and a lack of collective memory of?) the disappearance of the open late Pleistocene environments. The relatively recent (i.e., post-1800 BP) prominence of bison (Chatters 1998:47) may be reflected in the lack of an indigenous term for this species. It is important to remember, however, that bison were also present on the grass steppe of the early Holocene (Chatters 1998:43) and thus may be expected to be preserved in a communal memory of the early Holocene.

Given his position on an early Holocene terrace of the Columbia River, the Kennewick individual and his group most likely exploited seasonal salmon runs on the river. During his/their period of occupancy, however, salmon productivity was limited by hot summers and warm water runoff. An increased salmon presence coincided with a period of maximum productivity on the Southern Plateau occurred during the period from 4000 to 2000 years ago (Chatters 1998:47; Ames *et al.* 1998:111). Indeed, roughly contemporaneous faunal assemblages from across the Plateau have substantial amounts of salmon bones for the first time (Ames *et al.* 1998:111). The importance of salmon species in Sahaptian vocabulary may therefore reflect this increased productivity.

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