1.5-Ma age for terrace at Deschutes-Shitike confluence?

In 2013 I posted the glass-geochemical data supporting a roughly 1-Ma age for pumiceous gravel in terrace deposits 150–200 ft above the Deschutes River at Maupin and farther north at the Oak Springs fish hatchery (appended to this pdf file). The posting prompted Willie Scott to dig up samples of pumice granules he collected in 1997 from a terrace at the confluence of the Deschutes River and Shitike Creek, where US Highway 26 crosses the river at Warm Springs. The glass analysis and information about possible correlative distal tephra fallout were received recently.

The terrace at Warm Springs is well developed along Shitike Creek (fig. 1). Its base on the east side of the Deschutes River lies about 200 ft above modern river grade (map, fig. 2, unit Qt). The pumice granules (gravel) in it range to several centimeters in diameter, so their source must be somewhere along the Cascade Range from the Three Sisters or Newberry northward to about latitude 45°. The pumice granules were flushed down the Deschutes River or Shitike Creek to their depositional setting in the terrace.

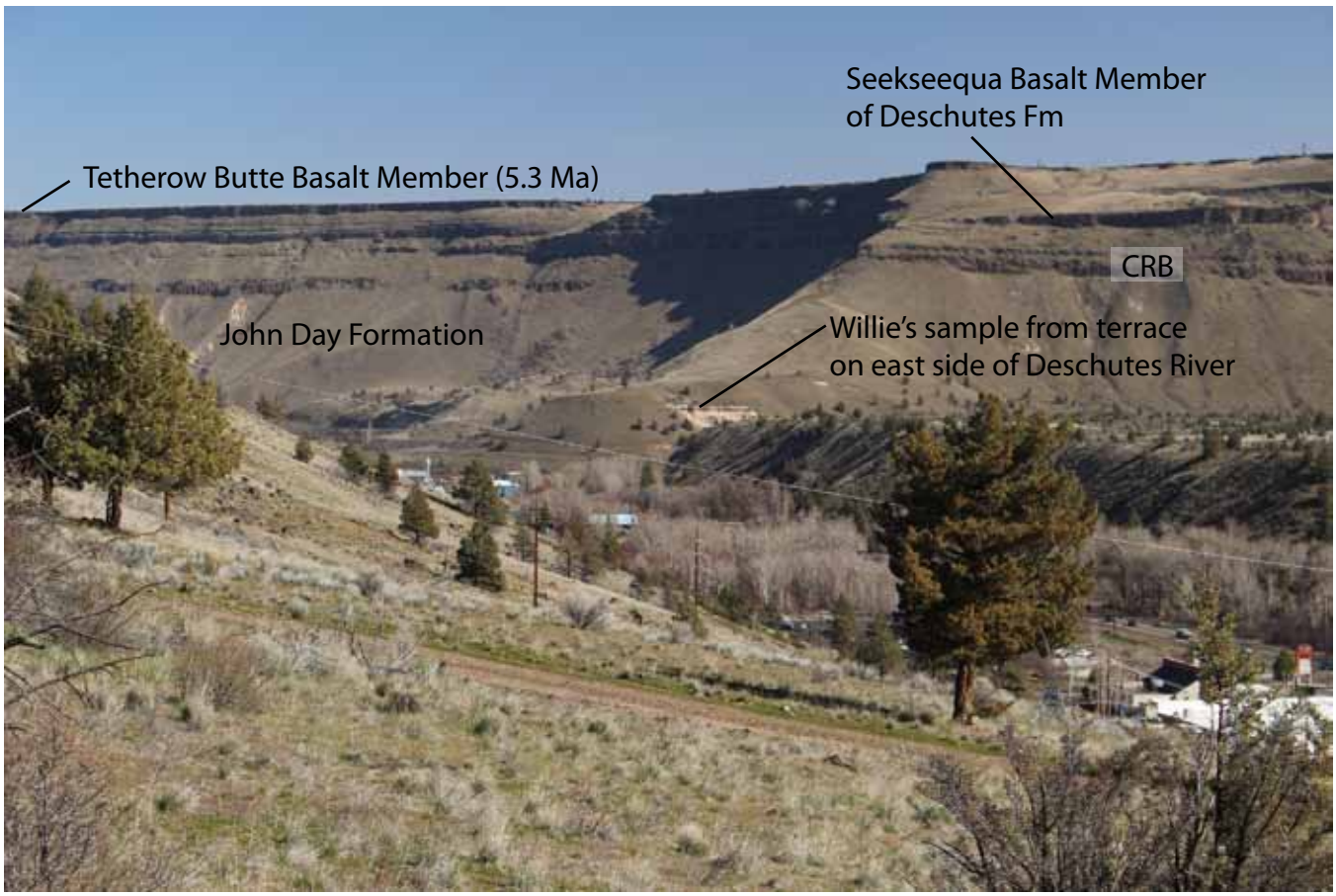


Figure 1. View east along Shitike Creek to its confluence with Deschutes River. Shown labeled are umiceous gravel in perched terrace and some stratigraphic formations (geology by Smith and Hayman, DOGAMI GMS-43, 1987). US Highway 26 descends from Madras into Deschutes River valley to the right (south) of this view, crosses the Deschutes River at about the position of the perched terrace, and traverses west toward the camera along Shitike Creek in Warm Springs village.

Given its geologic setting, the currently preferred match for the Shitike confluence pumice gravel is with the "Rio Dell ash bed," which is reported from the Rio Dell Formation in coastal California near Eureka. The Rio Dell Formation is a strandline and marine deposit extending offshore (Humboldt basin). The ash bed there is in the upper part of the Rio Dell. Its age is thought to be about 1.5 Ma (Sarna-Wojcicki and others, 1991). As described in the 1991 paper, source for the ash is unknown, but its chemical characteristics suggest a source in the central Oregon Cascade Range.

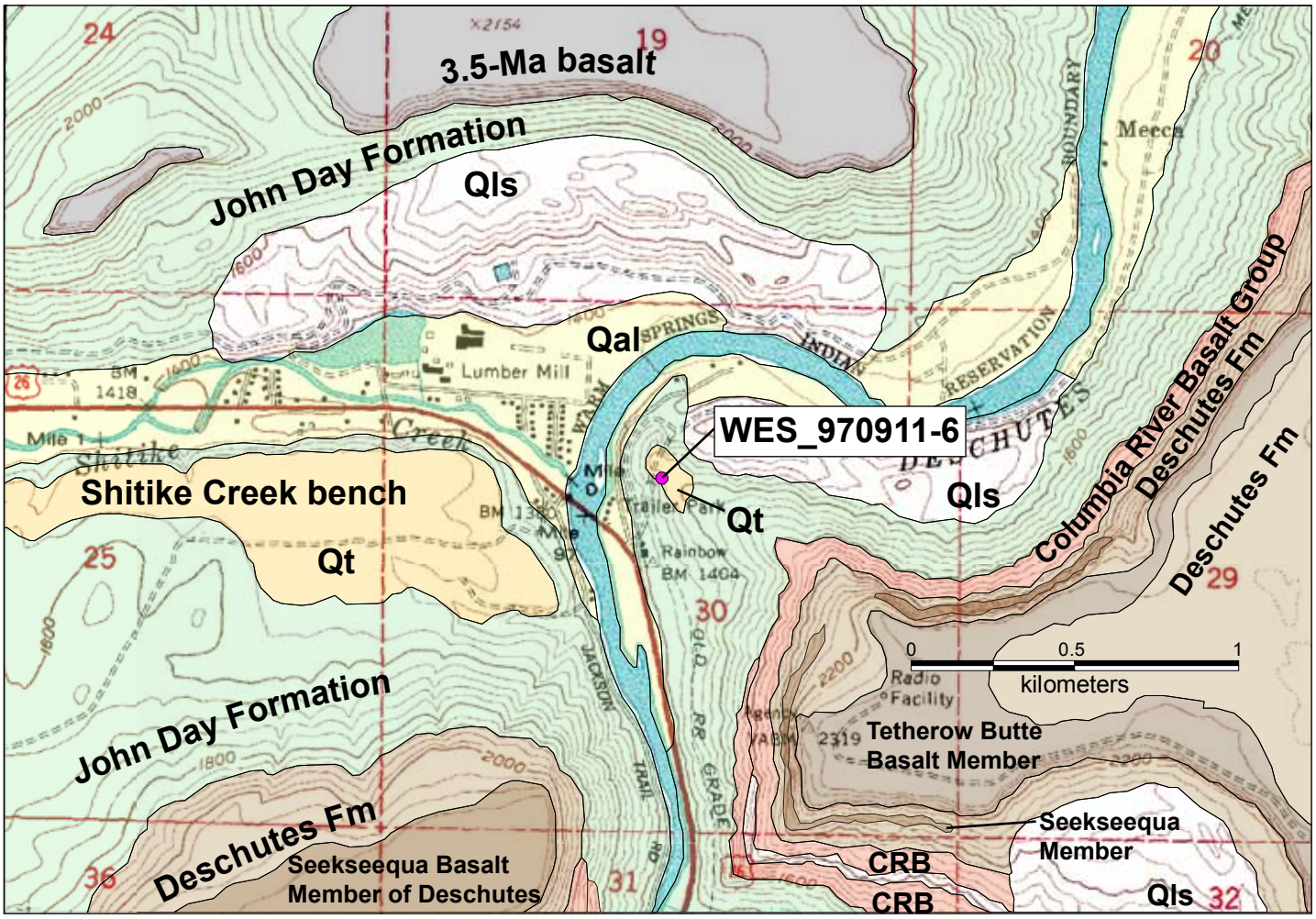


Figure 2. Geologic map of the Shitike Creek-Deschutes River confluence. Map from Smith and Hayman (1987) as compiled in the Oregon Geologic Data Compilation (Ma and others, 2009). Glass analysis is from pumice granules in terrace deposit (Qt) on east side of Deschutes River. Topographic base from Eagle Butte 7.5-minute quadrangle; altitude in feet.

The geologic map (fig. 2) offers some topographic constraints on downcutting (reporting present topographic altitudes). The Deschutes Formation's Tetherow Butte Basalt Member flowed across a broad floodplain about 5.3 Ma (Smith and Hayman, 1987). Base of the Tetherow Butte Member at the Shitike confluence area is about 2,200 ft. The ancestral Deschutes River, by Tetherow Butte time, was already being pinched into its approximate current alignment northward from the Shitike Creek confluence.

By about 3.5 Ma the informally named basalt of Mill Creek, from Cascade Range source, mantled much of the terrain eastward to Warm Springs. Highway 26 crosses the mima mound-littered Mill Creek basalt plain on its route toward Portland after ascending westward from Warm Springs village. The Mill Creek basalt has base level of 2,000 ft at the Deschutes River (fig. 2). Thus much or most of the Deschutes incision occurred after Mill Creek time, or after about 3.5 Ma.

If the glass geochemical correlations are correct, then Willie's sample from the Shitike Creek confluence is 500,000 years older than the pumice-bearing terrace near Maupin. In that case, downcutting may have stalled 1.5 m.y. ago, allowing emplacement of the Shitike and Maupin terraces at about same height above modern grade. Alternatively, we may see here one of the weaknesses of tephra correlation: since the glass geochemical catalog grows spotty for increasingly older tephra deposits, the very best correlations may be missed altogether.

The rest of this pdf is appended from a listserv report of 2013, for those who weren't on the list at the time or members who don't have the time to seek it out but might like the refresher.

The last two pages of this attachment shows the locations and outcrop settings for two terrace-deposit outcrops now perched 150–200 ft above the Deschutes River at Maupin and a few kilometers north at Oak Springs fish hatchery. The terrace sand and gravel is rich in subrounded pumiceous granules. The pumice is slightly plagioclase phyric; no other phenocrysts were noted.

Glass analyses by microprobe show the samples from the two outcrop localities are essentially identical. Statistical analysis indicates a close match geochemically with a sample T453 from the Western U.S. tephrochronology database. T453 (silicic fraction) is an unnamed Pleistocene (0.88 Ma) Cascade-type tephra from lake sediment coring in the Tule Lake basin.

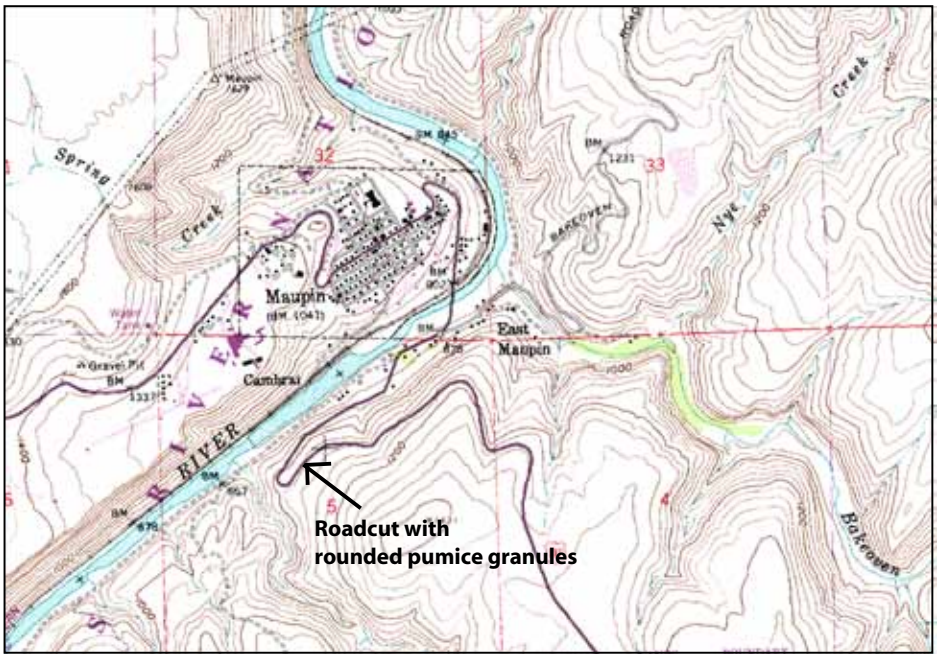
View west across Deschutes River to Oak Springs fish hatchery. Pumiceous granules for sample S12-OS871 were collected from the circled terrace, 150 ft above modern river shore.

Outcrop views of the pumice-bearing sand and gravel. Some beds are nearly 100 percent pumice granules.

The Oak Springs-Maupin pumices are also similar to BUR498 (age 1.15-0.87 Ma), a tephra from the Bonneville basin in northwest Utah. BUR498 was derived from Glass Mountain (Long Valley caldera, Calif.). We can rule out that source, given the size of the pumice granules in the Oak Springs and Maupin terrace deposits.

The Oak Springs pumices were erupted from some source tapped by the Deschutes River. The vent could have been south of Chemult (south of the Deschutes River basin) if pumice and ash were deposited toward the northwest. But given the size of the pumice granules in the terrace deposits, I think it more likely the source was in the stretch of Cascade Range from the Three Sisters north to Mount Jefferson. This assessment is based on size comparison with Mount Mazama lapilli deposited within the Deschutes River basin, none of which is as coarse as the largest of the Oak Springs-Maupin pumiceous gravel.

In my view, the terrace deposits likely formed soon after the 0.88-Ma eruption, a time when the landscape would have been mantled by pumice lapilli that could be sluiced into the Deschutes River. The likelihood of depositing nearly monotonic pumice granules would diminish with the passage of time. Regardless, the terraces must be younger than the T453 match, so an 0.88-Ma age is a maximum age for the terrace deposits.



Roadcuts exposing pumiceous gravels where U.S. Highway 197 ascends the grade east of Maupin. Deschutes River, flowing north here, today lies 180–200 ft lower than the terrace deposits exposed in roadcut.

Pumiceous gravel deposits in roadcut along Highway 197.

Sample S12-OS883 is pumiceous granules collected from this roadcut.