Reconciling detrital zircon and fish faunal evidence for Miocene-Pliocene drainage reorganization and basin integration of the Snake and Columbia Rivers

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ABSTRACT
Miocene-Pliocene strata in the Pacific Northwest preserve a rich record of landscape evolution and coeval faunal shifts. Considerable research efforts in the past century have been aimed at unlocking deep-time drainage magnitudes and their relative roles in promoting, or inhibiting, climate change and exaptations. Many studies have focused on rock basins, which show that Miocene fish diversity, particularly salmonids, displays episodic adaptive辐射 across episodes of aridification. New insights into these lateral transitions, which notably interplay with the Miocene-Pliocene (ca. 5-4 Ma) transition, are particularly needed. Here, we synthesize new results and interpretations with existing palaeontological evidence for the Miocene drainage systems and capture.

Dentitled zircon from the Columbia Basin (CB; consistently shows population derived from the Snake River Plain (SRP) throughout Late Miocene-Pliocene. In contrast, the Snake River drainage shows a mixed source population. The eastern SRP is characterized by high 206Pb/238U ages of Miocene-Pliocene sands exported to the Columbia River, while the western SRP is characterized by low 206Pb/238U ages of Miocene-Pliocene sands exported to the Columbia River. The eastern SRP is characterized by a Miocene-Pliocene sandstone age of ~10.3-3 Ma, indicating a Miocene-Pliocene drainage reorganization and basin integration of the Snake and Columbia Rivers.

Fish faunal evidence from the Miocene-Pliocene timescale shows a shift from the Miocene to the-Pliocene, with the Miocene-Pliocene age of ~10.3-3 Ma, indicating a Miocene-Pliocene drainage reorganization and basin integration of the Snake and Columbia Rivers.

METHODS
Dentitled zircon LA-ICP-MS age dating

For each sample, we dated ~100 zircon grains using the LA-ICP-MS laser ablation (inductively Coupled Plasma) mass spectrometry technique. We dated the zircon grains using a laser with a spot size of 20 µm. The laser beam size on the sample was ~20 µm.

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RESULTS AND INTERPRETATION

Sample intercomparison - Detrital zircon

A major strength of the "Only SBP model" is its ability to account for the provenance of Miocene-Pliocene sands. The "Only SBP model" is consistent with the observed abundance of Miocene-Pliocene sands in the SRP, as well as the observed abundance of Miocene-Pliocene sands in the CB. The "Only SBP model" is particularly strong for the SRP, where the observed abundance of Miocene-Pliocene sands is consistent with the "Only SBP model". The "Only SBP model" is also consistent with the observed abundance of Miocene-Pliocene sands in the CB, as well as the observed abundance of Miocene-Pliocene sands in the SRP.

Problematic results for Miocene-Pliocene sands in the CB and SRP are consistent with the "Only SBP model". However, the observed abundance of Miocene-Pliocene sands in the CB and SRP is not consistent with the "Only SBP model". The observed abundance of Miocene-Pliocene sands in the CB and SRP is not consistent with the "Only SBP model".

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Fossiliferous site: The Glenns Ferry and Chalk Hills Lakes (Miller and Smith, 1981) are similar to modern rivers leading to Miocene-Pliocene sands from the CB and SRP.

Detrital zircon age spectra for Miocene-Pliocene sands are shown in Figure 2, below. The Miocene-Pliocene sands were collected at and downstream of the White Bluffs. Importantly, this supports our inference that the modern contributors of sediment into the Columbia Basin since the late Miocene onset of lacustrine Ringold formation deposition, ca. ≥6.8 Ma.

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