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Using maximum age of deposition and trace element data from detrital zircon to constrain tectonic setting and basin formation: insight from the Yukon-Koyukuk basin, Alaska.

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U-Pb ages and trace element data from detrital zircon, combined with U-Pb tuff ages, from sedimentary units in the Yukon-Koyukuk Basin (YKB) in Alaska, are used to understand basin evolution within a tectonic framework. The development of the YKB is closely linked to Brookian orogenesis, which began in the middle to Late Jurassic following the collision between an intraoceanic volcanic arc (Koyukuk Arc Terrane, KAT) and the Arctic Alaska margin. This collision ultimately led to the thrusting of oceanic basement over the passive continental margin. Two models are proposed for basin formation: one suggests that the YKB formed contemporaneously with collision, while the other attributes its development to an extensional event that occurred between 130 Ma and 90 Ma. To test these models and better understand the YKB response to major tectonic changes in the region, we analysed the entire stratigraphic column, from the basal deep marine units to the upper non-marine fluvio-deltaic sequences.

U-Pb zircon data from sedimentary rocks and igneous tuffs are used to constrain the timing of basin formation and sediment deposition, providing new and important age constraints for the entire stratigraphic section. Our results indicate that basin fill began around 138 Ma (Valanginian) and extended at least until 90 Ma (Turonian). The age of the basal layers supports the model interpreting the YKB as having formed during collision, in a forearc-backarc setting. Trace element analyses of magmatic zircons matching the age of the KAT reveal significant crustal contamination and indicate that subduction of the passive Arctic Alaska margin beneath the intraoceanic arc influenced arc magma evolution and composition over time.