THE WORLD IN A GRAIN OF SAND—DEVELOPMENT AND TESTING OF NOVEL ISOTOPIC PORVENANCE TOOLS IN THE NORTHWESTERN ZAGROS OROGEN, IRAQI KURDISTAN

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Abstract

Detrital zircon (DZ) U-Pb geochronology is rapidly becoming an essential tool in Earth science research and is commonly used to estimate depositional ages, reconstruct the timing and rates of past orogenic and magmatic episodes, and provide constraints for paleogeographic and paleodispersal models. However, DZ U-Pb dating alone is often complicated in complex tectonic zones due factors such as sediment recycling and homogenized U-Pb age signatures among source terranes. To address these critical limitations, I propose the development of novel analytical techniques that will simultaneously collect comprehensive chronologic and geochemical data across multiple growth domains and extract a cooling age from a single detrital mineral, thus providing multiple criteria of crystallization age, thermal history, and source-rock petrology from that individual grain. We use the Cenozoic Zagros orogen as natural laboratory for testing this novel isotopic provenance technique: (1) How can we differentiate between sediments derived from various source-terranes with indistinguishable U-Pb age signatures and cooling ages? (2) Are sediments derived directly from the different hinterland regions distinguishable from recycled detritus? (3) What can this method reveal about basin burial-heating history, source-rock petrochronology, and the links between hinterland exhumation and foreland basin evolution during fold-thrust propagation? This study not only has direct implications for specific basin evolutions, but more importantly provides robust tools for deciphering obscure provenance signals and sediment recycling in basin systems across the globe. Furthermore, this work can offer valuable insight into basin thermal histories as well as the broader interactions among tectonics and sedimentation during early-stage continent collision.

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