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A new application of monomineral chemical composition in reconstructing regional weathering history in the Qaidam Basin, northeastern Tibetan Plateau

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Factors including grain size, hydraulic sorting, diagenesis and recycling may bias the utility of bulk geochemical indices in revealing regional weathering histories, especially in thick sedimentary sequences characterized by frequent facies and lithological changes. To eliminate these effects in sedimentary sequences, a better approach is to use chemical compositional variation of a certain mineral. In this study, we preset some monomineral indices to reconstruct Paleogene (54-26 Ma) weathering history in a sedimentary sequence with frequent interbedded conglomerates and facies changes in the Qaidam Basin, northeastern Tibetan Plateau. The studied sequence contains the Lulehe, Xiaganchaigou and Shangganchaigou Formations. The Lulehe Formation is coarse-grained and generally consists of conglomerates, sandy conglomerates, sandstones, and purple mudstones, indicating alluvial fan–fan delta facies. The Xiaganchaigou and Shangganchaigou Formations contains lacustrine sediments, the former contains brownish–red and purple mudstones and interbedded sandstone while the latter contains brown-yellow and brown mudstone with gray sandstone. The monomineral indices, illite chemistry index, chlorite chemistry index, chlorite Mg/Al ratios of hydrochloric acid (HCl) leachates collectively present a continuously decreasing trend in the Paleogene. The intense weathering process occurred in the early Eocene (54-49.5 Ma), which is further supported by high beidellite content, followed by a long-term decrease from the middle to late Eocene (~49.5-34 Ma), and finally a weakened stage at ~34-26 Ma. Our study suggests that monomineral chemical variation serves as an efficient proxy in regional chemical weathering reconstruction, even in thick sedimentary sequences with frequently changing facies and lithology.