(U-Th)/He geochronological evidence for rapid uplift of Tianshan orogenic belt since Miocene

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The Tianshan orogenic belt, lying across Central Asia, is an important part of the Central Asian Orogenic Belt, which formed by the continental collision between Siberia and Tarim plate in Late Paleozoic. Since Cenozoic, strong compression caused by the collision between Indian and European plates has led to intense uplift of pre-Mesozoic terrains in Tianshan Area. Analysis of growth strata and regional geological studies show that rapid uplift of the Tianshan in Late Cenozoic occurred younger than 10-7Ma, of which the existence of extremely thick Quaternary molasse sediments indicates that the uplift and denudation in a relatively high tectonic position occurred younger than 3Ma, paradoxically, most of the thermochronology data gained from the FT (Fission Track) is >20Ma [1], lack of data which is <7Ma.

Non-dilution ^{4}He content measurement technique is developed in the Helix MC multi-collector mass spectrometer in our laboratory [2], as well as the establishment of the (U-Th)/He dating experimental procedure. Apatite in granite、gabbro sampled from Tianshan orogenic belt are dated by (U-Th)/He method, obtained a series of ages around 5Ma-10Ma, which provide geochronological evidence for a rapid uplift event in Late Miocene-Pliocene in Tianshan orogenic belt.

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Redox evolution of the late Neoproterozoic to early Cambrian ocean on Yangtze platform, China

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The late Neoproterozoic-early Cambrian interval (663-521 Ma) witnessed a critical transition in the surficial Earth system. Although it is still debated whether physical or biological factors controlled this transition, the redox state of the atmosphere and ocean are generally considered to be a key factor in the cause and effect relationships. Here we present data for several redox tracers, including Mo isotope compositions, Fe speciation and Mo/TOC ratios in the organic-rich shales/carbonates from the Yangtze platform, Southern China.

The results suggest a key evolutionary transition either side of ca. 580-551 Ma. Between 663 and 580 Ma, Fe speciation data give high Fe_{HR}/Fe_T (> 0.38) with relatively low Fe_{Py}/Fe_{HR} (< 0.7). Both Mo concentrations and Mo/TOC ratios are low. δ^{98}Mo values are not far from the modern dissolved riverine input value of 0.7. Between ca. 551 and 521 Ma, Fe speciation begins to show more variation. Unprecedented enrichment of Mo also emerges as a characteristic of sediment and the range of δ^{98}Mo values show an extended range of variation.

The data suggest a still low atmosphere O_2 level during the early stage, resulting in low input of Mo and sulfate to the ocean. Sulfate deficiency and/or low productivity in the ocean induced ferruginous anoxia. Due to a low proportion of Mo output via the oxic sink and quantitative removal to sediments, no obvious fractionation of Mo was recorded. But a pronounced oxidation event initiated after (at least) ca. 551 Ma. Elevated atmosphere O_2 level and sulfate input to the ocean may have resulted in expansion of euxinic, suboxic, and oxic environments. Moreover, expansion of the ocean Mo reservoir also stimulated greater fractionation of Mo in anoxic/suboxic environments. δ^{98}Mo in euxinic sediments reached the modern value after ca. 530 Ma, marking the epilogue of this profound redox transition in the ocean, and coincident with the immediately following peak of metazoan radiation. This study is supported by NSFC grant 40872025.