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Mineralization, uplift, weathering, and climate in Mesozoic East Asia: Skarns beyond decarbonation

WENBO WANG[1,2], PANLAO ZHAO[1,3], WEI LIU[1,4] AND **XU CHU**[1]

[1]University of Toronto
[2]China University of Geosciences,Beijing
[3]Chinese University of Geosciences
[4]Institute of Geology and Geophysics, Chinese Academy of Sciences

Presenting Author: xu.chu@utoronto.ca

When arc magma intrudes into overlying carbonates, it triggers metamorphic reactions between carbonates and silicate-bearing fluids, forming calcsilicate assemblages ("skarns") and releasing CO_2. This process has led to suggestions of a link between Earth's greenhouse intervals and significant continental arc magmatism during the Mesozoic. In East Asia, the subduction of the Paleo-Pacific beneath continental arcs likely resulted in substantial CO_2 emissions. Our research explores further aspects of lithospheric processes reflected by skarn formations and their potential environmental impacts. During the late Triassic to Jurassic, a notable increase in W-Sn mineral deposits in East Asia was propelled by the subduction, rollback, and sinking of Paleo-Pacific slabs. These deposits are found alongside highly evolved granites formed from the anatexis of metasedimentary rocks. The separation of W- and Sn-bearing plutons suggests that these elements were sequestered at different partial melting temperatures. The late Jurassic saw a peak in Sn-rich mineralization associated with within-plate magmatism, linked to the foundering of a flat slab. This period also saw the accumulation of black shales with high metal content, potential ocean anoxia, and widespread red beds in East Asia. While skarnification increased CO_2 emissions, its primary environmental impact may stem from the supply of metallic elements to the ocean through the weathering of the metallogenic arcs. Concurrently, the uplift of the eastern coastal plateau was notable. We used oxygen isotope analysis of skarn garnets to deduce the origins and characteristics of mineralization fluids prior to the onset of crustal thinning. Depleted oxygen isotopes (< -3‰) were found exclusively in the northern margin of the North China Craton, indicating significant interaction with meteoric and lacustrine fluids. This hinterland of continental arc hosted back-arc plutons, a series of lacustrine basins, and the Jehol Biota. This geological record aligns with the climate modeling exhibiting that coastal plateau amplified eastward transport of moisture from tropical Tethyan Ocean. The long-distance transport strongly depleted ^{18}O and ^{2}H. After the cratonic lithosphere was thinned and the coastal plateau subsided, the climatic pattern of the majority of East Asia became progressively influenced by the Pacific regime.