Geophysical Research Abstracts
Vol. 21, EGU2019-6904, 2019
EGU General Assembly 2019

High resolution climate record during MIS3 from a stalagmite in the south Altai Mountain area

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This study presents a high-resolution paleoclimatic record of southern Russian Altai area during 33.7-59.4 ka based on ^{230}Th/U dating and stable isotope records of a stalagmite (K6) from Kyok-Tash Cave (51º43'43" N, 85º39'23"E, 890 m a.s.l.). This is the first stalagmite record in Russia to reveal the MIS3 climatic conditions. Ten good ^{230}Th/U dates provide the 23-cm long stalagmite spanning from 59.42 ka to 33.76 ka. The upper 15 cm part of K6 has an average growth rate of 0.006mm/y, and the growth rate increased $\sim$10 times below 15 cm depth, reaching 0.055mm/y. About 1450 subsamples for δ^{18}O and δ^{13}C measurements on the stalagmite provide decadal scales of climate records between 33.7 to 59.4 ka. The K6 records δ^{18}O and δ^{13}C compare with NGISP2 ice cores and Hulu Cave stalagmite records, showing that wet climates in the study area under warm conditions and dry climates during cold periods. The highly inversely correlation between the ice core oxygen isotope record and the K6 δ^{18}O record indicates that the oxygen isotope change of Altai Mountain is mainly affected by the "Amount effect" and seasonal rain ratio. General agreement exists between the K6 δ^{18}O record and the Hulu δ^{18}O record, especially between 33 ka and 44 ka. However, K6 record did not show strong enrichment during H5, and apparent depletion during DO14. This may be explained by opposite influences between amount effect and moisture source effect. In south Altai, the δ^{18}O is much lighter in winter precipitation (brought by the Westerly) than that of summer rain (mainly local evaporation). If winter precipitation increased but annual precipitation decreased during H5, the δ^{18}O depletion by enhened winter/summer precipitation ratio could reduce the δ^{18}O enrichment due to the decline of rainfall amount. During DO14, the increased summer rain which had heavier δ^{18}O might be balanced with the amount effect. In such a case, multiple proxies (e.g., δ^{13}C) should be used for climatic interpretation.