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タリム盆地砂漠化の時期とその原因
Timing and cause of desertification in the Tarim basin

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Desertification in the Asian interior is one of the most remarkable climate changes during Cenozoic, which characterizes the transition from the zonal climate distribution to the Asian monsoon climate distribution in the northern hemisphere. Increased number of studies on the timing of desertification in Asian interior has been conducted in the last decade. Based on these studies, the onset of desertification in the Central China seems to have been as early as 22 Ma. On the other hand, the evidence of desertification in the Tarim Basin goes back only to 5 or 7 Ma so far. Especially, the interpretation on the timing of desertification in the Asian interior during the Early Miocene is controversial. The Taklimakan Desert in the Tarim Basin is considered as one of the major source area of aeolian dust deposited in the North Pacific and Chinese Loess Plateau. Thus, it is important to improve our knowledge on the timing and formation process of the Taklimakan Desert in order to reconstruct of paleoclimatic evolution in East Asia.

The studied sequence is located at Aertashi in the southwestern margin of the Tarim Basin, where thick shallow marine to terrestrial sequence since Oligocene to Pliocene is well-expose.We try to distinguish the eolian dust contribution to detrital materials derived from the western Kunlun Mountains to Aertashi section. We compared Electron Spin Resonance (ESR) signal intensity and Crystallinity Index (CI) of quartz in two size fractions (fine=0-16um, coarse=63um<) separated from fluvial sediments. ESR is an analytical technique to estimate the amount of oxygen vacancy in quartz formed by natural radiation, whose amount shows positive correlation with the age of the host rock. Whereas CI of quartz has information on the physical condition of its formation. Therefore, these two parameters give us information on two different aspects of its host rock characteristics, one is the age and the other is the rock type. These two parameters help us to identify the provenance of quartz. We focused on quartz because quartz is a major component of eolian dust and resistant to chemical and physical weathering. The fine fraction may contain eolian grains transported long distance by wind whereas coarse fraction is dominantly composed of grains transported by river stream although this fraction may also contain local detrital grains transported only short distance by saltation or bottom traction in wind. In our previous study, it is demonstrated that ESR and CI of quartz in fine and coarse fractions are similar in river sediments uncontaminated by eolian dust whereas these values are different between fine and coarse fractions of the river sediments contaminated by eolian dust. It is also demonstrated that changes in ESR and CI of quartz in coarse fraction may reflect changes drainage or exposure of new rock types in the drainage area.

Rapid changes in ESR and CI of quartz in coarse fraction occurred around 8 Ma, 5.8 Ma and 3.2 Ma. Especially, paleocurrent direction also changes from westward to eastward around 8 Ma, suggesting changes in drainage area or exposure of new rock types within the drainage area around 8 Ma possibly associated with uplift of the western Kunlun Mountain. The comparison of ESR and CI between the two fractions revealed that these values are different around 8 Ma and 4.2 Ma,,suggesting eolian contamination within the fine fraction. These results suggest that the intensification of desertification of the Tarim Basin occurred in association with the uplift of the western Kunlun Mountain around 8 Ma and 4.2 Ma.

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