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Reconstruction of the tectonic activity in the southwestern Tarim Basin and its relationship with desertification

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Tectonics and climate linkage is one of the most important problems in Earth Science. Uplift of Tibetan Plateau is one of the most remarkable tectonic activities in the Cenozoic. Although climatic simulation studies suggest the possibility that uplift of Tibetan Plateau triggered the desertification of Tarim basin (e.g. Kitoh, 2005), the linkage between the two has not yet been proved. The major reasons that hamper proving the linkage are the difficulty in constraining the timing of the tectonic activity relative to the timing of desertification, and uncertainty in defining the onset of desertification. In this study, we tried to overcome these problems by extracting the climatic and tectonic information from the same sedimentary record using newly developed method to specify the onset of desertification.

We conducted a field research at the Yecheng section in the southwestern Tarim Basin. Fulvial to alluvial deposits with occasional intercalations of eolian sediments deposited between 7.6Ma to 1.8 Ma are continuously explosed along the Yecheng section (Zheng et al.,2010; Tada et al., 2010). We identified eolian sediment and river sediment in the field, and measured Electron Spin Resonance (ESR) signal intensity and crystallinity index (CI) of quartz in two size fractions of the sediments.

ESR signal intensity of quartz reflects the age of mother rock (Toyoda and Naruse, 2002), whereas CI of quartz reflects physical condition of its formation such as temperature and rate of crystallization (Murata and Norman, 1976). We used these two parameters to identify the provenance of quartz. In her study of river sediments in the Tarim basin, Isozaki (2009MS) suggested that quartz in coarse fraction (>64um) of river sediments reflects bedrock geology of the catchment area based on ESR signal intensity and CI of quartz. So, if tectonic uplift or lateral movement by faults occur in the catchment area, the assemblage of rock exposed in the catchment area should change, and we can detect the onset of tectonic activity by examining ESR signal intensity and CI of quartz in the coarse fraction. On the other hand, fine fraction (<16um) in river sediments may reflect geology of the river catchment area and eolian dust. So we can evaluate contamination of eolian dust by comparing ESR signal intensity and CI of quartz between fine and coarse fractions.

In this study, we applied these methods to the fluvial and alluvial sequence at Yecheng section to examine the relationship between tectonic activity in northwestern Tibet and desertification of the Tarim basin. The result will be presented at the meeting.

Keywords: Tarim Basin, Desertification, Tectonics, Fault, Provenance study, Eolian dust