Exposure dating of the surface in the Atacama desert in Chile usin in-situ Be-10 and Al-26

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Rainfall is considered to change landscapes on the earth surfaces by erosion or sedimentation. In order to reconstruct environmental fluctuation in continental areas, it is important to quantify the rates of erosion. Previously the rates of erosion were quantified indirectly based on deposit accumulation. Neither the rate of longer-term erosion nor that of extremely low erosion is undetected by using above-mentioned indirect methods. Recently in-situ TCN (Terrestrial Cosmogenic Nuclides) dating is used to quantify directly the rates of surface erosion. In-situ TCNs are produced in the rock with the interaction between the target atoms and secondary cosmic rays that reached to the earth surface via the cascading processes. In-situ TCN dating is very suitable for determination to the rate of erosion in the arid condition where there are no complex factors like vegetation.

The Atacama desert is one of the most hyper-arid areas in the world, with less than 1 mm mean annual rainfall. It is considered that the initial onset of hyperaridity was most likely to have developed progressively with the uplift of the Andes as they reached elevations between 1000 to 2000 m a.s.l. (Houston and Hartley, 2003) coupled with the intensification of a cold upwelling Peruvian Current (20-15 Ma: Lamb and Davis, 2003).

In continental areas where the circulation between atmosphere and water is fast, old landforms (more than 1000Myr) are difficult to remain because landforms are quickly eroded by flowing water [Kaizuka, 1998]. However, in extremely arid areas landforms are considered to remain because of little changes of landforms by water.

In this study, in order to quantify the rates of erosion in the arid area, we collected quartz bearing pebbles in the east of the Atacama desert (22degree40minuteS, 69degreeW) .We sampled granite or hornfels from surfaces of top of the hill, hillslope and alluvial fan. Exposure ages were determined from the concentration of in situ-produced cosmogenic Be-10 and Al-26 in purificated quartz by chemical etching.

As a result, the rate of erosion is 1-6 m/Myr in this study area ,and this erosion is considered to be caused by winds, chemical effects and mass movements.