[JJ] Evening Poster | S (Solid Earth Sciences) | S-GL Geology

[S-GL30]Geochronology and Isotope Geology

convener:Takahiro Tagami(Graduate School of Science, Kyoto University), Yuji Sano(Division of Ocean and Earth Systems, Atmosphere and Ocean Research Institute, University of Tokyo)
Wed. May 23, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)
Reliable reconstruction of geohistory is of primary importance to better envision the present and future of the Earth. Geochronology and isotope geology play major roles in the reconstruction. This session offers an opportunity to present the results of fundamental studies, including the developments / improvements of analytical methods and age calibration, as well as applications to the Earth and planetary materials. We particularly focus on: (1) radiometric dating, bio-stratigraphy, magneto-stratigraphy and stable isotopic time series that provide the age information, (2) radioisotopes and stable isotopes widely employed for analyzing the Earth and planetary systems and (3) hypothesis and numerical modeling that utilize / assimilate the age and isotopic data. We also welcome contributions that integrate a variety of relevant disciplines.

[SGL30-P09]Unclosure temperature and geometry

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Keywords:unclosure temperature, geometry, closure temperature, relaxation time

A diffusion process in an object is analytically solved for sphere, cylinder and plane geometry. Diffusion parameters obtained in experiments are used to estimate closure temperature of minerals, assuming that those parameters are the same between cooling process in nature and short heating in laboratories. In the cooling model by Dodson (1973), the closure temperature at the start of an isotope clock are defined as the temperature when the diffusion process is considered to be practically ceased due to cooling. There seems to be some ambiguity left for the timing of the practical termination of diffusion. To deal with this, Dodson adopted a cooling rate , leaving some flexibility. Approximate forms of analytical solutions provide fractional loss as a function of temperature and relaxation time, using Arrhnius relation. Geometry factors are given different numerical factor in the Dodson's model, but they are expressed in different functional forms of fractional loss in approximate solutions.

In age dating, it is the primary interest to obtain the cooling age of the rock body, or to recover the age after secondary event. We call the maximum temperature which allows the recovery of the cooling age as unclosure temperature. When the time is reversed, the practical accumulation of the isotopes start below this temperature. Turner (1968) and others estimated that age could be approximately recovered from the high temperature fractions when fractional loss, f is about 20% for sphere and about 10% for cylinder, assuming an uniform distribution of grain size. We calculated unclosure temperature of minerals. The temperature differs depending on the relaxation time. Approximately 1 Ma of relaxation time allows reasonable agreement between closure temperature and unclosure temperature.