Thermal sensitivities of zircon (U-Th)/He and fission-track systems

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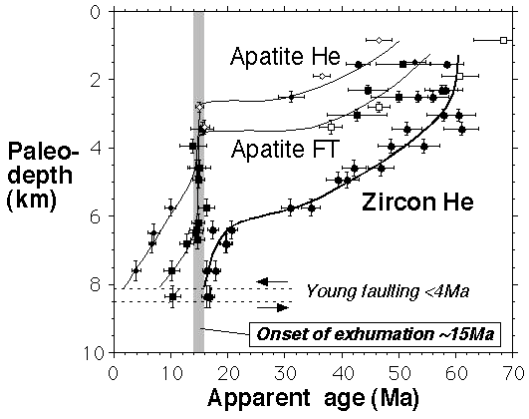
To constrain better the thermal sensitivities of the zircon (U-Th)/He system, here we report new ^{4}He laboratory diffusion data as well as a (U-Th)/He age profile of an exhumed section with reliable paleogeothermal framework. We also compare the thermal sensitivity of the zircon (U-Th)/He with those of other thermochronometers, particularly zircon fission-track (FT) system, by compiling available laboratory and geologic heating data.

^{4}He laboratory diffusion characteristics

Despite its potential for studying crustal tectonics, the thermal sensitivity of (U-Th)/He system is not yet well understood for zircon, compared to other minerals such as apatite and titanite. We will present a series of ongoing laboratory heating data, document ^{4}He laboratory degassing characteristics and propose a diffusion model that works for natural zircons. Our preliminary data suggest the closure temperature of ~180°C (cooling rate; 10°C/my), consistent with the previous estimates.

(U-Th)/He age profile of an exhumed section

The diffusion model shall then be tested using geologic samples with well-constrained heating conditions. The figure below shows an example from a Wassuk section of the Basin and Range province, which yields an zircon age variation against paleodepth that represents an exhumed He partial retention zone in Miocene.



Integrated ocean Drilling Program (IODP) and research opportunities on deep subsurface biosphere

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The successful Ocean Drilling Program (ODP) which started in 1985 will end on Spetember 30, 2003. International groups of scientists plan to commence a new program called IODP (Integrated Ocean Drilling Program) immediately following ODP. This program is expected to utilize multiple drilling platforms including a riser-equipped large drilling vessel Chikyu that is under construction in Japan and conventional non-riser vessel provided by US together with mission specific platform provided by European consortium. Chikyu will be available to international scientific use in late 2006 after about a year and half of testing and training period. The ship will be installed with riser capability of 2500m water-depth operation initially. Unprecedented well control system beyond 4000m water-depth is under planning phase. 12,000m drill strings will provide deep penetration into previously unexplored regions.

Use of Chikyu in IODP will open a new horizon in Earth-Life Science. Deep structure of ocean crust to Moho, seismogenic fault zones, the crusts of island arc and backarc basin and thick sedimentary piles can be reached and studied using this state of art technology. Long-term monitoring experiments using boreholes will bring a new insight into Earth's dynamics. One of new and exciting objectives of IODP is a concentrated effort to study deep sub-seafloor biosphere. Deep drilling technology and advanced laboratory facility of Chikyu may revolutionize the idea of chemical evolution and origin of life. IODP will provide exciting opportunities for deep subsurface biosphere.