Disturbance of U–Pb system and trace elements in hydrothermal altered zircon: An example from AS3 zircon, Duluth Complex, U.S.A.

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U–Pb zircon dating has played a pivotal role in geochronology because of high durability and high closure temperature. Some previous works, however, reported disturbance of U–Pb system during low temperature alteration. Microbeam analysis such as SIMS and LA–ICP–MS allow us to avoid altered domains in zircon which decrease the data quality. Therefore, it is important to establish quantitative criteria to distinguish the altered domains. In this study, we discuss disturbance of U–Pb system and distribution behavior of major and trace elements during hydrothermal alteration of zircon. AS3 zircons collected from gabbroic anorthosites of the Duluth Complex, Minnesota, U.S.A., were used. Previous work reported that some grains in AS3 zircons yield discordant data due to Pb loss caused by thermal diffusion [1].

Some AS3 zircons showed highly discordant U–Pb data. The analytical spots yielding discordant data can be classified into (i) altered domains characterized by high contents of LREE and non-formula elements, such as Ca, Mn, Fe, Al, Mg and K and (ii) domains including undersurface fractures. The latter suggests that fractures in zircon worked as channels of hydrothermal fluid [2] and there are possibilities that areas around the fractures were altered like a clad by the fluid. Therefore, selection of the analytical spots for U–Pb zircon dating should be based on observation of fractures not only on the surface but also under the surface. In addition, the K content in zircon is sensitive criteria to distinguish the altered domains.

[1] Schmitz et al. (2003) *Geochimica et Cosmochimica Acta* **67**, 3665–3672. [2] Nasdala et al. (2010) *Chemical Geology* **269**, 290–300