HYDROTHERMAL ALTERATION OF MARTIAN ZIRCONS IN NWA 7034/7533.

Yang Liu[1], Chi Ma[2], and John Beckett[2]
[1]Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109, USA. Email: yang.liu@jpl.nasa.gov. [2]Division of Geological and Planetary Sciences, California Institute of Technology, Pasadena, CA 91125, USA.

Introduction: The martian regolith breccia NWA 7034/7533 contains abundant zircon grains, which can provide insight into crustal processes through isotopic compositions. For example, *in-situ* U-Pb measurements on these zircons suggest a crystallization age of ~4.4 Ga with resetting at 1.5-1.7 Ga [1-3]. On the basis of intragrain and intergrain oxygen isotope variations, Nemchin et al. [4] proposed that zircons crystallized from melts that had assimilated ^{17}O-enriched regolith, and that the metamict zircons were later altered by low-temperature fluids near the surface at ~1.7 Ga. Here, we describe the textural context of zircons in NWA 7034 and 7533, with an emphasis on those aspects touching on their hydrothermal alteration.

Results and Discussion: Zircon in NWA 7034/7533 is known to occur as isolated grains and in monzonite clasts [1-4]. We observed both of these types of occurrences in our sections but also some additional textural associations. Highly altered zircons were observed in a xenotime-bearing clast dominated by altered pyrite and ilmenite [5]. These zircons are anhedral in shape with crackled textures and appear dark in cathodoluminescence imaging. We also observed a hedenbergite grain with 20 zircons, all of which contain 'spongy' interiors (e.g., Fig. 1). In addition, some of the isolated zircon grains display oscillatory or sector zoning, a few of which contains regions/zones rich in submicron fluid-inclusions.

Zircon is generally resistant to surface weathering, so the fluid-inclusion-bearing zones and spongy interiors indicate interaction with or growth from hydrothermal fluids [6]. The fluid inclusions may contribute significantly to the enriched ^{17}O data of [4] on ~4.4 Ga and 1.7 Ga zircons. Together with evidence of the alteration of rare-earth minerals in these samples [5], our observations provide additional support for hydrothermal environments in Martian crust at ~1.5-1.7 Ga.

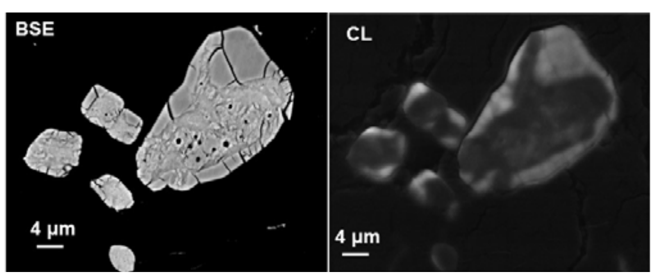

Fig. 1. Back scattered electron (BSE) and cathodoluminescence (CL) images of zircons in a hedenbergite.

References: [1] Humayun, M. et al. (2014) Nature, 503, 515-516. [2] Yin, Q.-Z., et al. (2014) 45th LPSC, #1320. [3] Tartèse, R. et al. (2014) 45th LPSC, #2020. [4] Nemchin, A.A. et al. (2014) Nature Geosci., 7, 638-643. [5] Liu, Y. et al. (2015) this volume. [6] Ayers, J.C. and Watson, E.B. (1991). Phil. Trans. R. Soc. Lond. A. 335, 365-375.