MICROTEXTURAL STUDY OF FELDSPAR IN PETROLOGIC TYPE 4 ORDINARY CHONDRITES: CONTRASTING RECORDS OF PARENT BODY METASOMATISM.

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Introduction: Feldspar observed in petrologic type 4-6 ordinary chondrites (OCs) is usually considered to be the product of recrystallization of chondrule mesostasis to albite through the petrologic type 3 sequence [1]. However, in detail the development of feldspar is considerably more complex. In type 3 and 4 L and LL OCs, feldspar spans a range of plagioclase compositions from An85 to An5 which is likely a combination of primary igneous feldspar [2] and recrystallization of mesostasis of variable composition [3-5]. Plagioclase in type 4-6 Ls and LLs then equilibrates to albitic compositions (~An10) due to metasomatic reactions with Na-bearing fluids during metamorphism [3]. In contrast, feldspar within H chondrites has already equilibrated to albitic compositions (An12) by petrologic type 4 [3]. This implies significant differences in fluid histories between the H vs. the L and LL parent bodies. We have carried out a detailed microtextural study of feldspar in type 4 H, L, and LL OCs in order to understand differences in the composition and/or timing of fluid reactions among the OC parent bodies during metamorphism.

Methods: We studied feldspar in chondrules of three type 4 OCs: Avanhandava (H4), Saratov (L4), and Bjurböle (L/LL4). We carried out BSE imaging and EDS analysis on an FEI Quanta 3D FEG-SEM and WDS analysis on a JEOL 8200 EPMA.

Results: In all three samples we observed abundant smooth albitic feldspar that commonly contains fine-scale (<1 µm) K-feldspar exsolution lamellae and occasional patches of an unidentified, possibly amorphous, high-silica phase. Albite also occurs with chromite in a fine-grained assemblage, in which albite contains numerous small (~1 µm) pores, and rare K-feldspar exsolution. Anorthitic feldspar, up to An85, is present in Saratov and Bjurböle and commonly contains elongate dissolution lamellae and abundant micropores [6]. Much of the anorthite is present in grain cores while the grain edges have been replaced by albite. We observed the same texture in Avanhandava, but only found rare remnant anorthitic cores with compositions up to An27.

Discussion: All three samples show similar textural features, indicating that petrologic type 3 and 4 material of all three parent bodies was infiltrated by Na- and K-bearing fluids of similar composition. The paucity of anorthitic feldspar in the H4 is a significant difference from the L and L/LL chondrites. However, remnant anorthitic cores in Avanhandava show that anorthitic plagioclase was initially present, but has largely been altered to albite. This points to differences in either the amount of available fluids or the duration of fluid interaction among the different OC parent bodies, particularly in the early stages of metamorphism.

References: [1] Van Schmus W.R. and Wood J.A. 1967. *Geochim. Cosmochim. Acta* 31:747–765. [2] Lewis J.A. and Jones R.H. 2015. Abstract #2067. 46th Lunar Planet. Sci. Conf. [3] Kovach H.A. and Jones R.H. 2010. *Meteorit. Planet. Sci.* 45:246–264. [4] Gallegos J. and Jones R.H. 2011. Abstract #5433. 74th Meteoritical Soc. [5] Lewis J.A. and Jones R.H. 2014. Abstract #5176. 77th Meteoritical Soc. [6] Jones R.H. and Brearley A.J. 2010. Abstract #2133. 41st Lunar Planet. Sci. Conf.