MACROSCALE AND MICROSCALE FABRIC ANALYSIS OF ALLENDE.

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Introduction: The Allende CV3 meteorite is arguably the most well studied meteorite. However, even 50 years after its discovery with the advancement of modern analytical techniques we are still learning new information about how our solar system formed from this meteorite. For example, recent electron backscatter diffraction (EBSD) analysis of fine grained rims [1], chondrules [2] and matrix [3] within Allende have revealed textures consistent with impact induced compaction of meteorites from initially highly porous 'candy floss' like bodies [4]. Additionally the contrasting heterogeneous Fe contents of chondrule olivine and homogenous Fe content of matrix olivine are consistent with the action of metasomatic fluids on the Allende parent body [5]. Here we examine a 25 cm slab of Allende (USNM-3529), and new EBSD analyses of matrix and chondrule olivine to investigate macro-scale effects of impact induced compaction and microscale effects of fluid rock reactions during parent body metasomatism.

Methods: The 25 cm slab of Allende was imaged on both sides using a high resolution digital camera. High resolution EBSD maps (120 nm step size) of chondrules and matrix olivine in Allende were obtained using an Hitachi SU70 scanning electron microscope equipped with an Oxford Instruments, Symmetry CMOS EBSD detector.

Macro: Visual investigations of the slab reveal a clear and pervasive shape preferred alignment of the Ca-Al-rich Inclusions (CAIs) (Fig. 1). It is unclear whether this fabric is a foliation of lineation due to the 2D nature of the slice surface. This texture is interpreted as further evidence of compaction of asteroids during low velocity collisions [4] supporting previous EBSD studies [1-3 & 6]. Quantitative fabric analyses will be presented at the meeting.

Micro: EBSD of Allende matrix and chondrule olivine grains reveal that some are twinned (60° rotation about <100>) (Fig. 2). However, olivine typically does not form twins. These twins propagate from neighboring twinned pyroxene crystals consistent with replacement of pyroxene with olivine, supporting previous inferences that pyroxene replacement may be a source of fayalitic olivine during metasomatism [7]. This observation suggests that the original mineralogy of Allende was substantially changed. Through further crystallographic investigations the primary mineralogy of the CV parent body may be revealed.

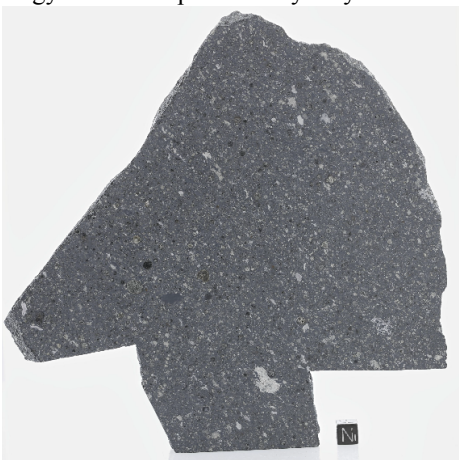

Figure 1: A slab of the Allende meteorite. CAIs (white objects) form a distinct shape preferred orientation aligned from the top left to the bottom right of the image.

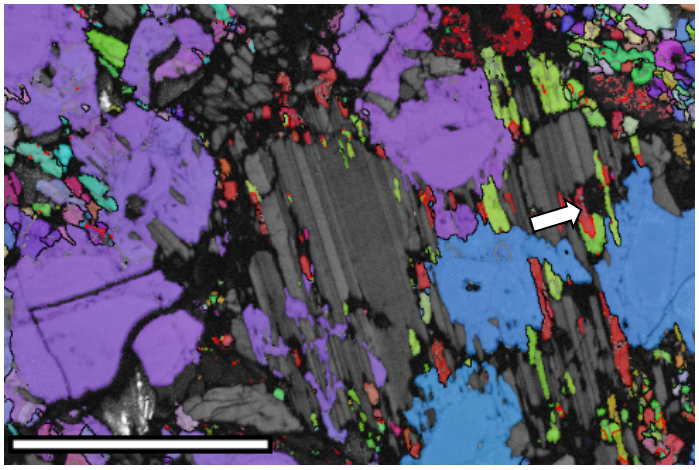

Figure 2: An Inverse pole figure EBSD map of a chondrule in Allende. Olivine is in colour and pyroxene is in greyscale. Twins in pyroxene propagate into the olivine in a replacement texture highlighted by the white arrow. Scale bar 50 µm.

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