TEXTURE ANALYSIS IN ACAPULCO AND LODRAN ACHONDRITES. J. Bascou[1], E. Dobrica[1], C. Maurice[2], B. N. Moine[1] and M.J. Toplis[3]. [1]Equipe Transferts Lithosphériques, UMR-CNRS 6524, Université de St-Etienne, France. [2]UMR-CNRS 5146, Ecole Nat. Sup. des Mines de St-Etienne, France. [3]Observatoire Midi-Pyrénées, UMR-CNRS 5562, Toulouse, France, (email: Jerome.Bascou@univ-st-etienne.fr, Elena.Dobrica@csnsm.in2p3.fr).

Introduction: Improving our knowledge of the formation of the acapulcoite and lodranite primitive achondrites is fundamental for a better understanding of the differentiation processes on small bodies in the early solar system. Acapulco is fine-grained and has chondritic proportions of Fe-sulfide (troïlite) and plagioclase, while Lodran is coarse grained and depleted in troïlite and plagioclase relative to chondritic precursors. Textural analysis based on measurements of the lattice preferred orientation (LPO, or crystallographic fabric) of minerals using electron backscatter diffraction (EBSD technique) is a new and powerful approach, as yet barely used for the study of primitive achondrites [1, 2]. In this study, LPO of silicate phases (olivine, orthopyroxene, plagioclase) and troïlite of both Acapulco and Lodran achondrites have been analyzed and combined with petrological and geochemical investigations [3]. This textural analysis provides new constraints on the evolution and melt extraction or migration processes in Acapulco and Lodran.

EBSD Technique: Crystallographic orientations were measured using a Field-Emission Gun Scanning electron microscope (FEG SEM - JEOL 6500) equipped with an Electron Backscattering Diffraction (EBSD) system at the “Ecole des Mines de Saint – Etienne” (ENSMSE). The indexation of the observed patterns of Kikuchi bands was performed through a comparison with diffraction predicted for the analyzed crystal using the *HKL CHANNEL 5* software [4], Fig.1. Working conditions were: 17 kV for acceleration voltage and 18 mm for working distance. The crystallographic orientation of crystals was measured following a grain-by-grain, operator-controlled indexing procedure to avoid possible oversampling of the largest grains and bias due to pseudo symmetry of olivine.

Results: In Acapulco, the crystallographic fabric strength [5] of silicates and troïlite is not very strong (J-index $\leq$ 3). These minerals display LPO characterized by a maximum of density in a single direction (Zac), Fig.2. The Zac direction is also a preferred direction for iron, for which the [111] axes are concentrated parallel to Zac,

In Lodran, the crystallographic fabric strength of silicates and iron is comparable to those described in Acapulco. Orthopyroxene, troïlite and iron have LPO characterized by a maximum of density in a single direction (close to Xlod), Fig. 2. However, olivine does not show a concentration in crystallographic orientation close to the sample direction Xlod. In contrast, troïlite LPO is characterized by a very high fabric strength number (J-index > 80).

Discussion: The maximum LPO concentration of olivine along the direction Zac in Acapulco suggests homogenous ductile deformation. In this case the Zac direction is interpreted as the direction of compression. Deformation may be due either to a shock or burial that produced melt extraction. The very high fabric strength of troïlite suggests a single crystal signature and therefore that troïlite grains were once connected. To explain this interconnection of troïlite grains, despite the high dihedral angles between troïlite and silicates (~ 130°), different solutions based on experimental results (see [6] for details) may be envisaged: (1) when the parent body reached the temperature of the Fe,Ni-FeS cotectic, the percentage of metal-sulfide alloy melt may have increased and the interconnection threshold exceeded (red arrow, Fig. 3), or (2) there is a significant decrease of the dihedral angle of sulfide liquid relative to the solid state (sulfide dihedral angles of ~70° at the liquid state versus ~130° at the solid state as indicated by experimental data [6]; arrow blue, Fig. 3). The absence of visible interconnection between the grains of troïlite may be result of later reequilibration.

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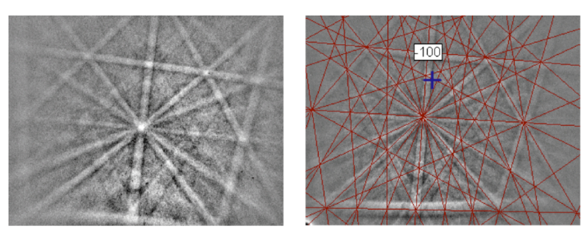

Fig. 1. Measured (left) and indexed (right) EBSD pattern of troïlite.

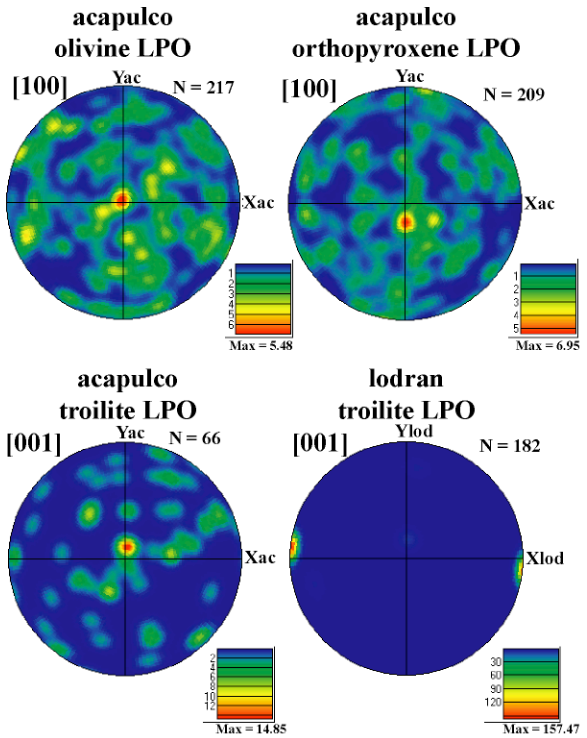

Fig. 2. Lattice-preferred orientations in acapulco and lodran samples. Lower hemisphere and equa- area projection in the sample coordinate system. Density is in Multiples of Uniform Distribution (M.U.D.) and N is the numbers of measurements.

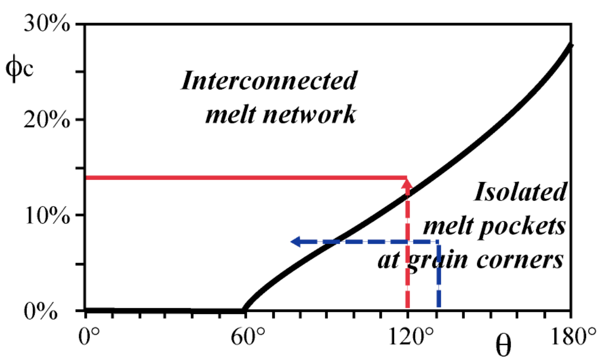

Fig. 3. Interconnection threshold, ϕc (in volume percent), as a function of the dihedral angle, θ, in an idealized partially molten system, modified from [6]. Increasing of metal-sulfide alloy melt in red. Decreasing of dihedral angles with the solide - liquide transition in blue.