FRONTIER MOUNTAIN 93001: AN IGNEOUS-TEXTURED MEMBER OF THE ACAPULCO-LODRAN CLAN. A. Burroni* and L. Folco, Museo Nazionale dell’Antartide, via Laterina 8, I-53100 Siena. (*correspondence: burroni2@unisi.it).

Introduction: Frontier Mountain (FRO) 93001 is a ~16 x 13 x 12 mm, ~20% fusion-crusted stony fragment of 4.86 g, initially classified as a Lodranite [1]. During a survey of the acapulcoites and lodranites present in the collection of the Museo Nazionale dell’Antartide in Siena, we observed that FRO 93001 is unlike any other known lodranite, but that it resembles the igneous regions described in the LEW 86220 acapulcoite [2]. Given the importance that such lithologies may have for understanding the igneous processes on the Acapulco-Lodran parent body [2-5], we report on our petrographic and electron microprobe study of FRO 93001.

Petrography and mineral chemistry: We have analyzed two polished thin sections with maximum dimensions of ~13 x 11 mm, from the largest side of the FRO 93001 specimen. FRO 93001 has a medium- to coarse-grained granular texture. It mainly consists of orthopyroxene, augite and plagioclase poikilitic crystals up to 1 cm across, enclosing numerous grains of olivine, metal and troilite, often associated with accessory chromite, phosphate and schreibersite. Orthopyroxene and augite are typically equant anhedral; they are exsolved on [100], with nearly homogeneous bulk composition Fs_{13.1} Wo_{2.3} and Fs_{5.8} Wo_{43.6}, respectively, which yield equilibrium crystallization temperatures of 1100±15 °C. Plagioclase is characteristically interstitial, with variable composition An_{16.3±3.7} Or_{3.2±0.9}. Olivine grains have an average grain size of 600 µm, are often isolated with rounded-shapes although, in places, they may form clusters of several individuals characterized by 120° triple junctions. Olivine composition is Fa_{9.8±0.7}, with a chondritic [Mn/Mg] = 0.006. Metal and troilite form irregular crystals with embayed contours or rounded clots up to several hundred micrometers across. Mineral mode (vol.%) is orthopyroxene 52, olivine 14, metal 11, plagioclase 9, augite 6, troilite 7, others 1.

Shock stage. FRO 93001 shows petrographic features diagnostic of unshocked meteorites, i.e. shock stage S1 after [6], such as sharp optical extinction in olivine and other silicates.

Weathering grade. Oxide haloes affect very few metal grains, indicating minor weathering, i.e. grade W1 according to [7].

Discussion and conclusions: Mineralogical data confirms that FRO 93001 is a sample of the Acapulco-Lodran parent body. Contrary to known acapulcoites and lodranites, however, FRO 93001 resulted from the crystallization of coalescent gabbroic and Fe,Ni-FeS melts. Olivine with relics of granoblastic textures are interpreted as unmelted residues of the source rock; based on the olivine grain-size, the source must have been a lodranite-like material. The presence of abundant relics of the source rock, together with equilibrium temperature similar to lodranites, suggest an in situ (or nearly so) origin for the FRO 93001 melts. The lack of fractionation between the gabbroic and the Fe,Ni-FeS melts, in spite of their different liquidus temperatures (i.e., >1100°C and ~980°C, respectively) and density contrast (~3.5 vs. 5 g cm⁻³), is difficult to reconcile with a magmatic origin as proposed for the similar lithology in LEW 86220 [2], but rather suggests a relatively rapid, localized melting process, likely associated with cosmic impacts.