A METALLOGRAPHIC AND EBSD STUDY OF THE MARIA DA FÉ IRON. M. E. Zucolotto[1] and A.L. Pinto[2], [1] Museu Nacional/UFRJ (Quinta da Boa Vista – Rio de Janeiro – Brazil – 20940-040 – zucoloto@ism.com.br), [2] IME - Instituto Militar de Engenharia (pinto@ime.eb.br)

This Iron meteorite was found around 1987, at the city of Maria da Fé (20º .30 S.; 45º.37 W.) at vicinities of Itajubá, Minas Gerais State, Brazil. Many masses were found during the cleaning of the Eucalyptus forest for potato cultivation when the plough's blades began to break. Unfortunately only one mass was preserved which was given to the owner's son Diógenes B. Ninis, who keep it as a curiosity until 1999, when he informed the LNA (Laboratório Nacional de Astrofísica) and a sample was sent to Museu Nacional for identification.

The mass measures (26x14x12cm.) and weighs 18 kg. It is weathered and covered with 0.5 – 1 mm thick crust of terrestrial oxides no fusion crust is preserved.

Polished and etched (2% nital) sections showed that the heat affected α_2 zones have been removed by corrosion and weathering products penetrate into the interior. All sections displayed fine and homogeneous widmanstätten structure, which presented kamacite lamellae with 0.35±0.05 mm width of straight long (L/W ~20). The kamacite bands exhibited profuse Neumann lines, varying in quantity from grain to grain. They are commonly crossing three or more kamacite lamellae at the same direction, sometimes also crossing plessite fields. The kamacite was shock-hardened to a micro hardness of HV 240 ± 15 and displayed some mate hatched ε structure suggesting shock intensity above 130 kbar.

Taenite and plessite covered about 30% of the observed area, mostly as net black and duplex plessite, some poorly resolvable. Cellular and degenerated plessite were also common. Those were composed of a rim of clear taenite followed respectively by indistinct martensite, tempered martensite and duplex structure. Electron microprobe profiles indicated nickel amounts correspondingly varying from 35%Ni on border to 15% at interior.

No cohenite, schreibersite, nor rhabdite were detected in kamacite. Sulfides were very rare and appeared as small daubreelite monocrystalline particles.

Neutron activation analysis was performed by Wasson [1] and giving: 7.43 % Ni, 0.38% Co, 1.73 ppm Ga, 3.78 ppm Ir and 0.611 ppm Au. These values were in agreement with group IVA.

Besides the traditional nital 2% color etching [2,3] was tried with an aqueous solution of 10% sodium thiosulfate ($Na_2S_2O_3$) and 3% potassium metalbisulfide ($K_2S_2O_5$). Kamacite was colored as blue, yellow and brown, exhibiting profusion Neumann bands crossing two or more kamacite lamellae of the same color. As suspected the kamacite plates with the same orientation showed which was proofed by EBSD (Electron Back-scattering Diffraction) techniques as described before [4]. Although it possible to correlate colors with the orientations through EBSD the color etching technique is not easily reproduced, since small differences at the etching time give different color shades.

The OIM (Orientation Image Mapping) maps along kamacite bands showed moderate to hard distortions at kamacite lamellae with one color/orientation in contrast with the neighboring lamellae of different color/orientation, which presents only Neumann bands. The presence of Neumann bands at some lamellae and shock hatched ε structure at others in the same meteorite should be indicative of a preferential shock propagation at some orientations.

References: [1] Wasson, J. T. (*personal communication*), [2]. (2001) *Advanced Materials & Process*, 37-41, [3] Vander Voort, G. F. (1984) Metallography Principles and Practice, Hill Books, 752 pp, [4] Pinto, A. L. and Zucolotto, M. E. *Acta Microscopica* (in press).