ELECTRON BACKSCATTERED DIFFRACTION STUDIES OF THE BARBACENA METEORITE.
M. E. Zucolotto[1] and A. L. Pinto[2], [1]Museu Nacional, Quinta da Boa Vista, 20940-040, Rio de Janeiro, Brazil (zucoloto@acd.ufrj.br), [2]Instituto Militar de Engenharia, Praça General Tibúrcio 80, Praia Vermelha, CEP 22290-270, Rio de Janeiro, Brazil.

The relatively new technique of electron backscattered diffraction (EBSD), the essential features of which are its unique capabilities of diffraction and imaging in real time with spatial resolution of 0.1 µm, may be combined with the regular capabilities of scanning electron microscopy (SEM), such as chemical analysis and simple specimen preparation [1]. In addition, it makes it possible to perform orientation imaging microscopy (OIM) [1], providing the means for obtaining overall crystallographic orientation distribution and misorientation distribution from a set of individual crystal orientation measurements of bulk samples.

The SEM/EBSD analysis provides the ability to rapidly collect data while maintaining the relationship between crystallography and microstructure, thus showing the microtexture. Although there is potential for this technique as a tool in assisting phase identification through crystallography when minerals have similar chemistry, these facilities have not yet been explored to the same extent as orientation measurements.

In the present work, we have investigated the Barbacena iron meteorite, which exhibits a Widmanstätten structure and displays an irregular network of kamacite bands, including spindles varying from 100 µm to 400 µm wide and centimeters long and numerous plessite fields with features of both groups IVA and IIC. The chemical analysis performed by instrumental neutron activation analysis (INAA) (Fe, 10.5% Ni, 0.5% Co, 12.6 ppm Ga, 2.98 ppm Ir, and 1.9 ppm Au) allowed Wasson to classify this meteorite as ungrouped [2].

The kamacite is limpid and shows fainted Neumann bands and very soft HV = 155 ± 10, corresponding to a well-annealed material. The taenite appears as a discontinuous rim separating kamacite lamellae. Plessite fields exhibit a clear and rather homogeneous taenite rim without cloud edges but followed by a transitional zone of small, elongated kamacite precipitates and further inward polycrystalline α matrix with well-defined γ particles.

Phosphide segregates were frequently observed at the center of kamacite lamellae. Many of these phosphides are enveloped in a discontinuous rim of 1–4-µm-wide γ particles. It appears that this last one was formed during annealing, when Ni-rich schreibersite seems to have decreased its Ni content according to the equilibrium phase diagram [3].

Although this meteorite clearly shows signs of cosmic annealing, the recrystallization did not take place, as we could verify by OIM. Figure 1a shows a Kikuchi pattern obtained from the kamacite phase, which is properly indexed in Fig. 1b. The SEM micrography at Fig. 1c shows a field of fainted Neumann bands crossing a kamacite lamellae between two typical plessite fields. The orientation maps, Fig. 1d, show a detailed pattern of the perfectly oriented kamacite lamellae with smoothed Neumann bands. The lattice remains distorted inside these bands. The evidence indicates mild shocks smaller than 130 kbar and posterior mild and long-time annealing, which permitted changes of the taenite and phosphides by diffusion but only the recovery of the kamacite.

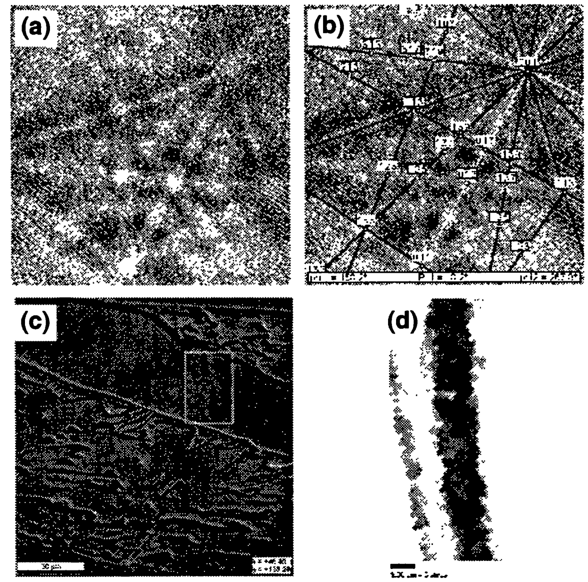

Fig. 1.

It is also interesting to notice that the difference in orientation between the kamacite lamellae and the Neumann bands was ~20°, indicating that perhaps they are not really twins but in fact slip bands.

References: [1] Randle V. (1992) *Microtexture Determination and Its Applications,* Inst. Materials, London. [2] Kracher et al. (1980) *GCA, 44,* 773–787. [3] Buchwald F. V. (1966) *Acta Polytechnica Scandinava, 51.*