

THREE NEW BRAZILIAN IRON METEORITES: NOVA OLINDA, CONCEICAO DO TOCANTINS AND AUGUSTO PESTANA .

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Introduction: Three new Brazilian iron meteorites, named Nova Olinda, Conceicao do Tocantins and Augusto Pestana, were analyzed using a suite of metallographic, geochemical and mineralogical methods: optical microscopy (OM), electron probe microanalyzer (EPMA), laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) and inductively coupled plasma mass spectrometry (ICP-MS) after the test portion acid dissolution.

Historical background: The Nova Olinda meteorite was found by brothers Edson Oliveira da Silva and João Jarba Oliveira da Silva in November 2014, while prospecting for gold with a metal detector in a dry lake region of a farm in the rural area of Nova Olinda, Paraíba state. The meteorite measures 29cm×15cm×17 cm and weighs 26 kg. The Conceicao do Tocantins meteorite was found by a gold miner on a farm in the rural area of Conceição do Tocantins, state of Tocantins, when looking for gold with a metal detector in October 2020. Only a single weathered small mass weighing 449 g, measuring ~79mm×52mm×32 mm, was found. The Augusto Pestana meteorite was found by a farmer while cleaning a recently acquired property in October, 17th, 1977. The meteorite measures 33cm×22cm×16 cm and weighs 28kg.

Characteristics: Nova Olinda etched slices show thick lamellae of kamacite typical of coarsest octahedrites. The average kamacite bandwidth is 5.93±2.4 mm (n=5). Neumann bands are abundant and were observed in some kamacite lamellae. Sparse plessite fields develop as comb plessite sometimes associated with wedge-shaped black taenite fields. Wide ribbons and crystals of schreibersite are abundant. A polished and etched slice of the Nova Conceicao meteorite was analyzed and showed a structureless surface, typical of hexahedrites, with numerous plate-shaped and prismatic rhabdite crystals, many of them surrounded by oxide. Schreibersite is also found around troilite nodules. Kamacite shows shock twinning features known as Neumann lines. A troilite nodule inclusion (5 × 2 mm) was observed. A heat zone region was observed on one side of the slice. A polished and etched slice of the Augusto Pestana meteorite measuring 50mm x 30mm was analyzed. The slice shows a typical coarse octahedrite Widmanstätten pattern showing swollen kamacite lamellae with bandwidth of 1.82±0.34 mm (n=43). The kamacite lamellae are bordered by taenite and plessite fields that covers 40% of the slice area. Plessite fields are found in many forms as comb, acicular, martensitic and spheroidal. Schreibersite is found as rhabdite needles and irregular forms. Troilite was not observed in the studied slice.

Results: *Nova Olinda.* LA-ICP-MS at UNICAMP [1]: Ni = 62.2±1.0 (1s), Co = 5.33±0.11 (both mg/g); Cr = 16.8±2.3, Ir = 0.02±0.01, Ga = 51.9±1.1, Ge = 95±3, As = 13.7±0.9, Pt = 1.02±0.15, Cu = 120±2, Au = 1.13±0.07, W = 0.5±0.2, Pd = 2.27±0.19, Ag = 0.2±0.2, (all µg/g, n=10, except Ag n=3). ICP-MS at UAb: Ir = 0.01, Ga = 43, Ge = 105, As = 13, Pt = 1.4, Cu = 94, Pd = 1.4, (all µg/g). EPMA at the UFOP: kamacite: 0.55% Co. Schreibersite (Fe = 67.74±0.28 mg/g, Ni = 15.79±0.02 mg/g, P = 13.58±0.05 mg/g, n=7).

Conceicao do Tocantins. LA-ICP-MS at University of Campinas[1]: Ni = 54.6±2.3 (1s), Co = 4.40±0.09 (both mg/g); Cr = 37±6, Ir = 7.5±1.0, Ga = 62±2, Ge = 147±7, As = 2.5±0.3, Pt = 25.4±2.1, Cu = 156±4, Au = 0.50±0.02, W = 3.0±0.5, Pd = 1.6±0.1, Ag = 0.10±0.03, Os = 2.4±0.4 (all µg/g, n=15). ICP-MS at UAb: Ni = 53.8, Co = 4.5 (both mg/g); Ir = 6.1, Ga = 57, Ge = 148, As = 5.3, Pt = 27, Cu = 137, W = 2.6, Pd = 0.55 (all µg/g). EPMA at UFOP: kamacite Ni = 56.5, Co = 4.6 (both mg/g).

Augusto Pestana: LA-ICP-MS at UNICAMP [1]: Co = 5.24±0.31 (mg/g); Cr = 18.6±2.5, Ir = 0.11±0.07, Ga = 21.5±4.0, Ge = 30.5±4.3, As = 24.5±7.8, Pt = 0.87±0.18, Cu = 183.1±79.4, Au = 2.07±0.30, W = 0.24±0.16, Pd = 5.01±1.65, Ag = 0.16±0.11, (all µg/g, n=16). ICP-MS at UAb: Ni = 70, Co = 5.8 (both mg/g); Ir = 0.23, Ga=17, Ge = 41, As = 30, Pt = 1.6, Cu = 168, Sb = 0.21, Pd=3.8 (all µg/g). EPMA at UFOP: kamacite Ni=66.0, Co=5.8 (both mg/g).

Discussion and conclusions: The applied investigation methods [1] allowed us to classify Nova Olinda as a coarsest octahedrite (Ogg) of chemical group IIAB, Conceicao do Tocantins as an hexadrite IIAB, and Augusto Pestana as a coarse octahedrite of chemical group IIIE, following [2, 3]. The Conceicao do Tocantins is similar in composition to the Arraias meteorite, found in a nearby location (~100 km), but our data show them to be different meteorites. LA-ICP-MS measurements at the University of Campinas for the Arraias meteorite gave Ir=47±7 and Os=44±8 (all µg/g).

References:

- [1] Navarro et al. 2022. Chemical characterization of iron meteorites by LA-ICP-MS. *Geoanalysis 2022* (abstract).
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