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Evidence of manganese mineralization in the municipality of Comodoro – State of Mato Grosso, Brazil: new opportunities for the mineral industry

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Reference: CPRM – Geological Survey of Brazil *website:* www.cprm.gov.br / Geologia em Evidência/RECURSOS MINERAIS/Informe Técnico – CPRM/Edição Atual: Informe 10 (05/2017): Indício de mineralização de manganês no município de Comodoro – Mato Grosso, novas oportunidades para a indústria mineral.

Abstract

Evidence of massive manganese was found in the northwest of the State of Mato Grosso, in the municipality of Comodoro. The area is located in the southwest portion of the Amazonian Craton, in the Calimian Jauru Tectonic Domain, which comprises metasedimentary rocks of the Rio Galera Complex and calc-alkaline granites of the Pindaituba Intrusive Suite (Praia Alta and Rio Piolho granites). Chemical analysis of the manganese-bearing sample yielded the following oxide and element concentrations: MnO = 61.4%, BaO = 13.2%, Cu = 751 ppm, Mo = 417 ppm, Pb = 4,642 ppm, U = 107.8 ppm and Ce = 1,608 ppm. Petrographic analysis allowed the identification of pyrolusite as the manganese mineral totaling 95% of the analyzed sample and 5% of gangue minerals.

Keywords: Manganese, Hydrothermal, Jauru Domain.

INTRODUCTION

We describe a new evidence of high-grade manganese, discovered during the field work of the Novas Fronteiras - Sudeste de Rondônia Project. The evidence (Latitude -13°51’22’’; Longitude -60°00’33’’, Datum SIRGAS 2000) is located in the São Mateus farm, approximately 30 km west of the municipality of Comodoro, in the State of Mato Grosso, Brazil (Figure 1).

The high concentration of Mn, in addition to Cu, Pb, Mo, W, Ba and Ce, motivated the preparation of this report, because manganese is a strategic metal, whether for use in the iron and steel industry or as fertilizer.

We emphasize that the result is preliminary, based on an outcrop, and aims disseminate new mineral clues to the Brazilian mineral sector.

GEOLOGICAL SETTING

The area of the Mn evidence is located in the southwestern portion of the Amazonian Craton, in the Calymmian Jauru Tectonic Domain (Figure 2), which is represented by the Rio Galera Complex and the Pindaituba Intrusive Suite (Ruiz, 2005).

The Rio Galera Complex is composed predominantly of sillimanite schists, sillimanite garnet schists, quartzites and calc-silicate rocks, with subordinate amphibolites and exhalative chemical metasediments (magnetite chert).

The Pindaituba Intrusive Suite is composed of the Praia Alta and Rio Piolho granites, which show negative and positive ƐNd(t) values, respectively. Both are calc-alkaline, peraluminous and medium-to high-K granites, having general characteristics suggestive of generation in a magmatic arc setting (Ruiz, 2005).

The manganese evidence is associated to the outcrop area of an undeformed porphyritic rhyolite, with phenocrysts of quartz and potassic feldspar, discovered during the field works of this project (São Mateus Rhyolite, Figure 2). Its relation with the granites of the Pindaituba Suite is still unclear.

DESCRIPTION OF THE EVIDENCE

The manganese evidence crops out as a boulder (Figure 3A) and has been described in a single outcrop. In that, it is not possible to specify the actual area of distribution of the mineralized zone. The outcrop is located at the slope of a hill oriented in the east-west direction (Figure 1), and consists of an undeformed pinkish, porphyritic rhyolite, with quartz and potassic feldspar phenocrysts.

In hand sample (Figure 3B), the Mn-bearing rock presents massive texture, is inequigranular, with dark/black color, and does not present deformation. To the naked eye, we observed fibrous, sometimes radial fibrous crystals, having macroscopic characteristics of pyrolusite (MnO_2).

Under reflected light microscopy (Figures 3C and 3D), it is possible to observe aggregates of fibrous, prismatic, sometimes tabular mineral, gray in color, with cleavage, medium reflectance, and medium to strong anisotropy, possibly pyrolusite, composing up to 95% of the sample, in addition to gangue minerals, which have not been identified so far.

CHEMICAL DATA

Chemical analysis of major, minor and trace elements, including rare earth elements (REE), was done at SGS GEOSOL laboratory. The major and minor elements were analyzed using the XRF79C package (fusion with lithium metaborate, and analysis by X-ray fluorescence). REE and trace elements were analyzed using the IMS95A (fusion with lithium metaborate) and ICM40B (multiacid digestion and determination by ICP-MS) packages. The result is presented on Table 1, where high contents of MnO

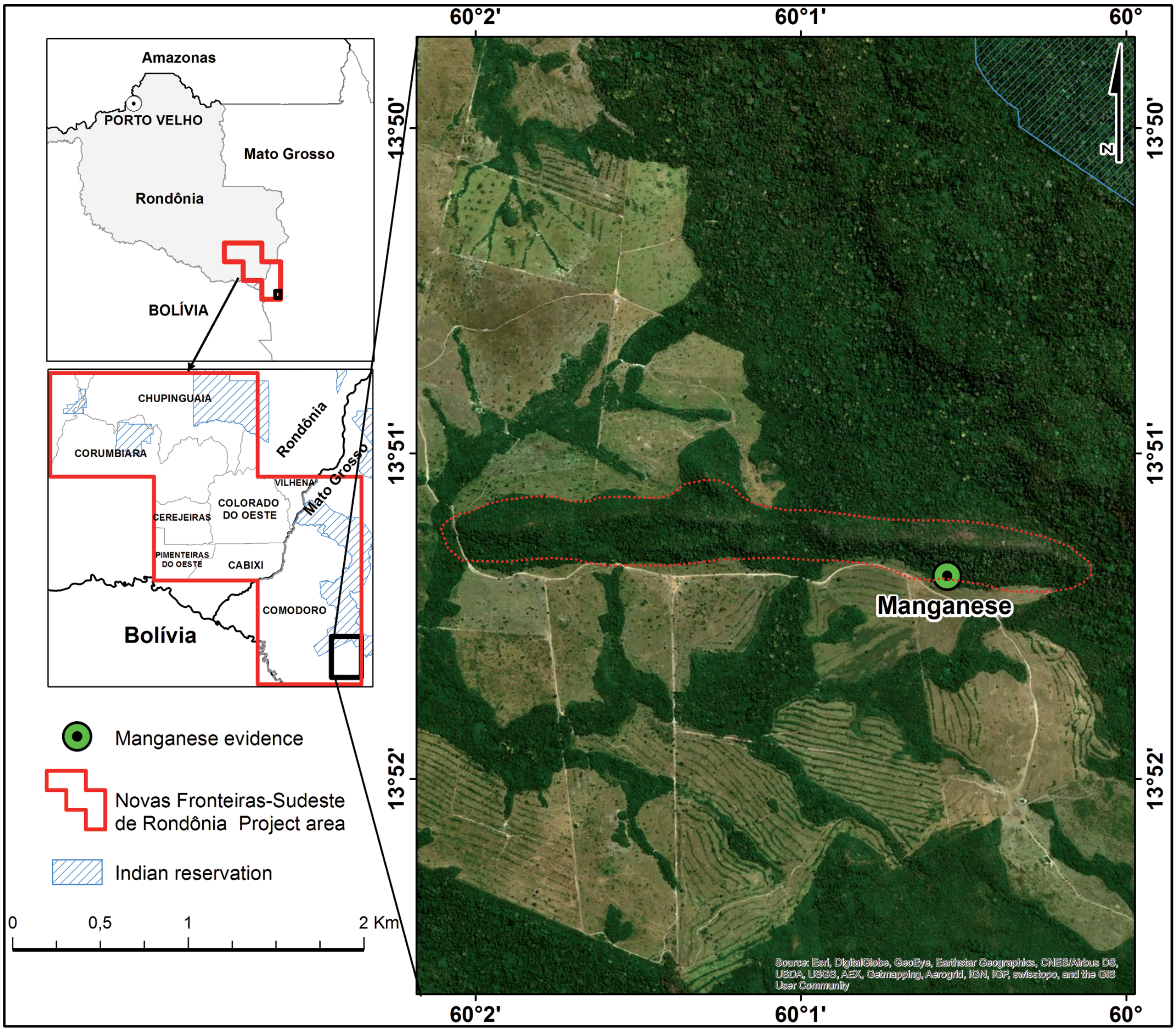

Figure 1: *Location map of the manganese area. Detail for the elongated ridge in the East-West direction delimited by the polygon dashed in red, where boulders of rhyolite crop out as boulders along whit the evidence of massive manganese. The background image is from the Google Earth Pro software.*

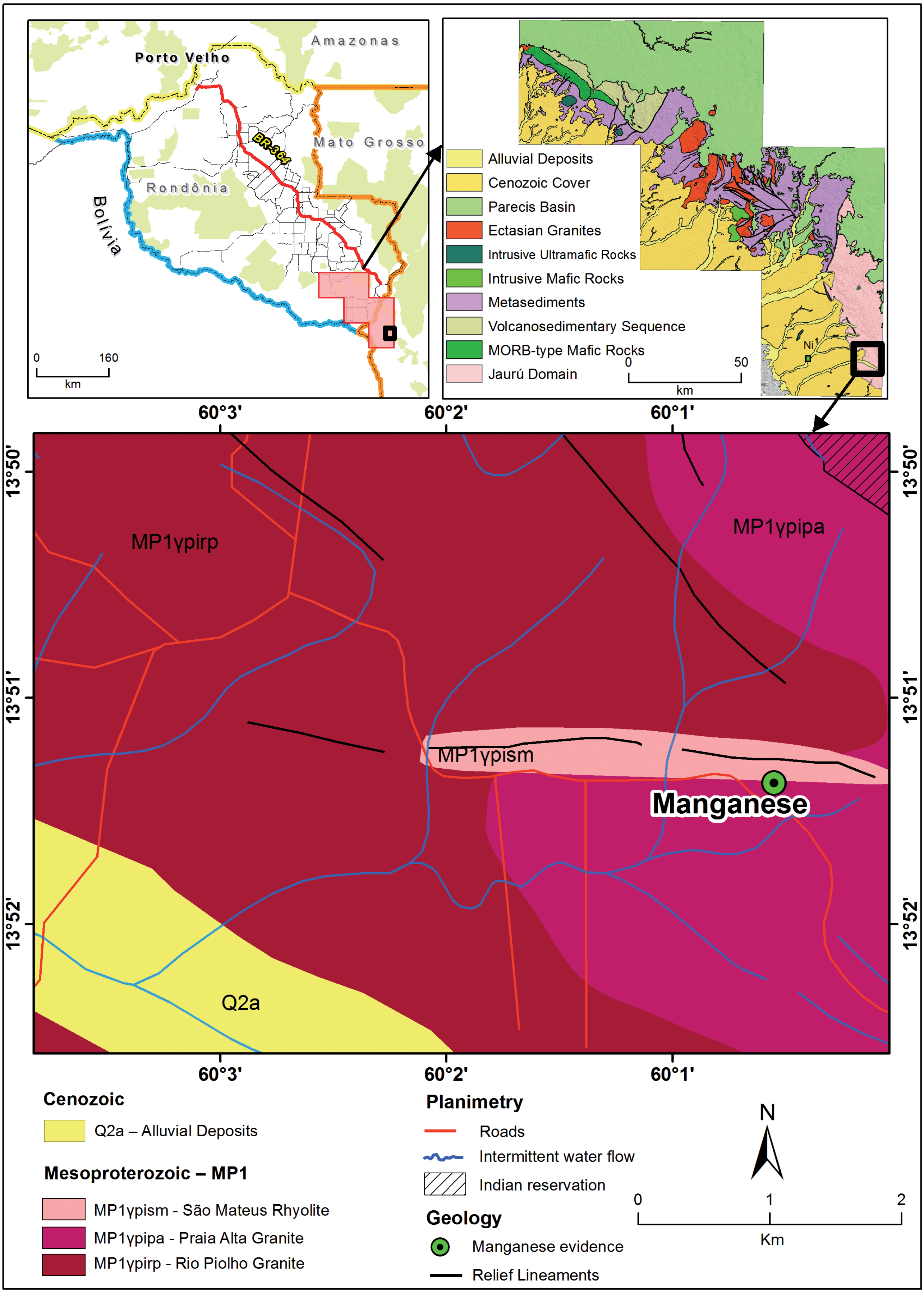

Figure 2: *Simplified geological map (adapted from Silva et al., 2016), showing the location of the manganese-bearing outcrop.*

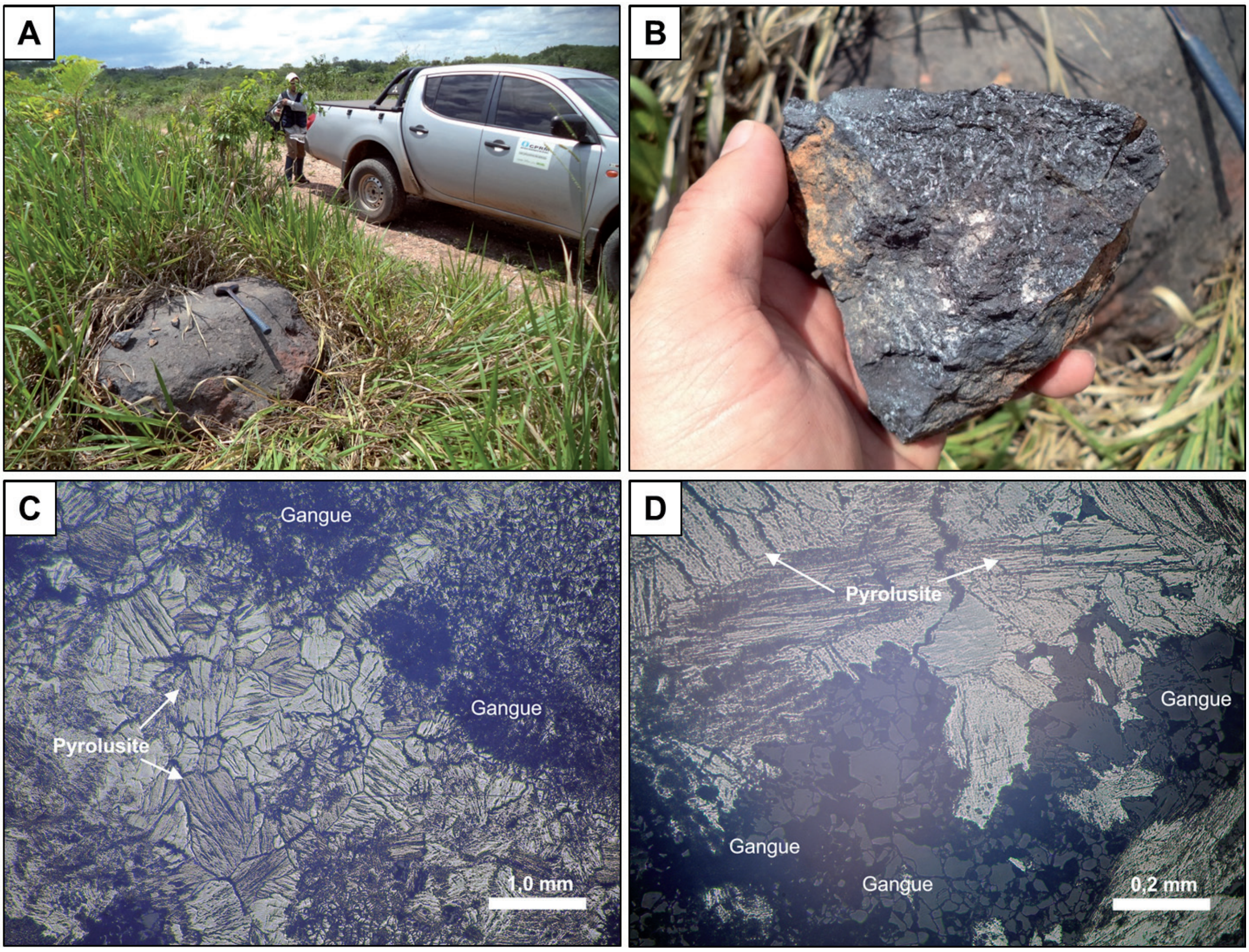

Figure 3: *Textural aspects of the manganese evidence: A) massive manganese boulder cropping out as possible rolled block; B) hand sample showing the fibrous habit of the manganese mineral (pyrolusite); (C) and (D) petrographic aspect (reflected light) of the manganese sample, with aggregates of pyrolusite crystals with fibrous, prismatic appearance.*

(61.4%) and BaO (13.2%), besides Cu (751 ppm), Mo (417 ppm), Pb (4,642 ppm), U (107.8 ppm) and Ce (1,608 ppm) can be observed. In addition, the low P_2O_5 content shows that this contaminant is restricted in the sample.

FINAL REMARKS

Manganese has essential use in the industrial production, with main use associated with the production of special steels. Also important is the use of manganese as fertilizer, animal food and in the manufacture of batteries (Garcia, 1999).

The information presented here is still preliminary, and studies involving scanning electronic microscopy (SEM) and X-ray diffraction are ongoing.

The preliminary result obtained here seems to indicate possible advantages for use in the steel and fertilizer industries due to the high Mn/Fe ratio and the low phosphorus content.

The data obtained so far are insufficient to determine the typology and extension of the mineralization. Geneyic possibilities are: supergene (tropical weathering), sedimentary or hydrothermal. There are no sedimentary rocks near the described outcrop (Figure 2), nor was possible to identify associated weathering profiles. Roy (1997) described hydrothermal manganese deposits in the form of veins that are commonly associated to volcanic rocks of varied composition, fact observed here, where the manganese crops out near a rhyolite.

A hydrothermal manganese deposit was recently discovered in Espigão do Oeste, in the State of Rondônia, where 50,000 tons of manganese ore were produced in the last two years (MCARTHUR 2016).

Table 1: *Analytical result of sample CE-R-89A.*

(to be continued)

Method	Element	Concentration
XRF79C	SiO_2 (%)	1.18
	Al_2O_3(%)	0.77
	MgO (%)	0.24
	CaO (%)	0,04
	K_2O (%)	0.14
	MnO (%)	61.4
	P_2O_5 (%)	0.034
	BaO (%)	13.20
	Fe_2O_3 (%)	2.77

Table 1: *Analytical result of sample CE-R-89A.*

(conclusion)

Method	Element	Concentration
IMS95A	W (ppm)	97.70
	U (ppm)	107.80
	Ce (ppm)	1,608
ICM40B	Cu (ppm)	751.60
	Mo (ppm)	417.37
	Pb (ppm)	4,642
	S (ppm)	< 0.01

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