SOS RARE:MULTIDISCIPLINARY RESEARCH TOWARDS A SECURE AND ENVIRONMENTALLY SUSTAINABLE SUPPLY OF CRITICAL RARE EARTH ELEMENTS (Nd AND HREE)

PRINCIPAL INVESTIGATORS

DANIEL ATENCIO
Geosciences Institute / University of São Paulo (USP)
FRANCES WALL
The University of Exeter

ABOUT THE PROJECT

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CONTACT

✉ datencio@usp.br

The rare earth elements (REE) are vital raw materials for a wide range of modern technology. Almost all of the world's production of the REE comes from a group of mines in China. Since 2010, they are considered as critical metals, and has driven substantial exploration and research. The highest REE concentrations are typically found in association with alkaline igneous rocks and carbonatites, or in magmatic-hydrothermal deposits. Deposits of the REE are characterised by varied mineralogy, with over 50 minerals being considered as potential REE ore minerals. This complex mineralogy has significant implications for the mining and processing of REE ores, and represents one of the key challenges that must be overcome to enable new REE mines to succeed. In Brazil, there are several incompletely studied rocks containing earth-rare elements, such as the alkaline rocks of Poços de Caldas in Minas Gerais, and the Jacupiranga carbonatite in Cajati, São Paulo, where some new minerals have been described and others are in study. Mineralogical studies (chemical and crystallographic) of these and other minerals of Brazilian occurrence are being carried out.

Parisite-(La) from Novo Horizonte, Bahia, Brazil (Menezes Filho et al. 2018)

SUMMARY OF RESULTS

During the development of this project two new rare earth minerals were described, waimirite-(Y) and parisite-(La). Also the gadolinite supergroup of minerals was established and a nomenclature system for them was developed. The most interesting feature of the new mineral waimirite-(Y), YF_3, from both the crystal chemical and potential application aspects, is the distribution of REEs. Ideal waimirite-(Y) contains 60.93 wt% of yttrium, whereas Y content in ideal xenotime-(Y) is 48.35 wt%. Waimirite-(Y) could be therefore a spectacular ore mineral. Parisite-(La), ideally $CaLa_2(CO_3)_3F_2$, is the second new mineral studied and is the La-dominant analogue of parisite-(Ce). Gadolinite is a very important ore for three metals of beryllium, thorium, and yttrium (this metal is used to provide red color in color TV sets). Also, thorium is often occurs as an impurity within the body of the mineral (thorium is a radioactive metal that may be converted to fissionable uranium-233).

MAIN PUBLICATIONS

Atencio D, Bastos Neto AC, Pereira VP, Ferron JTMM, Hoshino M, Moriyama T, Watanabe Y, Miyawaki R, Coutinho JMV, Andrade MB, Domanik K, Chukanov NV, Momma K, Hirano H, Tsunematsu M. 2015. Waimirite-(Y), orthorhombic YF_3, a new mineral from the Pitinga mine, Presidente Figueiredo, Amazonas, Brazil, and from Jabal Tawlah, Saudi Arabia: Description and crystal structure. *Mineralogical Magazine*. **79**: 767-780.

Bačík, P, Miyawaki, R, Atencio, D, Cámara, F, Fridrichová, J. 2017. Nomenclature of the gadolinite supergroup. *European Journal of Mineralogy*. **29**: 1067-1082.

Menezes Filho, LAD, Chaves, MLSC, Chukanov, NV, Atencio, D, Scholz, R, Pekov, I, Costa, GM, Morrison, SM, Andrade, MB, Freitas, E, Downs, RT, Belokovskiy, DI. 2018. Parisite-(La). Parisite-(La), ideally $CaLa_2(CO_3)_3F_2$, a new mineral from Novo Horizonte, Bahia, Brazil. *Mineralogical Magazine*. **82**: 133-144.