# Metales Críticos: a tool for processing geochemical and chemical mineralogical data and obtaining geothermobarometric constraints in granites and rare-metal granites

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## INTRODUCTION

METALESCRITICOS is presented, a database that allows the processing of geochemical and mineralogical data normally used by petrologists and mineralogists in their daily work, especially those working on granites and rare metal granites. Its ease of use and the range of functions and calculations it performs, some of which are tedious and error-prone, make it an indispensable tool.

## FUNCTIONS PERFORMED

### Chemical-mineralogical data processing

The tool can determine the formula of any mineral by simply selecting the number of oxygens or cations to normalize. It also calculates the extreme terms of minerals, such as the orthoclase, albite, and anorthite components in feldspars, the hafnium component in zircon, and the Ta* and Mn* ratios in Nb-Ta oxides. It also calculates the $Li_2O$ content from the F content (see Tinchendorf et al., 1997) and the $Fe^{2+}$ and $Fe^{3+}$ content in garnets from the charge balance. The application displays the results numerically and graphically. Some of the most commonly used diagrams for the classification of micas and Nb-Ta oxides are plotted.

### Geochemical data processing

The processing of whole-rock geochemical data is essential for rock classification and to address the petrogenesis of mineralized or barren granitic rocks. The tool estimates a large number of commonly used geochemical parameters such as the solidification index, Larsen index, A/CNK index, A/NK index, MALI index, Fe*, and Debon and Le Fort A and B parameters (Fig. 1). It also normalizes the REE to the chondrite, performs the sum of REE, the Eu anomaly (Eu/Eu*), and calculates the tetrad effect Te1-3 of REE. In addition, treatment of the radioactive isotopes is carried out, determining the parameters of $(^{87}Sr/^{86}Sr)_t$, $(^{143}Nd/^{144}Nd)_t$, the $\varepsilon Nd_t$ and calculating the depleted mantle model age, and the CHUR model age. The application also generates plots of most of these parameters and allows to obtain constraints on the petrogenesis using Harker variation diagrams.

### Geothermobarometric constraints

The emplacement temperature of granites and rare metal granites can be estimated from the saturation of zircon (Watson & Harrison, 1983), monazite (Montel, 1993) and apatite (Pichavant et al., 1992) and the whole-rock $Al_2O_3/TiO_2$ ratio thermometer (Jung & Pfänder, 2007) (Fig. 2). The code also compares the saturation temperatures of a sample, and if they are close, the application warns that the sample may not have a restitic, accumulate fraction, or alteration overprint and is a fairly pure melt. The application also estimates the magma emplacement pressure

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from the phengite barometer (Massonne & Schreyer, 1987). Since this barometer is temperature sensitive, the application performs the calculations for 650 ºC, but this equilibrium temperature can be changed by the user.

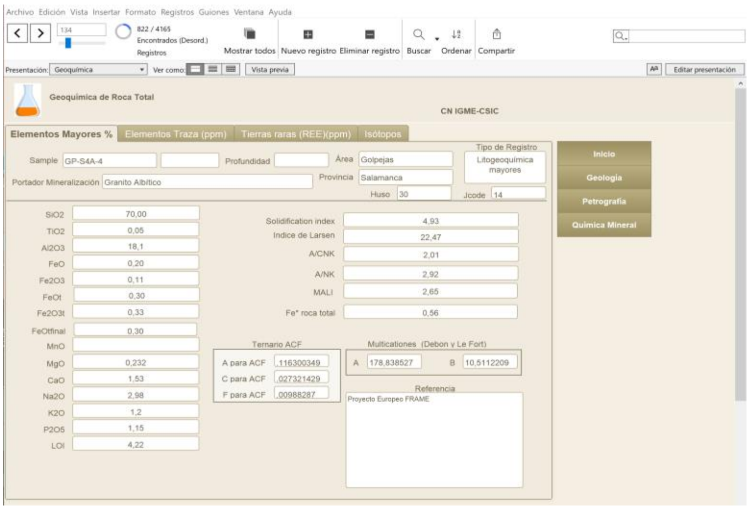


*Fig. 1. Screenshot of geochemistry presentation.*

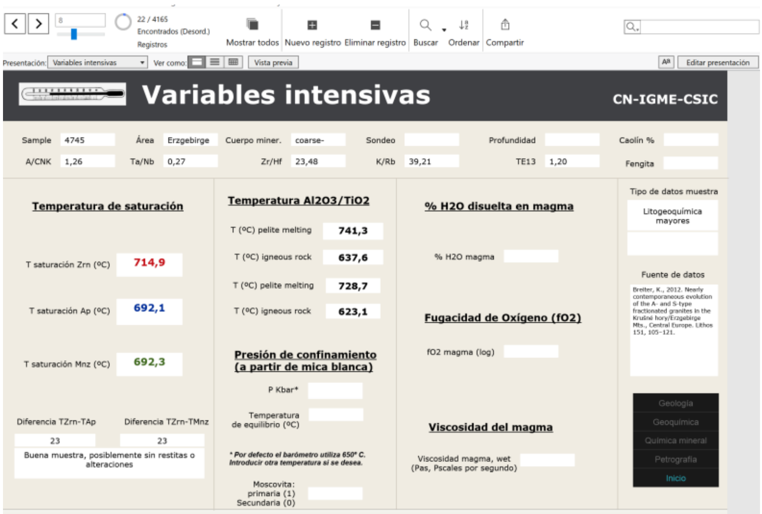


*Fig. 2. Screenshot of the geothermobarometric constraints.*

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