

Fe²⁺ and Fe³⁺ quantification by different approaches and f_{O_2} estimation for Albanian Cr-spinels

MARCO QUINTILIANI, GIOVANNI B. ANDREOZZI,* AND GIORGIO GRAZIANI

Dipartimento di Scienze della Terra, Università degli Studi di Roma “La Sapienza,” Piazzale Aldo Moro 5, I-00185 Roma, Italy

ABSTRACT

Fourteen Cr-spinels from Albanian ophiolites were examined. Fe²⁺/Fe³⁺ ratios were obtained by ⁵⁷Fe Mössbauer spectroscopy (MS) and compared with ratios retrieved by electron microprobe analyses (EMPA). MS spectra were collected at both 298 K (RT) and 77 K (LT), and fitted using various interpretative models. Fe³⁺ contents by EMPA, calculated from spinel stoichiometry, are almost always underestimated with respect to those obtained by MS. Moreover, Fe³⁺ contents by MS-RT are shown to be somewhat overestimated with respect to those by MS-LT, which are proved to be the most reliable. On basis of MS results, Albanian Cr-spinels proved to be non-stoichiometric, with an oxidation degree, z , ranging from 4 to 49%. Our results indicate no dependence of z on sample provenance, but suggest a strong dependence on spinel composition. Chemical data of Albanian spinel and associated olivine were used to estimate f_{O_2} via oxygen geobarometry. Notably, f_{O_2} values calculated on basis of the EMPA data are always largely underestimated with respect to those obtained on basis of MS data. However, f_{O_2} values calculated on basis of MS-RT data are equal to or higher than (up to 0.2 log units) f_{O_2} values based on MS-LT data. The increase in f_{O_2} responsible for spinel oxidation was tentatively estimated to be less than one log unit for poorly oxidized samples, but up to 6 log units for the most oxidized samples.

Keywords: Analysis, chemical (mineral), chromite, olivine, Mössbauer spectroscopy, thermo-barometry, olivine-spinel