Chromites from Upper Ordovician strata of the Precordilleran terrane as tracer of pre-Ordovician oceanic crust in Central Argentina

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Heavy mineral data from the Upper Ordovician Pavón Formation (Central Argentina) points to an ultrabasic to basic source of MORB and probable continental flood basalt provenance. The Pavón Formation was deposited on the disputed exotic Precordillera terrane (PCT), which most probably represent a fragment of Laurentia. The sedimentary rocks are characterized by an upper crustal component mixed with a basic source, where the latter could not be described in detail using geochemistry and isotope geochemistry. Heavy mineral analysis and the existence of detrital spinels give more information about this component. Apart from chromites, mainly zircon and rutile occur. The zircon population points to a promenant plutonic source and only a subordinated influence of metamorphic and volcanic sources. Chemistry of chromium-rich spinels allows separating them into two groups. Group 1 show typical characteristics for MORB host rocks since it has Cr# values between 0.4 and 0.6, Fe^{2+}# ranging from 0.2 to 0.4, low TiO_2 contents and low Fe^{3+}#. Group 2 displays Cr# around 0.7, Fe^{2+}# ranging from 0.5 to 0.8, higher Fe^{3+}# and TiO_2 contents up to 4.7 %. The latter chemical characteristics seem to be comparable to host rocks related to continental flood basalts, but as well exist in MORB. The two groups cannot be differentiated on the base of grain size or roundness. SEM analyses of grain shapes point to an only short transportation process and imply the existence of an oceanic crustal component closely related to the PCT. Source area candidates for such chromites are sparse. As the chromites are not metamorphosed pre-Ordovician ultrabasic to basic sequences of the Sierras Pampeanas can be excluded. Adjacent ultra-basic sequences from Pie de Palo (eastern PCT) and pillow basalts of the western PCT do not contain chromites or if they have the chemical compositions are not known so far. We propose a pre-Ordovician oceanic basin to the east of the PCT, which, during or after the collision (most probably during the Caradoc) of the PCT with Gondwana, was partly obducted and eroded into the Pavón Formation.

$MgCr_2O_4 – MgFe_2O_4$ characterisation: Single crystal XRD, Mössbauer and optical absorption spectroscopy and electron microprobe analyses

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The structural influence of $Fe^{3+} \rightarrow Cr$ substitution was studied in synthetic single crystals belonging to the $MgCr_2O_4 – MgFe_2O_4$ series produced by flux-growth at 900 -1200°C in air. Samples were analysed by single-crystal X-ray diffraction, electron microprobe analyses, optical absorption- (OAS), infrared- and Mössbauer spectroscopy (MS). The MS data show that iron occurs almost exclusively as Fe^{3+}. Only minor Fe^{2+} was observed in samples with very low total Fe. In the OAS spectra we observe a broad band around 8000cm^{-1} that is strongly intensified for samples with 40 mol-% $MgFe_2O_4$ and towards Fe-richer compositions. This band could be due to charge-transfer or conduction processes. MS data indicate less Fe^{2+} than estimated from the $^{IV}Fe^{2+}$ band at 5000cm^{-1} in infrared spectra and microprobe analyses. Cell edge a_0 increases with magnesioferrite content while oxygen coordinate u decreases due to the inversion of the structure. The trend between cell parameter and Fe^{3+} content (apfu) is described by the linear relation $a_0 = 8.3407 + 0.0222\ Fe^{3+}$. The oxygen positional parameter depends on the Fe^{3+} content according to the linear relation $u = 0.2615 - 0.0025\ Fe^{3+}$ which implies a linear increase of the inversion degree with Fe^{3+} increase. The inversion parameter x of the sample closest to magnesioferrite is consistent with the thermodynamic models by O'Neill and Navrotsky (1983), Landau theory and with magnesioferrite data by Antao et al. (2005).

References

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