
Natural hydrogen and helium seeps along thrust faults in the Brazilian Neoproterozoic Craton - Marica region, State of Rio de Janeiro

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Résumé

Seepage of natural hydrogen, associated with helium, was observed in the Marica region (State of Rio de Janeiro, Brazil), as part of a collaborative project led by CVA and GEO4U. The Marica region is located within the Neoproterozoic Mantiqueira Orogenic System, a tectonic complex composed of units bounded by major thrust faults. A geochemical survey and a radiometric survey were carried out along one of these faults between the central Superterrane granite and the Cabo Frio Superterrane gneiss.

For the geochemical survey, we drilled 1 meter deep and introduced a cannula to suck the gas from the ground and instantly measure its composition (GA5000 electrochemical sensors supplied by GEOTECH). When hydrogen was detected, the gas was drawn into a tube for later gas chromatography measurements in the laboratory. We carried out about forty in situ measurements of soil gases and 5 samples for analysis by gas phase chromatography. On the hills the values are low but in the valley along the fault, the hydrogen contents are very high, with often more than 500ppm. Laboratory measurements confirm these results with a maximum at more than 2700 ppm of hydrogen. It also shows relatively high helium contents due to the presence of crustal helium of deep origin. This gas associated with hydrogen marks its deep geological origin.

Soil gas measurements are point measurements while we need to map the extent of these hydrogen seeps. For this we carried out a mapping of the radionuclides by gamma spectrometry because we frequently observe a correlation between the anomalies of the radionuclides and the high values of hydrogen. The spectrometer (MS 1000 from MEDUSA) was transported on a man's back for several kilometres, then the data was processed and interpolated to produce maps of radionuclides (U, K, Th). The thorium maps are particularly contrasted with low values on the hills and very high values in the valleys, where the highest hydrogen values were measured.

These early results could be surface evidence of a deep natural hydrogen system rooted in the deep faults of the Mantiqueira Orogenic System with potential economic interest.

Mots-Clés: Natural Hydrogen, Exploration, Brazil, Marica

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