Hydrothermal fluid flow evidenced by mineral alteration assemblages and chemistry of metamorphic rocks, sediments and volcanics, on top of the southernmost Río de la Plata craton, eastern Argentina.

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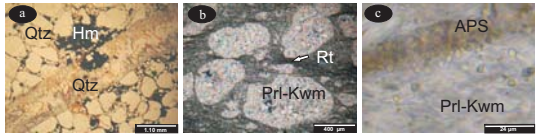
Two horizontally widespread alteration zones of the Barker-Villa Cacique area, Tandilia ranges, share common alteration features recognized by petrography, X-ray diffractometry, electron microprobe analysis, bulk-rock geochemical analysis and K-Ar age dating.

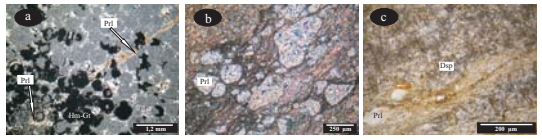
- Late Proterozoic unconformity between the basement (mainly migmatites) and the overlying epiclastic succession.
- Epiclastic and interbedded pyroclastic rocks (Frisicale and Dristas, 2000) of the middle to upper sedimentary succession.

PETROGRAPHY OF ALTERED ROCKS AT THE UNCONFORMITY

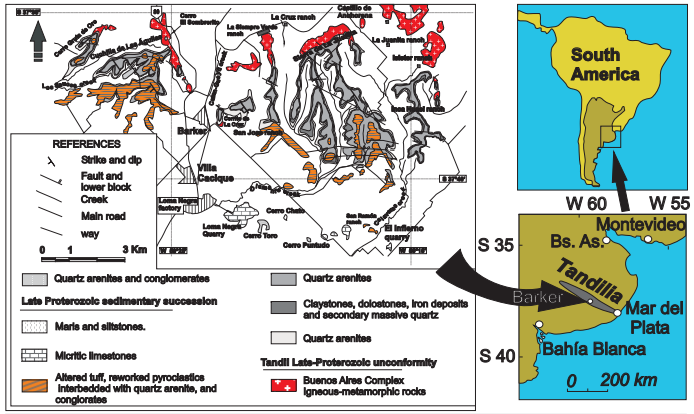


(a) Quartz arenite at the unconformity cut by quartz veins. **(b)** Sandstone with quartz grains replaced by pyrophyllite (Prl) and potassic white mica (Kwm). **(c)** Altered migmatite (basement) with pyrophyllite (Prl) and potassic white mica (Kwm).

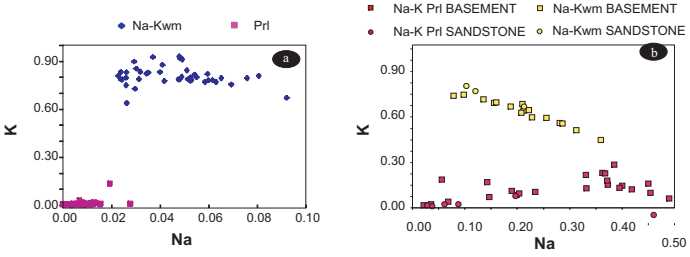
PETROGRAPHY OF ALTERED ROCKS AT THE MIDDLE TO UPPER SECTION OF THE SEDIMENTARY SUCCESSION



(a) Cement of silicified breccias with hematite-goethite (Hm-Goe) and pyrophyllite (Prl) precipitates. **(b)** Sandstone with quartz grains replaced by pyrophyllite (Prl). **(c)** White clays with the clay mineral assemblage Prl + Kwm + Dsp + Alun + APS + Tur + Rt (altered pyroclastic tuff).

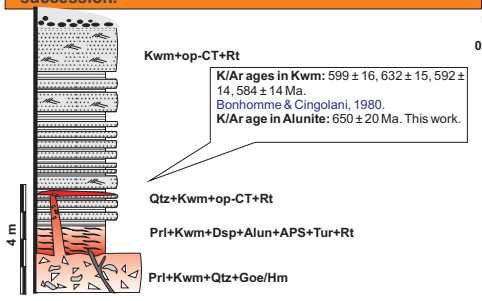


Location of the study area. The two units of interest are in color.

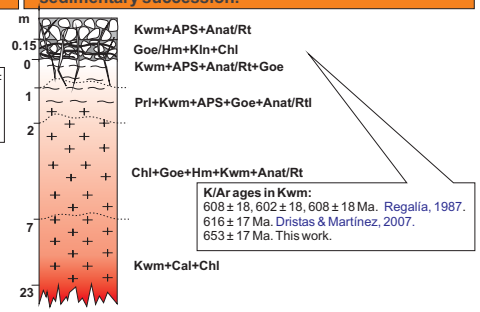


Distribution of Na and K pfu in potassic white micas (Kwm) and pyrophyllites (Prl) based on EMPA data. (a) Na-bearing Kwm and Prl of altered middle upper sedimentary succession. **(b)** Na-bearing potassic white-mica (Na-Kwm) and Na-K pyrophyllite (Prl) of the altered basement and sedimentary succession at the unconformity of Barker.

Schematic vertical section of reworked pyroclastic beds, sandstones and breccias at the middle upper sedimentary succession.



Schematic vertical section of altered rocks at the unconformity between the basement and the sedimentary succession.



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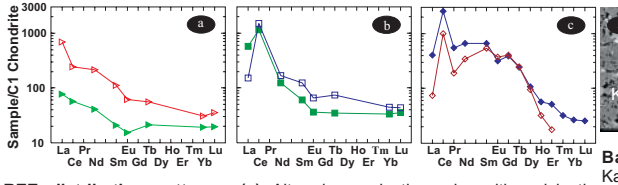
Abbreviations: Alun (Alunite); APS (Aluminium Phosphate Sulphate);Anat (Anatase); Cal (Calcite); Chl (Chlorite); Dsp (Diaspore); Goe (Goethite); Hm (Hematite); Kln (Kaolinite); Kwm (Potassic white-mica); op-CT (opal); Prl (Pyrophyllite); Qtz (Quartz); Rt (Rutile); Tur (Tourmaline).

Overburden
Reddish claystones, altered pyroclastic deposits
Pseudofoliation with obliteration of previous foliation
Quartz arenite with dissolution of quartz grains and replacive matrix
Quartz arenite
Secondary quartz breccias with clay lenses
Quartz arenite with replacive matrix and goethite-hematite veinlets
Increasingly altered basement towards the unconformity
White claystones
Secondary quartz and hematite-goethite veins
Bimodal quartz arenite
Fluid inclusion trends and quartz veinlets

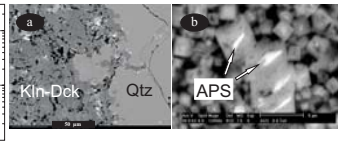
OUTCROPS OF ALTERED EPICLASTIC AND INTERBEDDED PYROCLASTIC ROCKS OF THE MIDDLE TO UPPER SEDIMENTARY SUCCESSION

Photographies of the middle to upper sedimentary succession: (a) Pyroclastic deposits interbedded with epiclastic components. **(b)** Intrusive breccia body. **(c)** Pyroclastic rocks altered to clay minerals. **(d)** Alunite veins in white clays.

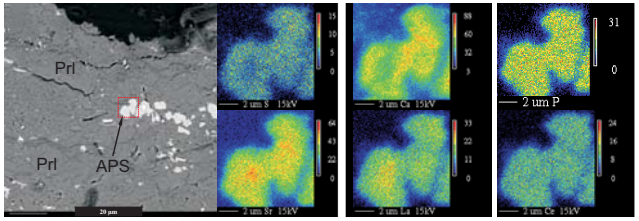
GEOCHEMISTRY OF THE CLAY MINERAL ASSEMBLAGES IN THE MIDDLE TO UPPER SEDIMENTARY SUCCESSION



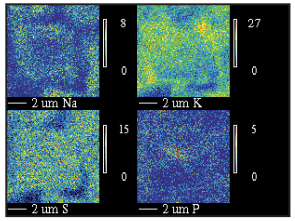
REE distribution patterns: (a) Altered pyroclastic rocks with epiclastic contamination. **(b)** Altered pyroclastic rocks. **(c)** Alunite veins.



Backscattered electron images: (a) Kaolinite-Dickite in corrosion voids of altered quartz arenites. **(b)** Pseudocubic alunite crystals with cores of APS minerals

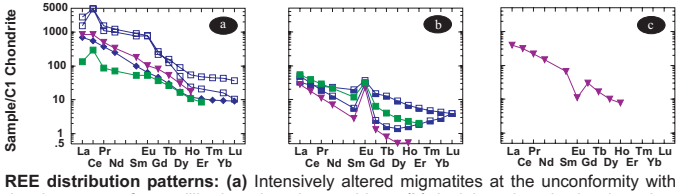


X-ray element mapping of REE-bearing APS minerals (Florencite-type) widespread in the altered pyroclastic rocks. Pyrophyllite (Prl) is the main mineral of alteration.

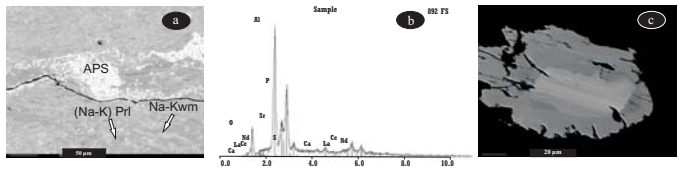


X-ray element mapping on alunite crystals with cores of APS minerals.

GEOCHEMISTRY OF THE CLAY MINERAL ASSEMBLAGES AT THE UNCONFORMITY



REE distribution patterns: (a) Intensively altered migmatites at the unconformity with developtement of an argillic clay mineral assemblage. **(b)** Incipient alteration in migmatites (Kwm+Chl+Cal). **(c)** unaltered migmatites.



Backscattered electron images and EDS spectrum. (a) Intensively altered migmatites at the unconformity with developtement of an argillic clay mineral assemblage (Prl-Kwm) and APS minerals. **(b)** EDS spectrum of APS minerals (Florencite-type). **(c)** Image of monazite of unaltered migmatites as possible source of LREE.

CONCLUSIONS

Similarities in:

- Chemistry: enrichment in LREE of the most altered rocks and Na content in secondary minerals),
- Mineralogy: clay mineral assemblage with Prl+Kwm+APS+Tur+Dsp+Rt),
- Alteration textures: Replacement where only quartz is present as relict, and
- Ages of altered rocks between 600 ± 20 Ma.

This allow us to interpret both alteration zones as related to fluid flow migration probably linked either to hidden igneous rocks, which are common in the Uruguayan portion of the Rio de la Plata craton, or to metamorphic fluids expelled during basement uplift by pressure release.

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