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NOTES

REGULAR KAOLINITE/SMECTITE (R1) FROM THE BERMEJO RIVER BASIN, ARGENTINA

Key Words—Regular mixed-layer, Kaolinite/smectite, Fluvial sediments, Bermejo River, Argentina.

Wiewiora (1971) and Moore and Reynolds (1989) have pointed out that mixed-layer clays containing 2:1 layer silicates are relatively common compared to those containing 1:1 layer silicates. In addition, most of the literature describing mixed-layer minerals that contain 1:1 clay minerals is concerned with randomly interstratified kaolinite/smectite layers (Wiewiora, 1971; Schultz *et al.*, 1971; Sakharov and Drits, 1973 and Hughes *et al.*, 1987). Recent papers by Thomas (1989) and Hughes *et al.* (1990) describe the occurrence and identification of a mixed-layer kaolinite/smectite. Thomas (1989) records the only documentation of a regular kaolinite/smectite mixed-layer mineral. This mixed-layer clay is dioctahedral, consists of 50% of each component and has R = 1 ordering.

In a study of the mineral content of the headwater tributaries of the Parana River (Bertolino and Depetris, 1991), a regular mixed-layer kaolinite/smectite mineral was discovered. Samples of the suspended load from the Bermejo, Pilcomayo and Paraguay tributaries were collected (Figure 1). Sample number 3 from the locality of Zanja del Tigre, Salta Province, Northern

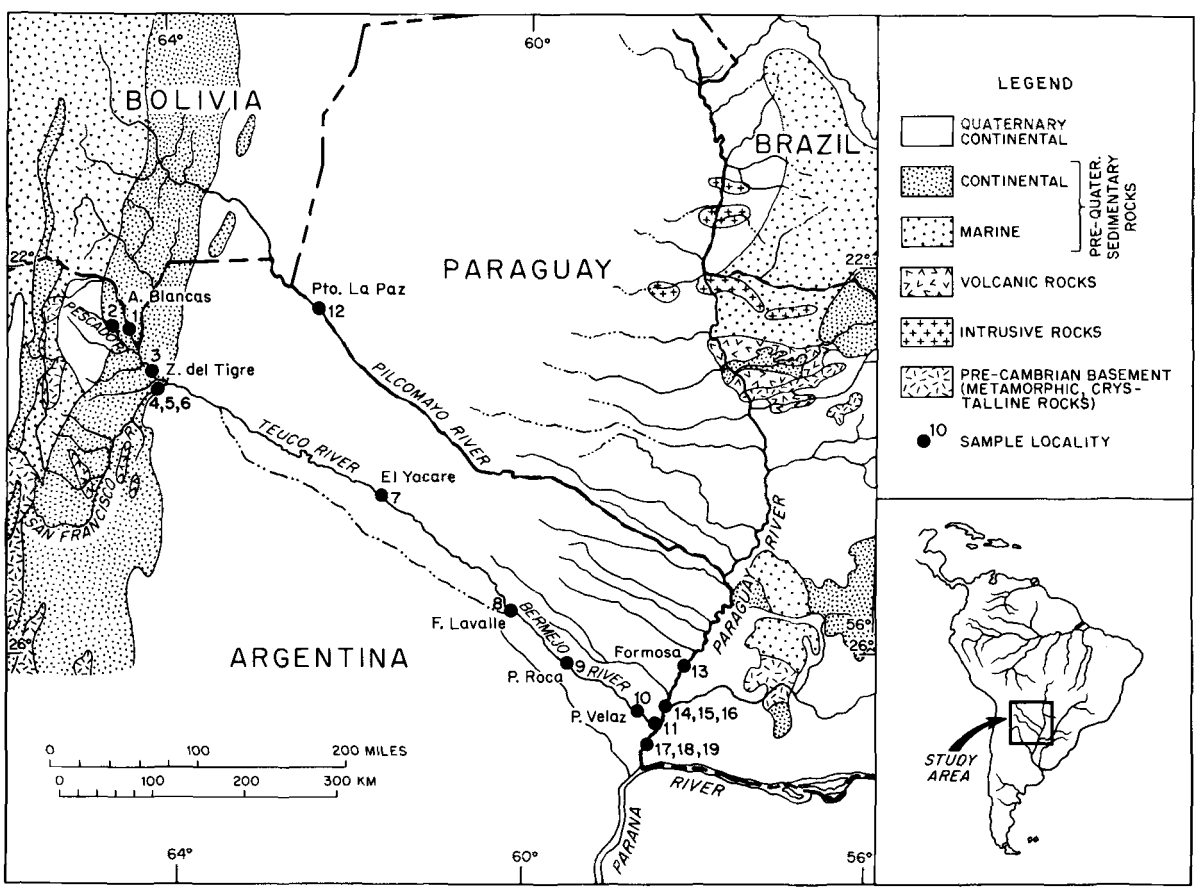


Figure 1. Schematic map showing the lithology of the area and the location of the samples.

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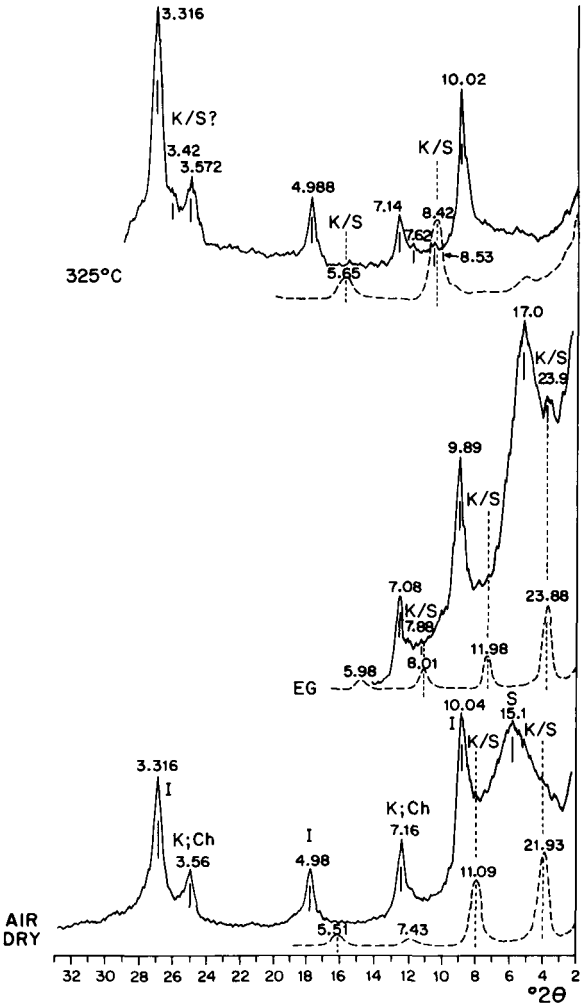


Figure 2. X-ray powder diffraction patterns (solid lines) of the natural sample and synthetic patterns generated with NEWMOD (dashed lines) for a kaolinite/smectite mineral. Synthetic patterns were provided by A. R. Thomas (Texaco Inc., 3901 Briar Park, Houston, Texas 77042).

Argentina, contained the regular kaolinite/smectite mixed-layer mineral.

RESULTS AND DISCUSSION

X-ray diffraction patterns revealed a regular mixed-layer kaolinite/smectite with the same characteristics as reported by Thomas (1989). He described a superlattice with a rational series of reflections that matches with synthetic patterns generated with NEWMOD for a kaolinite/smectite, R = 1 dioctahedral mineral, under different conditions (air-dried, glycolated and heated at 325°C). Major clay minerals in the <2-μm fraction are illite and smectite, along with minor amounts of kaolinite and chlorite. Because there is no other mixed-layer mineral with the most intense peaks at 23.9 Å after ethylene glycol solvation, and at 8.42–8.5 Å after heating at 325°C, the authors believe that a kaolinite/smectite regular mixed-layered mineral is present.

Figure 2 shows that the regular mixed-layer kaolinite/smectite is characterized by reflections at d = 21.9 and 11.09 Å. A low angle shoulder is present on the 7.16 Å peak of kaolinite. After glycolation these reflections increase to d = 23.9 and 11.98 Å respectively. The peak at 7.16 Å becomes sharper. When heated to 325°C a peak at d = 8.42 Å appears. Other significant features are the changes produced in the diffraction patterns in the 24 and 27°2θ region for the air dried and heated samples. The reflections of the (002) kaolinite and (004) chlorite are broad asymmetric reflections on the air dried sample at d = 3.56 Å, which after heating at 325°C separates into two peaks at 3.57 and 3.42 Å.

Synthetic patterns of the regular kaolinite/smectite mixed-layer generated by A. R. Thomas (personal communication) were superimposed on the patterns of the natural samples (Figure 2). Notwithstanding the complexity of the mineralogy of the sample, the concurrence of the positions and intensities of the (00*l*) peaks in both patterns is clearly observed. Therefore, in agreement with Hughes *et al.* (1990), we conclude that the detection of kaolinite/smectite mixed-layers is possible, even if present in small amounts.

The origin of this regular kaolinite/smectite mixed-layer mineral is unknown because the sample was collected from the suspended sediment load. It is not possible to establish the exact upstream source from which this regular mixed-layer kaolinite/smectite was derived. Further sampling in the area will be required to establish the provenance and origin of this mixed-layer clay.

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SILVANA R. A. BERTOLINO[1,2]
HAYDN H. MURRAY[1]
PEDRO J. DEPETRIS[2]

[1] *Department of Geology, Indiana University Bloomington, Indiana 47405*

[2] *CONICET. Fac. Ciencias Exactas Físicas y Naturales, Universidad Nacional de Córdoba Av. Velez Sarsfield 299, 5000 Córdoba, Argentina*

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