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Hydrochemical and isotopic assessment of the Iberá hydrogeological system in NE Argentina

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The Iberá wetland system overlies a large Pliocene-to-present alluvial fan of the Paraná River. The wetlands substrate is formed by fine to coarse quartz sands with silt and clay layers corresponding to alluvial sand bars, eolian dunes and fluvial beds (Ituizangó and Toropí formations). Abandoned beds of anastomosed streams are occupied by large, very shallow and mostly NE-SW elongated lagoons called esteros, covering 13200 km2. To the north and northeast of the Iberá system the sandy formations overlie basalts (Serra Geral formation) with sandstone intertraps (Solari formation), which deeps to the SW; to the west and south they underlie silts and fine sands of the Fray Bentos and Paraná formations.

The prevalent hydrological model indicates that the esteros receive mostly pluvial water, with some shallow groundwater discharge. The whole wetland system drains to the SW, discharging into the Corrientes River which, in turn, flows into the Paraná River.

To understand the hydrology of the system and its relationship with the aquifers in the area, two water sampling surveys were performed in September 2009 (14 samples) and August-October 2010 (23 samples). Water samples were taken from esteros, the Corrientes River and from wells taping different layers and depths. Major and some minor components, electrical conductivity (EC), pH and temperature were measured in all samples. In the 2009 samples the isotopes 18O, 2H. 3H, 13C and 14C were determined. In the 2010 survey, the activity of 222Rn was measured in situ with a portable RAD7-RADAQUA equipment.

Geological information suggests that deep wells in the SE (90-120 m) tap red sandstone formations under the basalts, assumed to belong to the Guaraní Aquifer System formations (GASF); shallow wells in the SE tap sands of the Toropí formation (TF); wells sampled to the NE and N (60->100 m deep) probably tap a variety of infra, intra and supra basalt sand layers (GASF; Solari formation and IF, respectively); wells sampled to the W (<60 m deep) seems to tap IF. Almost all groundwater samples were of the Na-HCO3 type, with some Ca-HCO3 samples in the western part of the system, and very few samples of the Na-Cl type. Groundwater salinity increases from west (EC<200 [U+F06D]S/cm) to north and northeast (EC=200-400 [U+F06D]S/cm), and in depth, reaching EC=1000-2000 [U+F06D]S/cm in the SE deep wells. Samples from the deep formations to the SE are chemically and isotopically similar to the GASF waters in the nearby Misiones Province. One sample available from the shallow sands in the SE (IF or TF) looks like a mixture between GASF and waters of sandy formations to the NE (IF or TP). Groundwater samples in the W (assumed IF) show the lowest mineralization and are quite similar to most surface water samples analyzed.

All surface samples, except the Corrientes River, are poorly mineralised. They seem to be mostly rain water (there was heavy rainfall prior to surveys), probably direct runoff plus discharge from sand belts merely emerging among the esteros. The Corrientes River sample is similar to the surface and groundwater samples from the western reach of Iberá but somewhat more mineralised, as expected.

The highest relative 222Rn activities were measured in the sandy formations to the N, NE and shallow wells of the SE (IF and TF). Deep wells to the SE (GASF) also had high, tough lower activities. Sandy formations sampled to the W (IF) showed the lowest activities. All surface waters measured showed very low, near cero 222Rn activities. Even though, the differences found prevent to discard the presence of a groundwater signature, though the dominance of rain water seems to have masked it.