APPLICABILITY OF THE URANIUM-ISOTOPIC MODEL AS A PROSPECTING TECHNIQUE IN GUARANY AQUIFER, SOUTH AMERICA. D. M. Bonotto, Departamento de Petrologia e Metalogenia, Instituto de Geociências e Ciências Exatas, UNESP, Av. 24-A, N° 1515, C.P. 178, 13506-900-Rio Claro-SP, Brasil, (dbonotto@dpm.igce.unesp.br).

**Introduction:** $^{238}\text{U}$ and its radiogenic daughter $^{234}\text{U}$ have been considered as very useful isotopes for the hydrogeochemical prospection of concealed uranium deposits, where the data for dissolved U content in ground waters and $^{234}\text{U}/^{238}\text{U}$ activity ratio (AR) are plotted on a two-dimensional diagram containing several areas of associative significance [1,2,3]. In terms of dissolved U content, the main defined categories characterize: oxidized aquifer bathing strata with “normal” U mineral content (values between 1 and 10 ppb); oxidized aquifer bathing strata enhanced in U mineral content (values higher than 10 ppb); reduced aquifer or strata with low U mineral content (values lower than 1 ppb). In terms of AR’s data, ground waters having values between 1 and 2 define “normal” world-wide situations, whereas it was also suggested the possibility of occurrence of processes related to the formation (values higher than 2), or remobilization (values lower than 1) of an accumulation of uranium. In this paper, the data on the isotopic concentrations of dissolved U in groundwater samples from Guarany aquifer, South America, were used to evaluate the applicability of the modeling in the area.

**Sampling and Results:** The Guarany aquifer of Triassic-Jurassic age extends over some 839,000 km$^2$ within the Paraná sedimentary basin [4], has an average thickness of 300-400 m, and is composed of silty and shaly sandstones of fluvial-lacustrine origin (the Pirambóia and Rosário do Sul formations in Brazil and Buena Vista formation in Uruguay), and variegated quartzitic sandstones accumulated by eolian processes under desertic conditions (the Botucatu formation in Brazil, Misiones formation in Paraguay, and Tacuarembo formation in Uruguay and Argentina). The sampling of the Guarany aquifer was performed at 67 localities in São Paulo, Mato Grosso do Sul, Paraná, Santa Catarina and Rio Grande do Sul States in Brazil, where 77 groundwater samples (19-20 kg) were collected, stored in polyethylene bottles, and submitted to standard analytical procedures for determinations of the U content and AR [5]. Table 1 summarizes the range of the obtained values.

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>UNIT</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uranium</td>
<td>ppb</td>
<td>0.004 - 15.36</td>
</tr>
<tr>
<td>$^{234}\text{U}/^{238}\text{U}$ A.R.</td>
<td>-</td>
<td>1.01 - 27.88</td>
</tr>
</tbody>
</table>

**Discussion:** The U content and AR’s values show great variability, where samples in all classification categories are present. A high dissolved U content value was found in one sample (15 ppb), which may be indicative of an previously unreported U accumulation though not necessarily of economic size and grade. Areas of stagnant alkaline waters where inflow is greatly restricted and residence time is long are common in the studied aquifer, but in spite of the alkaline character of the sample having high value of U content, it is not probable some relationship between the stagnancy of the water and its U content, because other samples having strong alkaline facies don’t exhibit high U content. The pH and Eh data for the studied ground waters define oxidizing, reducing and intermediate conditions, with several samples being properly classified according to the U-isotopes data, whereas other don’t adjust to any defined category, being plotted in fields not representing the actual redox conditions. Other factors responsible for the classification of the samples in different categories are: enhancement of $^{234}\text{U}$ in solution in accordance with an increase of the dissolution of calcium from the rock matrices; the occurrence of anthropogenic impacts affecting the oxidation-reduction conditions and modifying the presence of elements and compounds in solution, inclusive uranium; the effect of the temperature on the solubility of carbonates like calcite, since the precipitation of $\text{Ca}^{2+}$ may occur at higher temperatures, affecting the values of the AR’s. Therefore, the great complexity of the analyzed natural system suggests that several factors may be affecting the representation of the data on the U content vs. AR fence diagram, and that some caution be used on interpreting the high U content value measured for one sample.

**Acknowledgments:** The author thanks the International Atomic Energy Agency (IAEA Research Contract No. 9723/Regular Budget Fund) and CNPq (Conselho Nacional de Desenvolvimento Científico e Tecnológico)-Brasil for financial support of this investigation.

**References:**