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| Geochemical Dispersion Associated with Uranium Deposits in Sandstone Roll Front Type and its Relationship to the Orinoco Oil Belt, Venezuela |
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**Abstract.** In Venezuela, there is a potential for the formation of uranium deposits in areas such as the Guiana Shield, south of Eastern basin, the Andes, the massif of Baúl, among other areas. Especially great interest is the exploration of uranium redox interface type (roll front), in areas such as the southern part of the Orinoco Oil Belt, north and northwest of the Guiana Shield, where groundwater uranium collecting the weathering shield flowing northward in the sandstones and mudstones of the Cretaceous to Quaternary formations, which constitute the southern boundary of the Eastern basin Venezuela. The presence of gas, extra-heavy crude oil, bitumen and lignite of the Orinoco Oil Belt can be an effective barrier for uranium in solution, which may have precipitated at the redox interface of this groundwater. This work was based on a qualitative model describing geochemical dispersion associated with uranium deposits in sandstone, roll front type, which indicates that the daughter isotopes 238U, which can migrate extensively are: 222Rn, 4He, and smaller proportion: 226Ra and 222Rn daughters (214Bi, 210Pb). The main exploration methods were established, which can be applied in areas of the Orinoco Oil Belt, north of the Guiana Shield, and areas west of this.

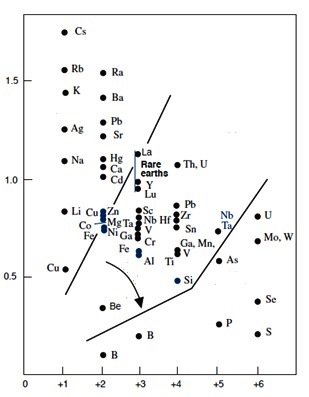
**1. Introduction**

The uranium deposits in sandstones of the "roll front" type, consist of areas or arched bodies or matrix impregnations of uranium, which cut across the stratification of the sandstones that contain limited at the top and bottom by beds less permeable. The mineralized zones consist of elongated and sinuous bands approximately parallel to the direction of stratification and perpendicular to the direction of sedimentation and groundwater flow. The redox interface controls the environment and configuration of these areas [1]. In the present study are considered favorable areas for the formation of these deposits, especially the south area of the Eastearn basin, the area comprising the Orinoco Oil Belt and west of it [2], so is recommended that a plan of uraniferous exploration in this area, because it has favorable characteristics to host uranium deposits and other elements, such as vanadium. A proposed exploration plan which is primarily a combination of geochemical, geological and geophysical methods, which allow detection of anomalous areas with emphasis on surface measurements and obtaining profile information oil wells in the area of interest. These methods are proposed according to a model of geochemical dispersion associated with this type of deposits, which is considered the most mobile elements within the 238U decay series [3].

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**2. Geochemical dispersion of elements of interest.**

In the radioactive series 238U, several elements with different chemical characteristics are formed, which are dispersed in different ways, according to its chemical and physical properties. In particular, the 4He and 222Rn are highly mobile and tend to escape while 226Ra, 234U, 210Pb and 206Pb can migrate under certain conditions in which the (Eh and pH mainly) system is. By contrast, 234Th, 230Th and 234Pa are extremely immobile and can stay with their daughters for significant periods of time, indicating the former presence of uranium or its proximity to the host rock of the mineralization.



Mobile cations

Immobile ions

Cationic radio apparent (Ǻ)

**·**Pa

Elements Series U

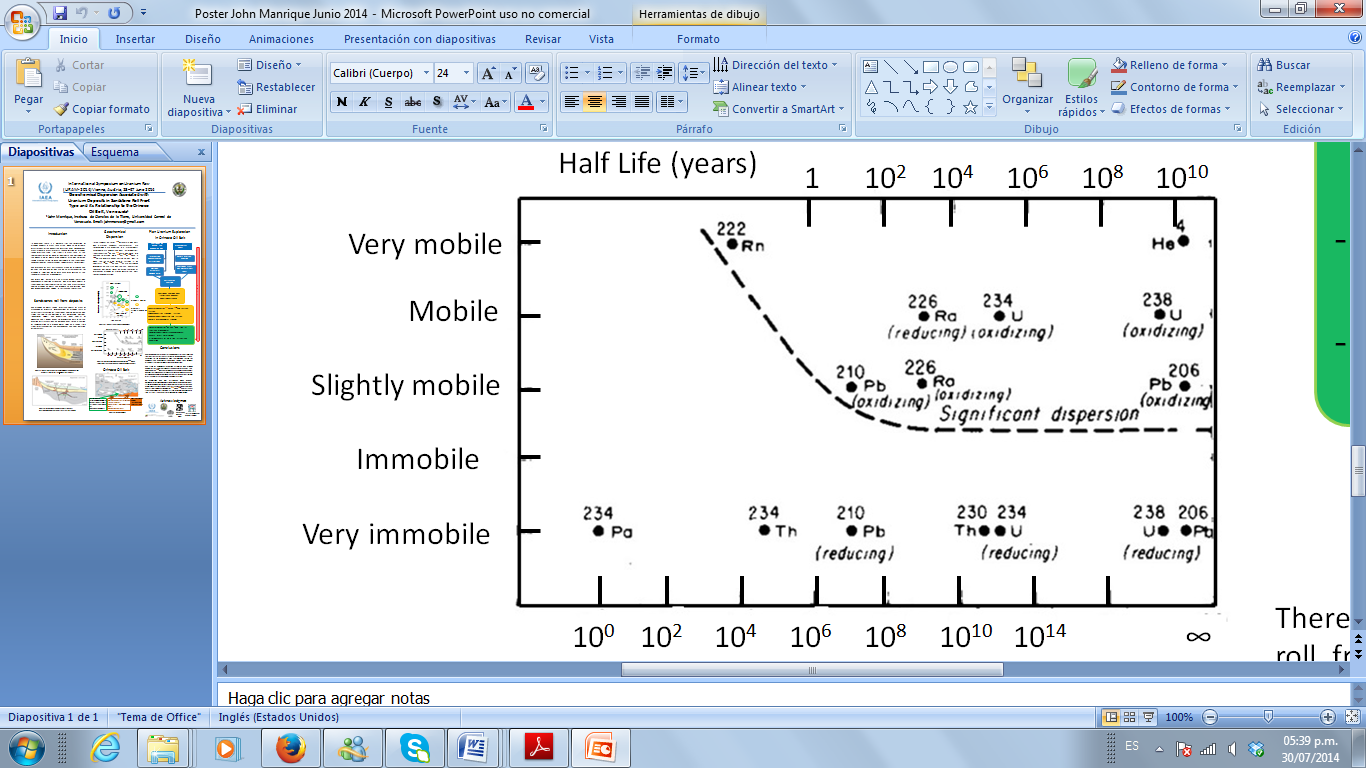
Elements associated with the U

Mobile Oxi –

anions

Ion charge

*FIG. 1. Ionic potential of several elements [4].*

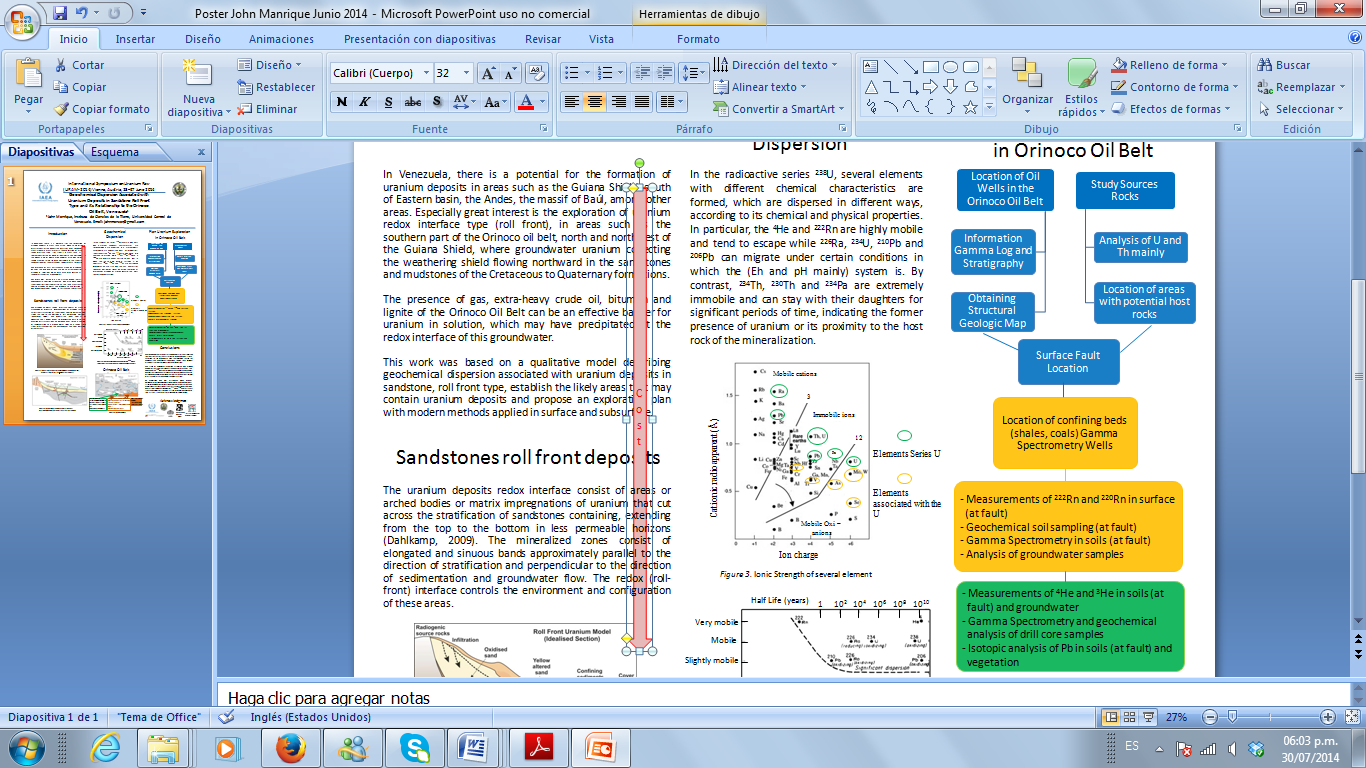
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*FIG. 2. Chemical mobility and half-life of 238U and some of its decay products [5].*

**3. Exploration Methods**

Suggested exploration area is located in the south of the Eastern Basin, north of the Guaiana Shield, whose uranium source rocks are thought to be system first geological Province Imataca (Guiana Shield) formed by granitic gneisses, granites and felsic granulites of Archean age and secondly the Formation Caicara of Pre-Cambrian age (1736 My), composed primarily of acid volcanic rocks. The transport of uranium may have been through surface waters by rivers flowing from south to north, which may have led uranium as uranyl ion and/or absorbed in inorganic and organic colloids. Subsequently uranium may have been infiltrated by groundwater aquifers in the Eastern basin. Host mineralization rocks may be the Cretaceous – Tertiary Formations, which are composed of Sandstones, shales, siltstones, coal, oil and gas. These formations were deposited in transitional fluvial-deltaic environments which are conducive to host uranium deposits in sandstones (e.g. uranium deposits, South Texas).

The main exploration methods were established, which can be applied in areas of the Orinoco Oil Belt, north of the Guiana Shield, and areas west of this, among the most important are: soil measurements of radon and helium near faults, sampling soils with gamma spectrometry analysis, log interpretation of oil wells in the area of interest to establish gamma – lithological anomalies, ground water analysis of uranium, radon, radium, helium, vanadium, selenium, molybdenum, analysis of samples oil drilling cores to locate anomalous stratigraphic levels.



*FIG. 3. Plan Uranium Exploration in Orinoco Oil Belt.*

**4. Conclusions**

There is good potential to host uranium deposits in sandstone type roll front, in areas of the Eastern basin (Orinoco Oil Belt), since according to this model may have the formation suitable for geological and geochemical conditions, source rock uranium, uranium transport, precipitation and preservation.

The study of geochemical dispersion associated with uranium deposits of this type, described as the behavior of each of the elements in the 238U decay series, which have chemical - geochemical behaviors different and different half-life times for which each have a different geochemical dispersion in the source rock, during transport in surface water - groundwater and mineralization.

An exploration plan was established which includes: obtaining information PDVSA location of wells in the Orinoco Oil Belt, structural geological map, location of potential source rocks and exploration areas, location of fault surface; location of confining beds, stratigraphy; measurements of 222Rn and 220Rn in surface (at fault), geochemical soil sampling (at fault), gamma spectrometry in soils (at fault), and analysis of groundwater samples mainly.

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