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INTERNATIONAL URANIUM RESOURCES EVALUATION PROJECT

I U R E P

NATIONAL FAVOURABILITY STUDIES

PARAGUAY

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GENERALIZED GEOLOGIC MAP OF PARAGUAY

1. INTRODUCTION

(a) Geography

Paraguay has an area of about 406,750 square kilometers. Its capital is Asunción. The Paraguay River separates the country into two distinct regions, eastern Paraguay and the Chaco area in the northwest. The bulk of the population lives in eastern Paraguay within 160 km. of the capital. This is a region of vast plains, broad valleys and extensive low plateaus which is mostly below 305 meters in elevation with a maximum of 700 meters in the plateau area. The flat, arid Chaco region comprises three-fifths of the country. Central Paraguay contains many swamps, largely of a seasonal nature.

(b) Climate

Winds blowing across land without significant topographic barriers cause abrupt and variable seasonal and yearly changes in the generally temperate to subtropical climate of hot summers and short, mild winters. Although rainfall is essentially moderate, there are large variations therein from year to year, and rapid evaporation produces a semiarid tropical climate in the Chaco region. The rainy seasons come in the March to May and October to November periods.

(c) Access

About 6,700 km. of generally unpaved roads have been built chiefly in eastern Paraguay radiating from the capital. The Chaco region has an unpaved 764-km. long road. Trails and many dirt roads are impassable in the rainy seasons. Two sections of the Pan American Highway (1,115 km.) extend between Asunción and Puerto Presidente Stroessner on the Alto Paraná River and from Asunción to Encarnación, while the Trans-Chaco stretches from the capital to Villa Hayes-Fidalelfia-Villazón. Railroads total 1,125 km. There are many airfields and airstrips, with international flights operating through Asunción airport. The roughly 3,220 km. of inland waterways are found principally along the Paraguay-Alto Paraná river system, and are sometimes restricted due to droughts.

2. GEOLOGY IN RELATION TO POTENTIALLY FAVORABLE URANIUM-BEARING AREAS

The Paraguay River divides the country into Paraguay Oriental and the Chaco Boreal. The Chaco makes up almost two-thirds of Paraguay and eastern Paraguay one-third. There is a vast difference in the topography on the two sides of the Paraguay River.

The Chaco Boreal is a vast aggrading alluvial plain that rises almost imperceptibly westward from the river to the Andean Foothills. The monotony of this nearly level, poorly drained, alluvial plain is broken only in its most northern part where a few bedrock hills protrude through the alluvium. The geology of this area is even less known than the eastern part of Paraguay. The Gran Chaco is a deep, elongated sedimentary basin that lies between the Andes on the west and the much lower ranges along the Atlantic Ocean. The area is covered, except for the few hills in the north, by a series of thick unconsolidated sediments. Only a few widely scattered oil wells have been drilled in all the Chaco. No well has been known to penetrate the entire section, even though some holes are over 10,000 feet deep. Some of the horizons penetrated are believed to be the equivalent of those exposed in eastern Paraguay. However, the available data are too meager for correlation.

The eastern one-third of Paraguay has gently rolling to hilly topography with level valleys. The soft sediments and deeply weathered basalts are being degraded and present low, rounded outlines in most places. In many places there are rugged hills and knobs formed of harder sediments or igneous rocks.

The rocks of Paraguay can be divided into five major classes depending on age and origin:

1) Precambrian

2) Cambrian - Early Devonian

3) Pennsylvanian - Triassic

4) Tertiary to Present

5) Igneous extrusive and intrusive rocks

Precambrian granites and metamorphic rocks underlie the entire country at varying depths but are exposed in two areas, one near the Rio Apa near the northern border and the other in south-central eastern Paraguay centering near Caapucú.

In the northern area, the lower Precambrian consists of a series of gneisses, quartzites, mica schists, amphiboles, granites and metabasalts. The upper Precambrian consists of quartz porphyries, quartzites, phyllites, limestones, dolomites, marine sands, shales and lutites, slates and basal conglomerates.

A series of pegmatites and aplites, believed to be Precambrian, is observed in the Apa crystalline complex.

In the southern area, Precambrian rocks are poorly exposed and are known only in a general way. Many of the iron veins are found in Precambrian quartz porphyries. Granites and a variety of porphyries comprise much of the younger Precambrian. There are also many small bodies of aplite and pegmatite.

Knowledge of the Paleozoic geology is sketchy. The Itapucumí series (Cambrian or Ordovician ?) of calcareous and dolomite limestone almost surrounds the northern group of Precambrian rocks. Some believe, too, that the Itapucumí group is upper Precambrian. It also has been thought to be equivalent with the Corumba series of Mato Grosso, Brazil.

The Silurian Caacupé consists largely of arkosic sandstone with a basal conglomerate and some clay and shale beds. The Silurian in deep wells in Gran Chaco is largely black marine shale with minor sandstone. The Devonian Itacurubi series of micaceous shale and arkosic sandstone beds is seemingly equivalent to the Furnas sandstone and the Ponta Grossa shale of southeastern Brazil and possibly to the Los Monos and Iquiri beds of the Andean Foothills of Bolivia.

The Pennsylvanian (Permian system ?) Tubarão series, which is poorly exposed, consists of glacial tillite, light colored sandstone and compact, laminated olive-green shale. It is correlated with the Tubarão series of Brazil.

The Santa Catarina "system" of the Paraná Basin is extensive in eastern Paraguay. Although the beds can be generally correlated with the Brazilian sequence, no detailed agreement exists.

The Permian Independencía series is made up largely of massive, medium-grained, cross-laminated feldspathic sandstone. It overlies the Tubarão and older rocks disconformably and is unconformably overlain by the Misiones sandstone (Triassic?). The Independencía beds of Paraguay appear to be stratigraphically equivalent to the Rio de Rasto and the Estrado Nova of the Brazilian Passa Dois series.

The Triassic Misiones sandstone appears to be the equivalent of the Triassic eolian Botucatu sandstones of Brazil. The Misiones consists of a homogeneous red sandstone with red clay or shale which is transgressive over the underlying formations. This is not a simple stratigraphic overlap but is due to a primary unconformity.

The Misiones unit is overlain by the Serra Geral basalt and is possibly interbedded with it in part. The Serra Geral basalt is of late Triassic or Jurassic age. In Paraguay these rocks constitute the westerly fringe of the Great Basalt field of the Paraná basin. The Serra Geral lavas are typical plateau-type basalts with no known pyroclastic features or evidence of explosive activity. In central Paraguay there are smaller bodies of diabase and similar rocks, mostly in the form of dikes, but including some flows and sills which are believed to be genetically related to the Serra Geral rocks.

The Tertiary and Quaternary systems cover much of eastern Paraguay with clay, silt and fine sand. Peat deposits are found in the southwestern corner of eastern Paraguay near Pilar.

In the north the Quaternary contains travertine, tuffs and limestone breccias and conglomerates. The alluvium consists of limonitic, clayey sands, gypsum and fluvial sands and gravels.

Alkalic rocks of an unknown age have been reported from many localities in Paraguay and nearby Brazil. Rock types varying from shonkinite, phonolite and nepheline syenite occur in dikes, small stocks and volcanic cones. They are tentatively assigned to the time between late Triassic and late Tertiary but may also be the same age as alkalic igneous rocks of Poços de Caldas which is upper Cretaceous.

In northeastern Paraguay an alkaline intrusion - Cerro Cora - is a carbonatite. Two other alkaline bodies - Cerro Sarambi and Cerro Guazu - are also believed to be carbonatites but, as no work has been done on them at all, it is not possible to make any type of decision regarding their geology.

The region east of the Paraguay River forms the western border of the Paraná basin. Sediments resting on the Precambrian basement are gently tilted toward the east and east-northeast.

3. PAST EXPLORATION

Exploration for uranium has been primarily surface sampling through scintillometer surveys and assays of various rock types.

A sample of monazite from the carbonatite at Cerra Cora contained 7.75% Th and 870 ppm U. Subsequent sampling showed the presence of monazite with 0.3 to 1.0% Th and 18 to 950 ppm U.

In the contact between a diabase dike and a saccharoidal sand some seven kilometers to the north of Piribebuy, a count of 1500 to 1800 cpm was obtained with a scintillometer. Other readings were 1500 to 2000 cpm, 1600 to 1700 cpm, and 3000 cpm.

An augite porphyry in a small hill near Ybycui gave a count of 1500 cpm. A track-etch survey made with 5-kilometer spacings covered all the easily accessible parts of eastern Paraguay from Pedro Juan Caballero southwest to Pilar. The area of most interest was in the southwestern quadrant of eastern Paraguay which recorded several anomalies that roughly coincided with the scintillometer readings.

4. URANIUM OCCURRENCES AND RESOURCES

With the exception of the very low-grade uranium content in a carbonatite at Cerro Cora there is no known uranium in Paraguay.

5. PRESENT STATUS OF EXPLORATION

No current exploration for uranium is reported.

Except for construction and rock materials, all mines belong to the state, but both national and foreign individuals and companies may obtain exploration permits and mining concessions. There are no specific statutes regarding atomic energy.

6. AREAS FAVORABLE FOR URANIUM MINERALIZATION AND POTENTIAL FOR NEW DISCOVERY

Paraguay is situated on the western margin of the Parana Basin which contains the Figueira area (in Brazil) where uranium is found in the Rio Bonito Formation (middle Permian). The Passa Dois Series in Brazil includes all the formations of

southern Brazil that are considered to be Permian in age. These rocks form part of the southeastern edge of the Paraná Basin. The Permian formations of the southern area of eastern Paraguay are believed to correlate with these uranium-favorable beds. Very little, however, is known of the Permian beds except that they are mainly sandstones and shales and that some of the beds are plant bearing. Deltaic crossbedding has been observed in many areas. Some observers believe these rocks can be also correlated with the uranium-bearing Karoo formations of southern Africa. Although there is no direct evidence of uranium mineralization in Paraguay, the correlations with the Permian of Brazil suggest that uranium mineralization might well occur.

The uranium potential is estimated at 1,000 to 10,000 tonnes.

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