Paper G 27

GEOLOGIC HYPOTHESES ON LAKE TANGANYIKA REGION, ZAIRE, DRAWN FROM ERTS IMAGERY

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INTRODUCTION

Based on initial work in the Lake Tanganyika area of eastern Zaire, we conclude that ERTS imagery is extremely useful for reconnaissance level geologic mapping and analysis in this region of the humid tropics. In particular, ERTS imagery has proven useful for recognizing and mapping regional structural units, for recognizing major structural features, and for arriving at some preliminary hypotheses about the mineral potential of the area. Results so far indicate that ERTS imagery can make a major contribution to the development of the mineral resources of our country. We hope to continue our research as principal investigators in the ERTS-B program.

The Government of Zaire is not a selected ERTS-1 principal investigator. We learned of the program too late to successfully propose an experiment. However, recognizing the wide range of potential applications that ERTS imagery could have in the field of resource inventory, management and development in our country, and anticipating the possibility of participating as Principal Investigators in the ERTS-B program, the Government of Zaire undertook an independent research program on the applications of ERTS imagery to several resource problems.

Our research has concentrated on applications of ERTS imagery in the field of cartography, geology, forestry, hydrology and agriculture. For the work in geology reported here, we chose a test site in eastern Zaire on the shore of Lake Tanganyika in the vicinity of the Lukuga River. This area was selected because of its varied geology and the existence of two frames of cloud-free ERTS imagery.

The ERTS imagery used for the experiment includes 70mm transparencies, 1:1,000,000 scale black-and-white prints and selected enlargements, and a limited number of color composites. For the most part, we used standard photo interpretation techniques and checked our interpretations with field work and existing work.

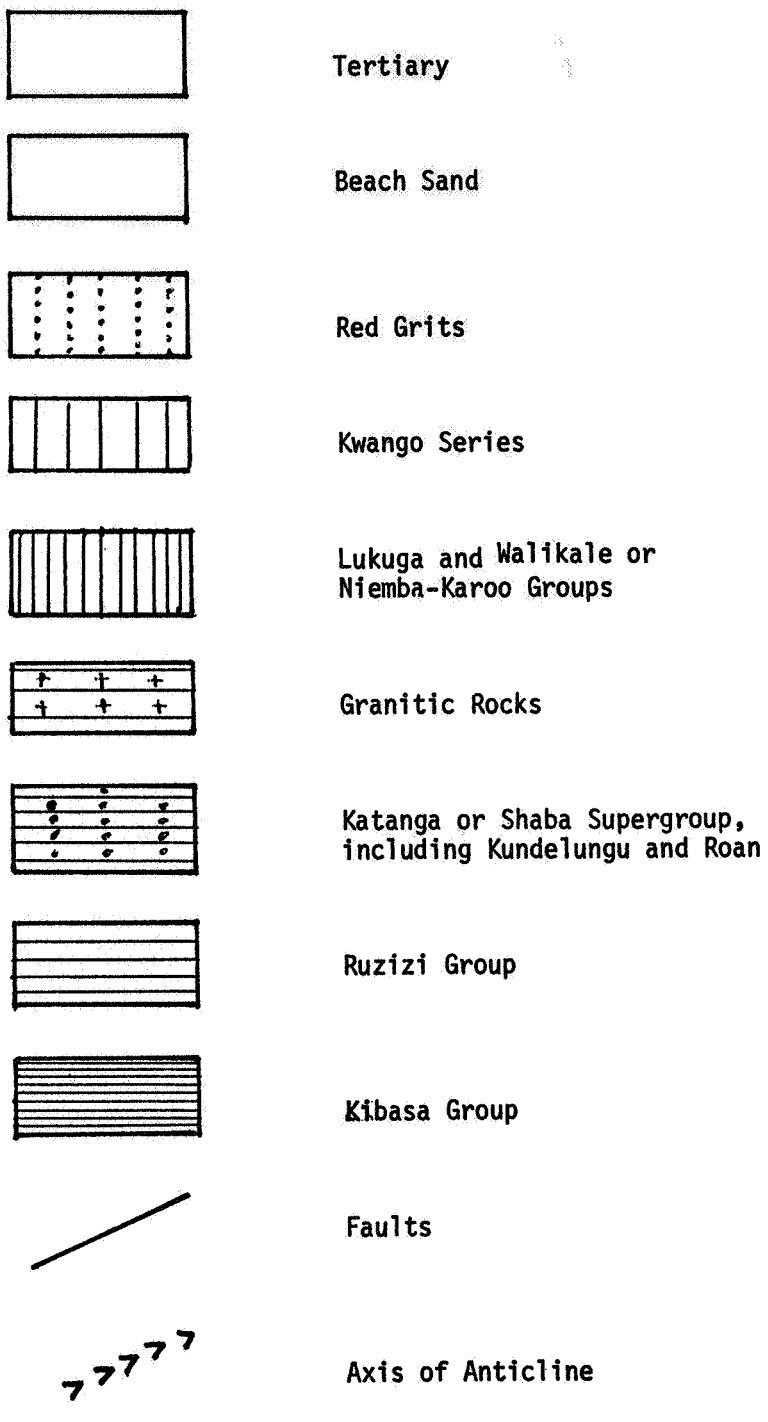
GEOLOGIC INTERPRETATION

The following observations are based on interpretation of ERTS frames 1052-07411 and 1052-07413 by geologists in the Bureau du President of Zaire (Figure 1).

Structural Units

The area covered by the two images can be divided into two zones separated by the Lukuga River. Within these two zones we were able to recognize and delineate nine major tectonic units. Several other large structural features are expressed clearly. The region studied covers the portion of Zaire lying south of 4°S and bounded by Lake Tanganyika on the east, meridian 28°30'E on the west, and the Lufira sector on the south.

LEGEND FOR FIGURE 1



* Unfortunately, the overlay for Figure 1 was mailed separately and has been lost or delayed in transit.

Figure 1

Southern Zone. In this zone, lying essentially south of 6°S and east of 28°E, one of the most prominent features is a large anticline or dome in the eastern part of the region known as the Grand Dome. In this part of the zone, the Kibasa Group crops out on the dome and are flanked on the north by a narrow band of Lukugian and Wasakalien rocks which lie along the south bank of the Lukuga River. The area underlain by Lukugian rocks is actually divided by the Lukuga River, with a strip of these rocks forming the north valley wall of this river.

The Grand Dome is covered by the Kibasa Formation and surrounded by the Rukugien through Niemba Formations and the Walikien Formation (Carboniferous through Upper Permian). The base of the Niemba is known elsewhere as the Karoo. The Karoo is equivalent to the Gres de Carnot which is well known as a diamond-bearing formation in the Central African Republic. This unit has yielded a few precious stones in the Equator Province of Zaire. In addition to scattered granitic intrusions, the southern part of the area is underlain by the Kundelunga Group, the upper part of the well known Katanga Supergroup which contains the rich copper deposits of Zaire in its lower unit called Roan.

Two large northeast trending faults cut the southeastern part of the Grand Dome. One of these lies essentially on the axis of this breached anticline. The second, essentially parallel to the first, passes through the Baudoinville area.

The rock unit exposed in the southern crestal portion of the anticline is clearly different from the surrounding units. This is the Kundelunga system.

The shores of Lake Tanganyika are composed of recent sediments derived from the upland described above. These sediments may contain detrital deposits of minerals present in the Dome.

Progressing to the west, the western flank of the Dome is bordered by Kibasien rocks which underlie the valley walls of the Niemba River. The region west of the river is essentially a granitoid terrain characterized by a large number of intrustions.

Immediately north and south of the Lukuga River, banks of the river expose a lithologic unit which Cahan has called Red Sandstone.

Northern Zone. This zone extends north of the Lukuga and is dominated by the Muhomba Plateau, an extension of the Mt. Mitumba upland in Maniema.

The units cropping out in the region are, in order of importance, the Ruzizi Group whose synclinal axes are occupied by the Kwango and Lualaba series and overlain by the red sandstones and the Tertiary rocks. It is in these Rheatic age plunging synclines that the coal beds were deposited. Three coal beds are the only mineral deposits currently exploited in this region.

The area is dominated by a large northwest trending fault system, which appears to be traceable in Tanzania across the lake. The

fracture system is composed of a large number of individual faults, all essentially parallel. Another important fault direction is suggested by a northeast trending fault oblique to the larger northeast trending fault.

One interesting feature should be pointed out here. There is a white polygonal area visible in the highlands of the Northern Zone. It has not yet been identified, but it may be a geometrically shaped, light colored granite cut by numerous joints.

As in the Southern Zone, the Northern Zone has a large number of granite intrusions.

Analysis of Mineral Potential

1. The Karoo is a continental deposit (Carboniferous, Permian, Triassic and Jurassic). Rocks of these ages are coal-bearing all over the world and are diamond-bearing in the Central African Republic (Gres de Carnot, for example) and in the Equator Province of Zaire. This unit also forms an extension of the "Golden Belt" of Kivu.

2. Alteration halos surrounding granitic intrusions in the area offer the possibility of supplemental mineralizations such as uranium, beryllium, tin, gold, zinc, lead, silver, etc. Systematic study

of these intrusions, particularly their alteration halos, may lead to economic discoveries depending on the degree of erosion.

3. The faulted areas north of former Baudoinville should be prospected, since they may have related copper and possibly cobalt mineralization. Indeed, these faults cut the underlying Roan copper belt formation. In general, the Katanga or Shaba Supergroup includes three units:

   - Kundelungu;
   - Dolomitic schist, called Minier;
   - Roan (Faisceau des Mines).

Continental Basin

Because we are dealing with a continental depositional site, it might be well to consider the type of deposits we are likely to encounter. In general, a former continental basin is also a former river basin. Thus, there were waters running downhill and converging in the basin. The discovery of current direction indicators in these paleo-channels will indicate the direction to the deepest part of the basin.

There is a wide variety of minerals associated with continental basin deposition, including uranium, vanadium, copper, nickel, etc. For example, the uranium associated with vanadium of the Colorado

Plateau is found in a paleo-river basin, now a desert. Similarly, the uranium in Agades, Niger occurs in a desert paleo-river basin. In fact, these beds are saturated with non-replenished fossil water which defines the extent of the old basin. Copper as well as uranium can be concentrated in the paleo-river channels and basins.

In assessing the mineral potential of continental sedimentary terrains, one must consider both primary and secondary features, that is, depositional and post-depositional possibilities such as secondary enrichment, alteration, etc. These two types of mineralization offer the possibility of not only hydrocarbons and placer deposits such as gold, but also gold, uranium, beryllium, wolframite, copper and zinc.

In light of these possibilities, it is particularly important to consider structurally disturbed areas such as the Permian beds present in the Hercynien folds of the Kibasa region situation on the edge of the African Shield peripheral to the Zaire basin. These are deeply eroded folded chains that contain some volcanic rocks. These are known to contain some deposits of magnetite, ilmenite, nickeliferous minerals, gold in quartz, and tourmaline. Deposits of monazite, uranium and ilmenite result from erosion of the Karoo or Gres de Carnot.

For example, the grits of the thick Karoo in Africa are diamond carriers. As mentioned above, in Central Africa Republic there are diamonds in the Gres de Carnot, the lateral equivalent of the Karoo of Zaire. A few stones have already been found in the Equator Province of Zaire.

In the faulted zones in the region north of Lake Moero and from Kapula to Moba, Seremi has found indications of wolframite, tin, copper, some graphite schists, and indications of gold.

Mineralization Found in the Southern and Northern Zones

The following description of prospecting tends to verify some of the hypotheses based on the interpretation of ERTS data. Regional prospecting work was completed in 1973. In Kivu, block Zer No. 166 probably contains the following deposits:

1. Tin and wolframite on the Grand Dome are considered certain.

2. Tin minerals, ilmenite and tourmaline exist in the metamorphic series and in the black sands on the beaches of Lake Tanganyika.

3. Prospecting in the zone of altered Kibasien evaporites around granites has yielded indications of gold, tin, copper and other associated minerals.

In Shaba, block Zer No. 165 has even more promising possibilities with about fifteen anomalies of copper/cobalt active, gold, tin, wolfram discovered in Haute Luizi and Kongolo, and the discovery of an extension of the Katangian rocks in the southeast part of the block.

The Katanga Supergroup includes the Roan Formation which contains the copper beds. This is a fortunate discovery and prospecting is in progress. Copper and zinc anomalies also were found in Kikwanga, Ngaza in the Cretaceous rocks of Mwajhidi.

Other very recent discoveries include:

August 1973 - Shaba, No. 165

1. Alluvial samples of gold, tin and wolfram in Kongolo and Haute Luizi.

2. The discovery of a deformed Katanga granite outcropping over an area of approximately 1,000 km^2 in the south-eastern part of Zer.

3. Granite and muscovite exposures in the Kibasien.

- Kivu, No. 166

1. Cassiterite in the Kawa River.

2. Syenite and granite-bearing muscovite.

3. Quartz and tourmaline, cassiterite and wolframite bordering the Kivu Permian.

4. Various quartz veins containing wolframite in the northeast of Zer. These indications seem to be promising.

September 1973 - Shaba, No. 165

Several significant samples in terms of their analysis suggest there may be as many as fifteen copper/cobalt anomalies.

- Kivu, No. 166

Several alluvial samples analyzed in the course of a regional geologic study of Kinshasa show concentrations of cassiterite.

CONCLUSION

Our preliminary testing of ERTS imagery for the purpose of assessing mineral resource potential in Zaire involved preliminary delineation of tectonic units and structural features on the imagery, developing hypotheses about mineral potential of the area based on what we saw in the imagery and general knowledge of the geologic units in the area, and preliminary testing of these hypotheses using the most recent information available on results of mineral prospecting in the area. To date, we have used ERTS imagery covering only a small part of our country. From this work we conclude that ERTS imagery can probably make a material

contribution to assessing the mineral resource potential of our country and will be particularly valuable in the less known areas. We very much look forward to ERTS-B and an opportunity to test ERTS imagery for geologic exploration over larger areas.

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