

Congo (Democratic Republic of Congo)

Total population (July 2000 estimate): 51,965,000

Area: 2,345,410 km²

Annual population growth rate (2000): 3.19%

Life expectancy at birth (1998): 51.2 years

People not expected to survive to age 40 (1998): 31.7% of the total population

GDP per capita (1998): US \$822



The Democratic Republic of Congo (DRC), previously called Zaire, is a vast, resource-endowed country with mining and agricultural sectors as the cornerstones of the economy. But despite its rich natural resource base, the DRC is among the least developed countries in sub-Saharan Africa.

Historically, the DRC has been a major mining country, a producer of copper/cobalt, diamonds and gold. The mining sector accounted for 25% of the GDP and three quarters of the total export revenue. Both large mining companies and artisanal miners extracted the mineral resources of the DRC. Artisanal miners have historically accounted for the extraction of the largest portion of diamonds (Coakley 1995). Despite civil war and insecurity, artisanal miners continued to mine diamonds and, in addition, produced approximately 9,000 kg of gold in 1994.

Continued civil war and the general breakdown of the formal economy and existing infrastructure have disrupted much of the mineral production in the country. Presently, copper production is only at 5% of capacity.

The International Labour Organisation (1999) reports the activities of 150,000 small scale gold and diamond miners.

The agricultural sector is largely subsistence based. In 1999 agriculture contributed approximately 58% to the GDP. The main food crops are maize, bananas/plantains, sweet potatoes, cassava and rice. Coffee is the main export crop.

Geological outline

The Congo Basin, made up largely of Mesozoic and Quaternary sediments, occupies large areas in the west and centre of the country. Precambrian metamorphosed sediments and Proterozoic platform sediments occur in the eastern part of the country. Dolomites and Neoproterozoic sediments of the Katanga Supergroup (Cahen and Lepersonne 1967) occur in the Shaba Province in the southeast of the country.

Along the Western Rift, in the eastern part of the country are numerous Tertiary to Recent volcanoes, and some carbonatites.

AGROMINERALS

Phosphates

Sedimentary phosphates have been reported in the Bas Congo region, close to the Atlantic Ocean, at the border with Angola and the Cabinda enclave. The area northwest of Boma was intermittently surveyed before 1960. Between 1969 and 1971 the United Nations Development Programme (UNDP/PNUD) carried out exploration work on the 100 km long and 10-20 km wide zone with Upper Cretaceous (Maastrichtian) beds which occur in the Cabinda enclave of Angola and continue into the Democratic Republic of Congo. Several layers of sedimentary phosphates have been found in Angola and the DRC at shallow depth (see Figure 2.2 on page 72 in the chapter on Angola).

During a subsequent project between 1978 and 1980 UNDP/PNUD carried out advanced exploration, including the drilling of 30 boreholes and sinking of 54 pits in areas of phosphate-bearing sediments (Barry 1981). Specifically, the exploration focused on three areas along the northwesterly striking sediments, Fundu Nzobe, Vuangu, and Kanzi (Figure 2.2, page 74).

Work at Fundu Nzobe in the north, close to the border with Angola's Cabinda enclave, showed five phosphate bearing layers of upper Cretaceous (Maastrichtian) to lower Eocene age. The thickness and grade of these sedimentary phosphate beds are: Bed I: 11.5 m, 11.5-18.5% P_2O_5 ; Bed II: 5.5 m, 18-19.4% P_2O_5 ; Bed III: 20 m, 18-19.7% P_2O_5 ; Bed IV: 5.1 m, 20.6% P_2O_5 ; Bed V: 10.7 m, 31% P_2O_5 . The geological conditions for mining are complicated as a result of structural deformation (open folding and faulting) and overburden. Superficial sand overburden reaches 20 m and more in some places. The resources in the Fundu Nzobe area are substantial but have not been assessed with certainty due their complex structural setting (Barry 1981).

In contrast to the area of Fundu Nzobe, the area of Kanzi in the south, close to the mouth of the Congo River, is tectonically less complicated. The phosphate mineralization consists of one layer of phosphorite only and is relatively uniform. The 8-10 m thick layer at 14% P_2O_5 is covered by a thick sandy overburden. The 'waste-to-ore' ratio ranges from 2:1-10:1. Twelve boreholes were drilled with a total length of 1,460 m (Barry 1981).

Geotechnical studies on samples from Kanzi showed that the ore could be upgraded to 34% P_2O_5 by removal of clay slimes and conventional double flotation methods (Zellars-Williams 1980).

On the basis of the existing borehole and pit data, the total phosphate resources at Kanzi alone were estimated at 20-28 million tonnes of phosphate ore, or 5-7 million tonnes of concentrate (Barry 1981).

The project was undertaken with the aim of developing a phosphate fertilizer plant with the capacity to process 150,000 to 500,000 tonnes of phosphate concentrate per year. The ore was to be mined with large draglines like in Florida and the concentrate was to be processed into phosphoric acid-based P fertilizers. The plan was to combine it with large-scale (100,000 tonnes per year) production of N fertilizers (ammonia). The project was not followed up for various reasons including concerns of economic and technical feasibility (Barry 1981). At the time, no consideration was given to small-scale extraction at sites where overburden is minimal.

Other phosphate resources available in the DRC include igneous phosphate resources, mainly associated with carbonatites.

Two carbonatites, located in the eastern part of the DRC, have been studied in greater detail: the Lueshe and the Bingo carbonatites. The Lueshe carbonatite (1°0'S; 29°8'E) is mainly made up of a syenite and carbonatite, with little apatite as an accessory mineral (Maravic and Morteani 1980). Biotite and vermiculite occur along the contacts of the dolomitic carbonatite, which is 822 ± 22 million years old (Kampunzu *et al.* 1998). The carbonatite is Nb-rich (de Kun 1961; Verhaeghe 1964), with a grade of 1.34% Nb_2O_5 in the residual soils. The principal niobium mineral is pyrochlore. An average chemical analysis of the lateritic residual soils is 5-9% P_2O_5 (Maravic *et al.* 1983).

Following the discovery of 3 million tonnes of pyrochlore-bearing ore at the Lueshe carbonatite, a pilot plant for the extraction of pyrochlore was started in 1986 by the German led company SOMIKIVU (Mining Annual Review 1985). The pilot operation with a production of 2 tonnes per hour came to an end in the fall of 1993 when the security situation worsened.

The Bingo carbonatite (0°5'N; 29°31'E) is mentioned by Verhaeghe (1964) and Lubala *et al.* (1985) as a carbonatite with large phosphate reserves, 'la réserve des phosphates semble énorme' (Verhaeghe 1964, p.23). Recent investigations at Bingo concentrated on the mineralogy of the Nb-bearing mineral, pyrochlore (Woolley *et al.* 1995; Williams *et al.* 1998). No detailed work on phosphate seems to have been carried out in recent years.

Limestone/dolomite/travertine

The limestone/dolomite resources of the DRC are substantial. Proterozoic marbles and dolomites are reported from near Lubudi where marble is used for the local cement industry (Buffard and Vicat 1975). Carbonates for the production of cement are also found around Lubumbashi in the 'copper-belt,' near Kalemie on the shores of Lake Tanganyika, north and northwest of Lake Kivu, near Kisangani, and in the Central Kasai Province (near Gandajika). Verhaeghe (1964) describes 16 metamorphic limestone occurrences in the North Kivu area and 12 from the South Kivu area alone. Precambrian calcareous metasediments are also found in the extreme west of the country (between Kinshasa and the coast) as part of the 'Schisto-Calcaire' sequence of the West Congo Series. Cretaceous limestones are exploited for use in cement production at Lukula in the west of the country.

The carbonatite of Lueshe contains considerable amounts of carbonates along with phosphates and pyrochlore. The Bingo carbonatite contains only small carbonate resources.

There are numerous travertine occurrences in the east of the country, along Lake Kivu and Lake Edward (Verhaeghe 1964; Gwosdz 1996). From the 19 travertine occurrences in the Kivu area, as described in detail by Verhaeghe (1964), some have resources in excess of 2 million tonnes. Many of these resources are of local importance.

Limestone is used for cement industries at five sites (near Likasi, Kalemie, Kimpese, Lubudi and Lukula). At the end of the 1970s, lime was produced on an industrial scale and by numerous small local industries with a total production of 120,000 tonnes (Gwosdz 1996).

Agromineral potential

The Democratic Republic of Congo is endowed with considerable agromineral resources. So far only a few systematic surveys have been carried out and it is likely that considerable amounts of additional agrominerals are yet to be discovered in the DRC. Resources of sedimentary and igneous phosphates have already been found.

The potential for developing the upper Cretaceous to Eocene sedimentary phosphates on a small scale for local consumption is high, especially in the Bas Congo area. These phosphates, located in the striking continuation of the Angolan phosphatic sediments, occur close to the surface and can be easily extracted.

Igneous residual phosphates may be extracted from the known mineralized carbonatites of Bingo and, as a by-product from Nb mining, from the Lueshe carbonatite complex.

The unmetamorphosed Neoproterozoic sequences of the West Congolian Supergroup overlying tillite horizons should be explored for their phosphate potential. The structural and stratigraphic position of the phosphate occurrence in the neighbouring Republic of Congo provides a good initiative to explore for phosphates in the Neoproterozoic Schisto-Calcaire.

Limestone and dolomite occurrences are widespread and may be developed on a small-scale in areas close to acid soils.

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