Chromium & Nickel
in Sudan

Republic Of The Sudan
Ministry of Minerals

Geological Research Authority of the Sudan (GRAS)

Chromite

Podiform chromite (chromium ore) occurrences were first reported in the Sudan in early 1930s. Small-scale mining of the ore is in progress intermittently since the 1950s. At present, Sudan produces around 40,000 tons of chromite annually. Recent studies have shown existence of many Late Proterozic Alpine-type ultramafic massifs, as part of dismembered ophiolites contain numerous pods of chromite, which at some localities furnish economic deposits. Target areas will be reviewed hereinafter according to their potentialities, available information and access.

Ingessana Hills Area:

The Ingessana Hills area of the Blue Nile State lies about 80km SW of Ed Damazin; the state capital. The Ingessana area is connected to Ed Damazin by a asphalt road. Ed Damazin lies near the main hydroelectric power station in Sudan. It has an air strip, and is connected to both Khartoum and Port Sudan by rail and asphalt roads.

Brief Geology of Chromite Occurrences:

The Ingessana massif (Lat. 11^0-$11^0$3' N Long. $34^0$00' -$34^0$07'E) is by far, the largest mafic-ultrarnafic complex in the Sudan. It represents the main and central part of the Ingessana-Kurmuk Ophiolite Belt. The massif comprises a highly serpentinized dunite-harzburgite lower facies overlain by peridotite and minor pyroxenite Chromite occurrences in the Ingessana massif is hosted by the lower dunite-harzburgite facies. The ore bodies are generally lenticular and range in size from 10 to 5Om long, 1 to 3m thick and 30 to l00m downdip extensions. The ore is generally massive, compact and consists of chrome-spinal, sometimes ferruginous with minor chrome chlorite and chrome garnet. Chemically, the ore is of metallurgical grade with a high Cr/Fe ratio.

Semi-detailed exploration in 1970s revealed total calculated ore reserves of about 750,000 tons with an average grade of 50% chromite. However, mining operations carried out so far anticipate a much bigger reserve in Gam mining area that is now leased to a national company. Disseminated low-grade banded chromite ores are also common in the Ingessana area, with up to 25% Cr_2O_3. Low-grade ore reserves in the waste dumps of the old mines were calculated totaling 120,000 tons with a Cr_2O_3 content of 22.6%

Chromitiferous black sand occurs in Ingessana Hills covering an area or several square kilometers. New discoveries of chromite ores of variable grades are being reported quite often.

QaIa En Nahal Area:

Mafic-ultramafic rocks, similar to those in the Ingessana Hills, crop out in two areas to the northeast of the Blue Nile-Dinder-Rahad Rivers at Qala En Nahal and Umm Saqata areas in Gedarif State. Chromite has been reported from the above mentioned localities in the form of small pods and lenses hosted by serpentinized dunite-harzhurgite units. The ore bodies vary in length from 3 to 6m, 1.5 to 2m in thickness

and unknown downdip extension. The ores are generally massive, with Cr_2O_3 concentration ranging between 25 and 37.8%.

Eastern Nuba Mountains:

The eastern part of the Nuba Mountains in the Central Sudan is predominantly covered by low-grade volcano-sedimentary sequence with dismembered ophiolitic bodies. The lower facies of the ophiohite comprises serpentinized dunite-harzburgite units that contain podiform chromite lenses. The analysis indicated the following concentrations: 30% Cr_2O_3, 12% Al_2O_3, 22% Fe_2O_3 and 12% SiO_2. The ore is composed of chrome spinel intimately undergrown with silicates. About 26 chromite occurrences have been recorded.

The Red Sea Hills Region - Onib area:

The Red Sea Hills Region of the Eastern Sudan is an integral part of the Late Proterozic Pan African Arabian-Nubian Shield. It comprises distinct terranes, and plutonic equivalents, all separated by ophiolite-decorated sutures. However, only the occurrences in the Onib ophilite may be considered of economic interest. There are a number of chromite bodies in the Onib ophiolite occurring as small pods and schilieren e.g. Wadi Sudi area.

The most important occurrence is found in Wadi Hamissana area where massive and sub-massive podiform chromite lenses are scattered within the serpentinites. The largest body is a lens 250m long, 5m average thickness, and 100m downdip extension. The ore is massive and coarse-grained. Assay results show an average of 28% Cr_20_3 and 2.50% Cr/Fe ratio. Small pockets of massive chromite have been reported from highly serpentinized ultramafic rocks of the Oshib ophiolite in the Nakaseib surture to the south.

The Jebel Rahib Area:

The Jebel Rahib area is located in North Darfur State. It is dominated by low-grade sequence of rift-type sediments with a complete but dismembered Late Proterozoic ophiolite complex.

Three zones characterized by chromite mineralization were identified. The major of which extends for more than 1km in a NNE-SSW direction and is about 200m wide. The zone contains several pods of chromite, some of which may attain 50m length and about 2 to 3m thickness, hosted by highly serpentinized dunite-harzburgite tectonite complex. The ore is very compact, massive and coarse-grained. Average Cr_2O_3 content is about 55%. The ore reserves, thought promising, are not yet determined.

Northern Sudan:

Recent studies resulted in the discovery of the Atmur-Delgo dismembered ophiolite belt, extending from the Nile to the NW of the Red Sea hills. Mafic-ultramafic massifs have been found with the major thrust slices. The west units of the massifs are dominated by highly-serpentinized dunite-harzburgite facies with pods of chromite. The latter vary from centimeter scale schilieren to lenses of more than one meter in length and up to 50cm in thickness. The ore is massive and compact. Sometimes it's highly sheared and the lenses show boundinage structure. Cr_2O_3 content of the samples collected from Wadi Akasha area reaches up to 31%. The area is accessible throughout the year and the massives are located between the River Nile and Wadi Halfa-Atbara railways line.

Nickle:

Nickel deposits are classified as either magmatic stratiform or lateritic deposits. So far, the magmatic deposits have not been reported in Sudan. However lateritic horizons with anomalous nickel values have been found associated with Late Proterozoic ophiolite mafic-ultramafic rocks in some investigated areas like Ingessana Hills, Jebel Rahib, and the Nuba Mountains.

1) Ingessana Hills:

Geological exploration by the UNDP mission in 1971 revealed some crests of highly anomalous nickel (up to 2.8%) in birbirite capping the crets of serpentinized ultramatic ridges of the Ingessana complex. The report concludes that the nickel-enriched zones are small remnants of an old lateritic weathering profile. However, recent investigations have shown the existence of similar mafic-ultramafic units cropping out discontinuously over an extensive stretch of land (~200km) aligned to the NE-SW of Ingessana Hills. Both recent and old lateritic weathering profiles occur. Detailed geochemical exploration for lateritic nickel occurrences is therefore, recommended in the region.

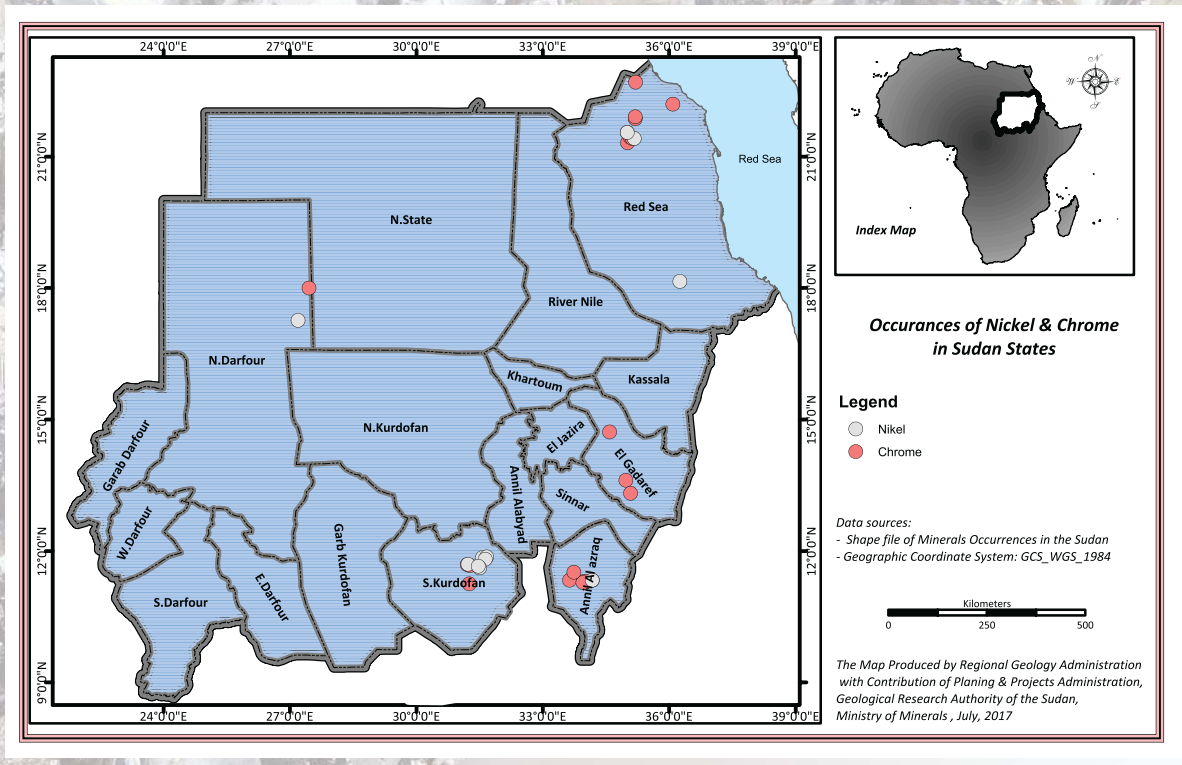
2) Jebel Tawiga - Jebel Tageru Area:

Nickel bearing laterities occur in Jebel Tawiga-Tageru area that lies between Lat. $17^0$16'-$17^0$26' N and Long. $27^0$11'-$27^0$12' E in North Darfur State. The area is accessible through good deserts roads throughout the year. Geologically, mainly low-grade metasediments and metavolcanics underlie the area. The latter represents the southern continuation of the Jebel Rahib ophiolite sequence. Lateritisation of these rocks took place at the termination of their structural evolution in the Late Proterozic. The weathering crust covers an area of about 1000 km2 and reaches thickness of about 25m. The weathering profile consists of a thick kaolinitic sarpolite overlain by 2-10m of laterite. Such concentration may encourage detailed exploration for lateritic nickle deposits.

3) Nuba Mountains - Nickle:

Geological mapping and geochemical exploration in the Nuba Mountains revealed the existence of base metal gossans anomalous in copper, zinc, and nickel. The gossans occur on top of low-grade volcanic rocks with ferruginated cherty sediments that crop out discontinuously for more than 50km along the eastern margin of the Nuba Mountains.

The average nickel content in the different gossans ranges from 112 ppm in Biteria area to 5,744 ppm in Jebel Tumluk area. The maximum value obtained so far is 10,000 ppm. Recent investigations proved the presence of similar gossans on the western margin of Nuba Mountains. Detailed geological and geochemical exploration supplemented by drilling is recommended to evaluate the economic potentially of these gossans, which overly massive sulphides of nickel and other base metals.



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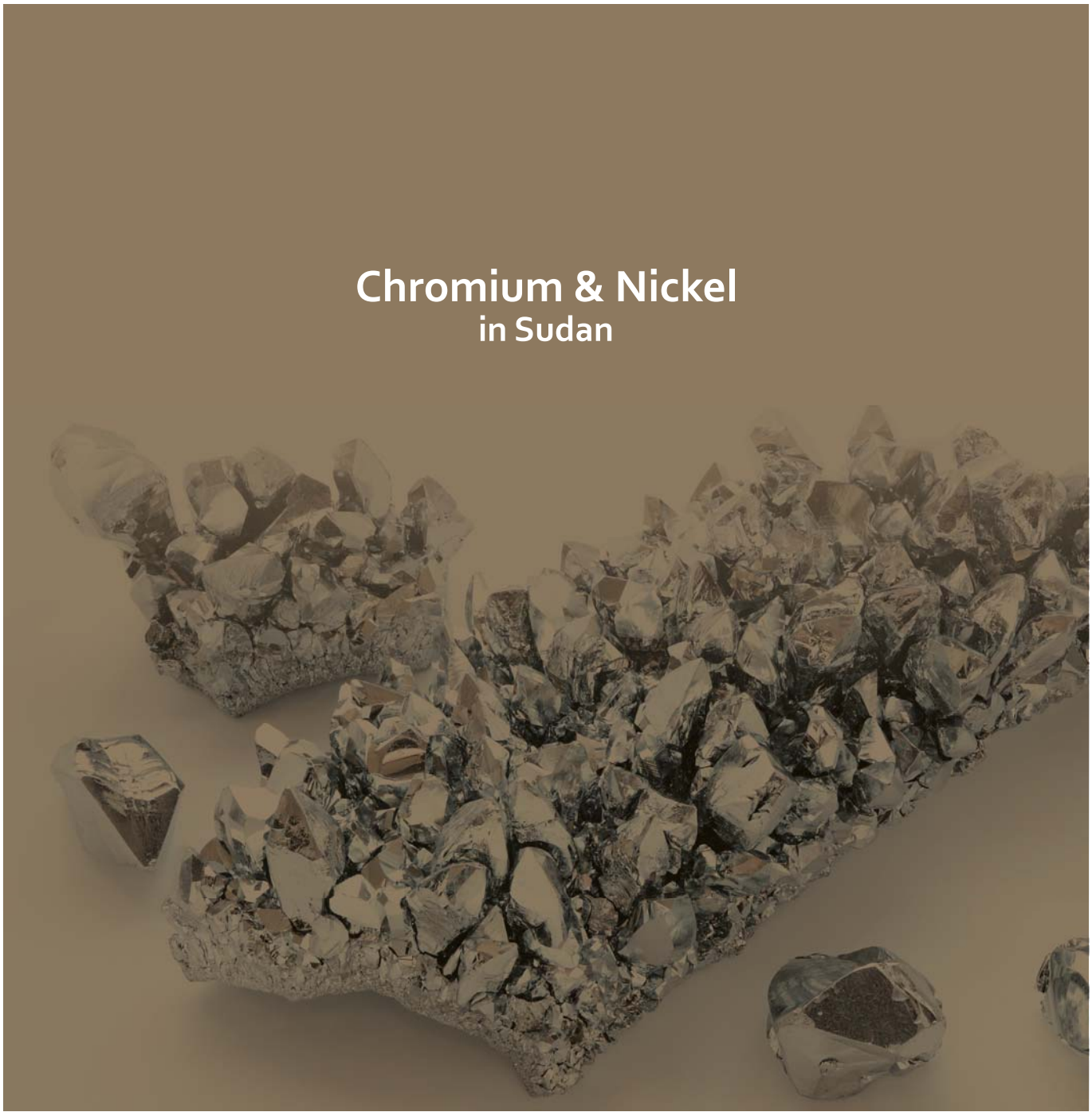

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