

Chromite Mineralization and Exploration in Ontario

Chromite in Ontario

Introduction

Chromium is the 'Stainless' in stainless steel, imparting it with a high resistance to corrosion and its shiny appearance. Chromite ((Fe, Mg)(Cr,Al)₂O₄) is the major ore mineral of chromium. Ninety percent of the chromite mined worldwide is converted to ferrochrome, which is used in the production of stainless steel. Ferrochrome is an iron-chromium (Fe/Cr) alloy produced in a high-temperature electric arc furnace from processing chromite ore. There is no substitute for this alloy. Chromite is also a key industrial mineral used for the manufacturing of refractory bricks, furnace linings and foundry sand because of its very high melting point.

Seventy per cent of the world's current chromite reserves are located in South Africa and Zimbabwe. Finland, Kazakhstan, Turkey, India and Brazil also have chromite resources. Ferrochrome production is dominated by South Africa, Kazakhstan and India. China is the largest (50%) consumer of ferrochrome.

Geology

Chromite is iron-black to brownish-black with a metallic lustre, a hardness of 5.5 and a specific gravity from 4.1 to 4.9 (moderate to high). Chromite is one of the earliest minerals to crystallise from a cooling mafic or ultramafic magma. Such igneous rocks are relatively low in silica and contain a predominance of dark, iron- and magnesium-rich minerals, primarily pyroxene and olivine. A rock composed chiefly of chromite (often with a mixture of magnetite or hematite) is known as chromitite.

The 'Ring of Fire' chromite deposits are stratiform in nature and belong to the magmatic Cr-Ni-Cu-PGE deposit type associated with layered mafic to ultramafic intrusions. Examples of this type of deposit include the Bushveld Complex in South Africa, the Great Dyke in Zimbabwe, the Kemi deposit in Finland, the Stillwater Complex in Montana (USA), the Campo Formosa and Jacurici Valley in Brazil, the Muskox Intrusion in the Northwest Territories and the Bird River Sill in Manitoba.

Exploration in Ontario

Chromite and other metallic deposits found in the 'Ring of Fire' have recently brought worldwide attention to the James Bay Lowlands area of Ontario. The only historic production of chromite in Ontario was from a small mining operation which closed in 1937, north of Thunder Bay. Chromite Mining and Smelting Corporation Limited outlined a 25,000 ton deposit averaging 12% Cr₂O₃ in 1934 from the Puddy-Chrome Lakes area. Bulk samples were extracted and run for concentrate testing. A 1979 study by the Ontario Geological Survey to examine chromite mineralization across the province documented five significant occurrences (see map) and established average chromium values for various mafic and ultramafic rocks.

Diamond exploration in the west-central portion of the James Bay Lowlands in Northern Ontario eventually led to the discovery of other metallic deposits. In 2008 and 2009, the Blackbird 1 and 2 chromite deposits were discovered by **Noront Resources Ltd.** During this period, 3 additional chromite deposits were discovered, including the SKF Joint Venture (**Spider Resources Inc., KWG Resources Inc., and Freewest Resources Canada Inc.**), Big Daddy chromite deposit and **Freewest Resources Canada Inc.**'s Black Thor and Black Label deposits. Subsequently, **Probe Mines Limited, Noront Resources Ltd.** and **Fancamp Exploration Ltd.** discovered their Black Creek, Blackstone and C-3 Horizon chromite zones, respectively. These chromite discoveries lie along a 12- to 14-km long northeast trend and are all hosted by the same layered mafic to ultramafic intrusion, known as the Ring of Fire Intrusion.

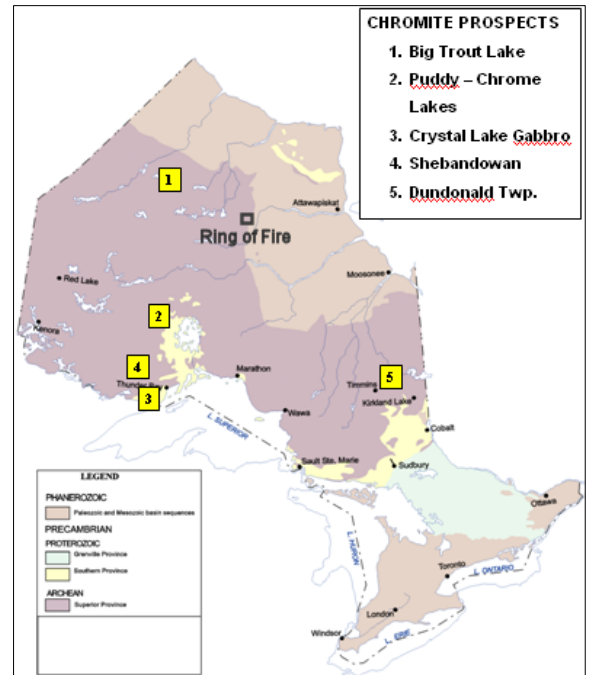
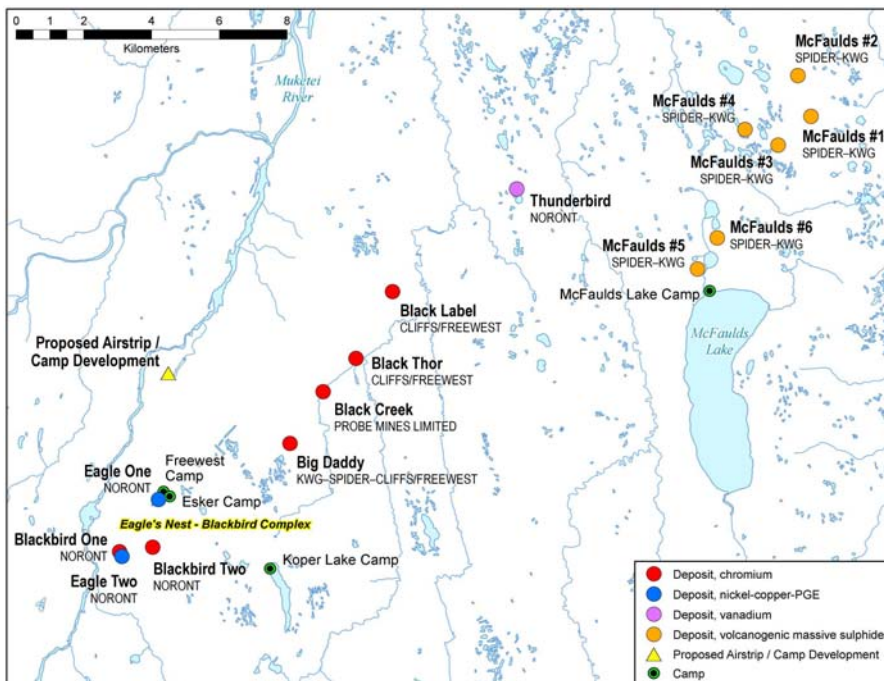
The strategic significance of these chromite discoveries to the North American steel industry attracted the interest of **Cliffs Natural Resources Inc.** Cliffs is the largest producer of iron ore pellets in North America, a major supplier of direct-shipping lump and fines iron ore out of Australia and a significant producer of high- and low-volatile metallurgical coal to the steel industry. For many decades North American stainless steel has been produced with imported ferrochrome because there is no domestic source. The Ring of Fire deposits represent the most significant chromite discovery made in North America, and possibly one of the largest chromite discoveries in the world.

In 2010, Cliffs Natural Resources acquired Freewest Resources Canada Inc., majority ownership of Spider Resources Inc, and a 19.3% share of KWG Resources Inc. This gives Cliffs a major share in 3 of the known chromite deposits in the Ring of Fire.

Published NI 43-101-compliant resource estimates are provided below. Drilling is ongoing and there are suggestions that these resources could support mining operations for more than 100 years.

Company / Deposit	Resource Category	Tonnage and Grade
Cliffs Natural Resources Inc. / Black Thor	Inferred	69.6 Mt @ 31.9% Cr ₂ O ₃ (@ 25% Cr ₂ O ₃ cut-off)
Cliffs & KWG Resources Inc. / Big Daddy	Indicated	23.2 Mt @ 40.66% Cr ₂ O ₃
	Inferred	16.3 Mt @ 39.09% Cr ₂ O ₃
Noront Resources Ltd. / Blackbird	Measured and Indicated	7.562 Mt @ 36.34% Cr ₂ O ₃
	Inferred	3.488 Mt @ 34.93% Cr ₂ O ₃
Probe Mines Limited / Black Creek	Measured and Indicated	5.714 Mt @ 40.00% Cr ₂ O ₃
	Inferred	2.726 Mt @ 40.99% Cr ₂ O ₃

In March 2009, European and North American importers paid approximately US\$0.86 per pound for South African ferrochrome. Since this time the price has climbed steadily as the world demand (mainly from China and India) for stainless steel has increased. The spot price for ferrochrome on February 16, 2011 was US\$1.35 per pound.



For more information about exploration opportunities in Ontario, go to:

http://www.mndmf.gov.on.ca/mines/ogs/resgeol/rfe/default_e.asp