

# Copper Cliff, Greater Sudbury

## A Driving Tour of Greater Sudbury's Mining Industry

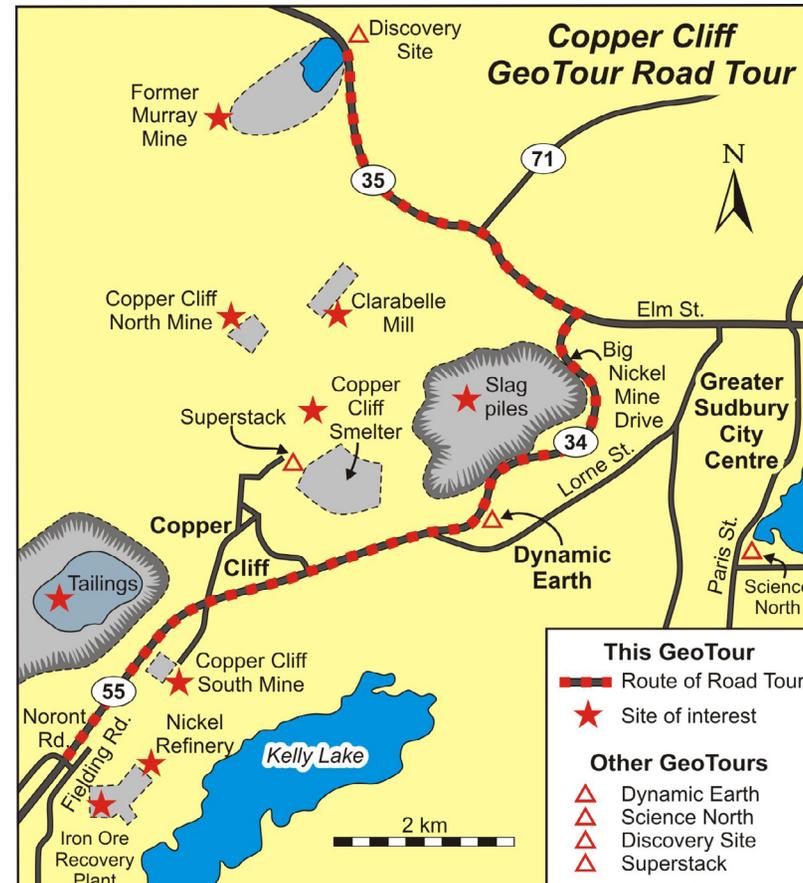
The Copper Cliff area of Greater Sudbury hosts one of the greatest concentrations of mining infrastructure anywhere in the world. A mine, mill, smelter, nickel refinery, extensive slag dumps and tailings deposition areas can be viewed from the major roadways. This guide outlines a short trip by car that provides views of these key elements of the local mining economy. Dynamic Earth, one of Canada's finest geoscience centres, lies along the route and provides an underground mine tour for visitors.



Aerial view looking northeast along Regional Road 55 and across the town of Copper Cliff. Seven major mining and mineral processing facilities are visible: inactive iron ore recovery plant (IOR), nickel refinery (NR), inactive southern headframe of the Copper Cliff Mine (CCS), active northern headframe of the Copper Cliff Mine (CCN), Copper Cliff smelter complex (SM), Superstack (SS) and Clarabelle mill (CM).

### How to get there

The tour starts on Regional Road 55 at the intersection with Noront and Fielding roads, 2 km west of Copper Cliff and 8 km west of Greater Sudbury city centre. The route follows regional roads 55, 34 and 35 to the east and north. Stops can be made at both Dynamic Earth (View 5) and the Discovery Site historic marker (View 8), and there are separate GeoTour guides for both these sites.



A map of the GeoTour route in the Copper Cliff area of Greater Sudbury showing the various mines and mineral processing facilities. Also shown are other tour sites in the GeoTours Northern Ontario series.

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## From mine to metal

Nickel-copper ore is mined, milled and refined within a 20 km<sup>2</sup> area centred on the town of Copper Cliff. It is remarkable that in this small area, a series of industrial operations transforms ore, mined deep in the Earth, into high-purity metal ready for sale on the international market. This industrial landscape displays a century-long history of intensive human use. These lands also illustrate community and industry success in replanting trees and grasses to restore ecological function.

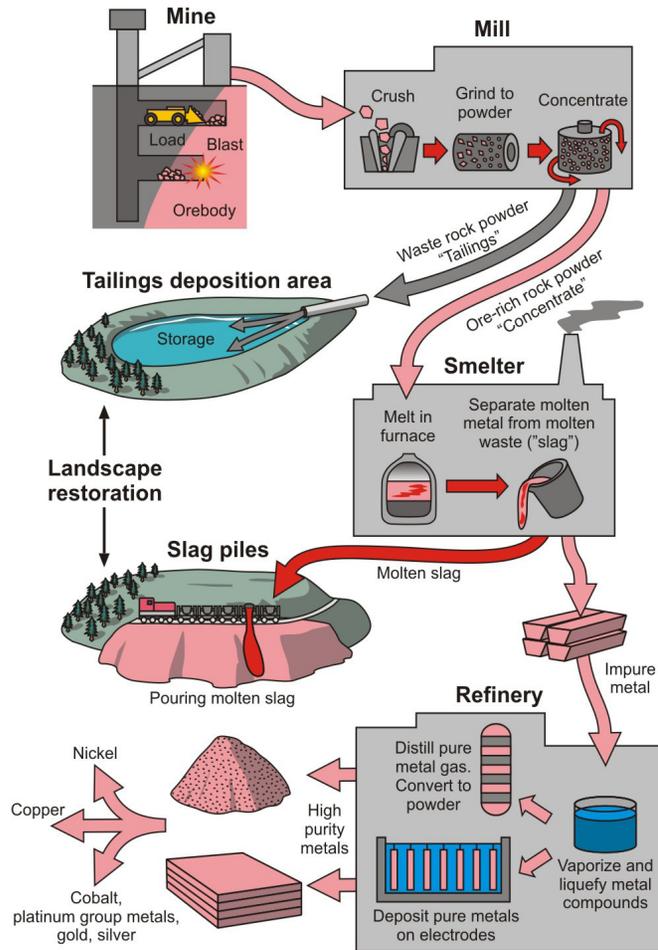


Diagram showing the stages of mining, milling, smelting and refining in the Copper Cliff area.

## View 1: Iron ore recovery plant and Copper Cliff nickel refinery

GPS co-ordinates: N46° 26.930', W81° 05.725'

The imposing red brick building and chimney of the decommissioned iron ore recovery plant rise above the junction of Regional Road 55 with Fielding Road. Greater Sudbury ores are largely composed of iron and sulphur. Iron was recovered for sale during the plant's operation, from about 1955 to 1990. Also in view is the Copper Cliff nickel refinery, where processed ores from the Copper Cliff smelter are further refined into nickel, copper, cobalt and platinum products. Nickel metal is used in the production of corrosion-resistant steel alloys, such as stainless steel, as well as nonferrous metal alloys, magnets, rechargeable batteries and coinage.



**View 1:** View, towards the northeast, of the red brick iron ore recovery plant (foreground) and nickel refinery (background). The recovery plant's 193 m chimney was the tallest in the world when it was built in 1954.

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## View 2: Copper Cliff (South) Mine

GPS co-ordinates: N46° 27.559', W81° 04.909'

Regional Road 55 passes a curious box-like tower, which is the southern headframe of the Copper Cliff Mine. This headframe stands directly above a mine shaft and houses the pulley structure and cables that raise and lower elevator cars in the mine shaft. This giant elevator system moves miners, equipment, ore and waste rock as much as 1300 m between the surface and mine workings. This shaft is like the tip of an iceberg, as it connects to a vast and hidden underground network of mine workings that extend over a lateral distance of 6 km from north to south and as much as 1500 m deep. These mine workings lie deep below Regional Road 55 and the town of Copper Cliff. The Copper Cliff Mine began in 1887 at a site now within the town of Copper Cliff and was the first major mine to be developed in the Greater Sudbury area.



**View 2:** An aerial view of the inactive Copper Cliff (South) Mine, showing the headframe on the left. Regional Road 55 is in the upper right. When the headframe was active, ore was raised from the mine and moved by an inclined conveyor to ore bins in the white building above railway tracks, where it was loaded in rail cars for shipment to the nearby mill.

*Photo courtesy of the Ontario Geological Survey.*



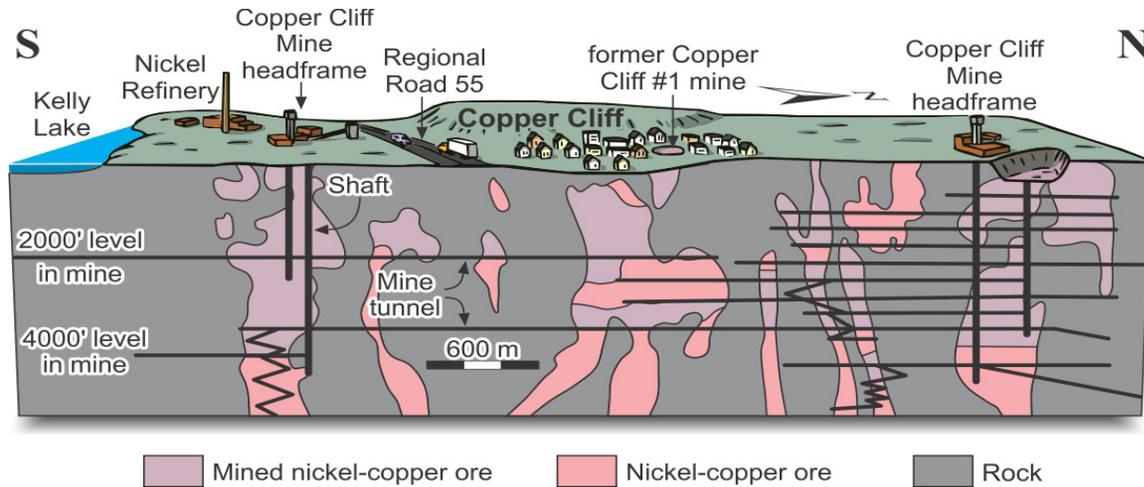
**View 2:** The concrete tower (photo right) adjacent to Regional Road 55 is the inactive southern headframe of the Copper Cliff Mine. The Superstack chimney at the Copper Cliff smelter rises in the background.



**View 2:** A rock-drilling machine used in an underground mine in Greater Sudbury. Drills mounted on the long mechanical arm are used to create holes that are then loaded with explosives. Blasting breaks the ore into rock fragments that are transported to surface and then to the mill for crushing and grinding.

*Photo courtesy of Vale.*

# Copper Cliff, Greater Sudbury



**View 2:** A cross-section of the underground workings of the Copper Cliff Mine, looking west. Much of the remaining ore is in the deepest parts of the mine. The original site of the Copper Cliff Mine (#1 mine) is located within the town of Copper Cliff.

## View 3: Copper Cliff tailings deposition area

GPS co-ordinates: N46° 27.559', W81° 04.909'

On the north side of Regional Road 55, opposite the Copper Cliff South mine shaft, reclaimed slopes have been planted with trees and grass. These slopes are the sides of human-made hills created by the deposition and storage of mining waste. The top of each hill holds a shallow lagoon called a tailings pond. Ore from Greater Sudbury mines is crushed to a fine powder at the Clarabelle mill (see View 7) and the powdered ore minerals are separated from the powdered waste rock. The powdered waste rock, or *tailings*, are transported as a wet slurry by pipeline to the tailings pond, where they are deposited. Once dry, they can be revegetated with grasses and trees.



**View 3:** Aerial view of tailings ponds north of Regional Road 55 (lower left). Oxidation of the iron-bearing tailings produces rusty-coloured shorelines. The slopes of the tailings pond hills have been planted with trees and grasses. *Photo courtesy of the Ontario Geological Survey.*

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## View 4: Copper Cliff smelter

GPS co-ordinates: N46° 27.885', W81° 04.608'

The Superstack towers above Regional Road 55 near Copper Cliff. The Superstack is the iconic chimney of the Copper Cliff smelter and, with a height of 380 m, it is the second tallest chimney in the world. Finely ground nickel and copper concentrate from the Clarabelle mill is roasted and then melted in the smelter, separating metal in a molten state from waste components, or *slag*. The *Copper Cliff Smelter Superstack* guide in the *GeoTours Northern Ontario* series provides further explanation of the smelting process.



**View 4:** Aerial view of the Copper Cliff smelter complex. Regional Road 55 is in the lower left. *Photo courtesy of the Ontario Geological Survey.*



**View 4:** Copper Cliff smelter and Superstack from Regional Road 55 at Copper Cliff.

## View 5: Dynamic Earth

GPS co-ordinates: N46° 28.432', W81° 02.081'

The GeoTour route follows Big Nickel Mine Drive (Regional Road 34) from Regional Road 55 past the entrance to Dynamic Earth. This well-known geoscience centre is a popular attraction for residents, students and tourists. See the *Dynamic Earth* guide in the *Geotours Northern Ontario* series for a description of geological features in bedrock surrounding the geoscience centre.



**View 5:** Dynamic Earth includes an underground tour that describes both modern and historic mining practices.

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## View 6: Slag piles

North of Dynamic Earth, Big Nickel Mine Drive climbs a steady grade along the grassy slopes of a flat-topped and terraced hill. For the next 6 km, Big Nickel Mine Drive and Regional Road 35 skirt the edges of this hill of waste rock. Slag is the molten waste that is separated from molten metal in the smelter furnaces. Slag is transported in a molten state by train and poured onto the slopes, where it cools, solidifies and breaks into dark-coloured rock rubble. The slag piles you can see from Dynamic Earth have been reclaimed with a soil cover that has been planted with grasses and trees.

GPS co-ordinates: N46° 28.654', W81° 01.984'



**View 6:** Slopes of reclaimed slag piles rise above Big Nickel Mine Drive (Regional Road 34) just north of Dynamic Earth.



**View 6:** Fragment of slag displays a "Swiss cheese" texture that reflects its origin in a smelter furnace, where gas bubbles in molten slag were trapped as the slag began to cool to solid. Crushed slag is used as fill for the beds of roadways and railways in the Greater Sudbury area.



**View 6:** Aerial view of reclaimed slag piles along Big Nickel Mine Drive. Dynamic Earth is the black building in the lower left of the photo.

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## View 7: Clarabelle mill and Copper Cliff (North) Mine

GPS co-ordinates: N46° 30.363', W81° 02.869'

Driving north on Regional Road 35 from Big Nickel Mine Drive, there are views of the slag piles to the west. Some of the slag piles are being quarried and reprocessed for other uses, such as fill for the beds of roads and railways. Further north, near the turnoff to Regional Road 71, there are views of the Clarabelle mill to the west. This mill crushes and grinds ore from mines in the Greater Sudbury area and separates the powdered rock into nickel and copper concentrates that are then sent to the nearby Copper Cliff smelter for further processing.

On the far western skyline beyond the mill is the northern headframe of the Copper Cliff Mine. This headframe rises above a shaft that accesses the northern part of the mine workings that connect underground with the southern headframe (see View 2) along Regional Road 55.



**View 7:** The Clarabelle mill is visible from Regional Road 35 just northwest of Greater Sudbury city centre. *Photo courtesy of the Ontario Geological Survey.*



**View 7:** Aerial view of Copper Cliff (North) Mine. The concrete tower is the mine headframe. *Photo courtesy of the Ontario Geological Survey.*

# Copper Cliff, Greater Sudbury

## View 8: Former Murray Mine

GPS co-ordinates: N46° 31.252', W81° 03.230'

About 4 km north of its intersection with Big Nickel Mine Drive, Regional Road 35 skirts the edge of a fenced lake. This is the flooded workings of the former Murray Mine open pit and the northern end of this GeoTour. Across the road are a pull-out and a historic marker that commemorate the discovery of the Sudbury mining camp. The *Discovery Site of Sudbury Mining Camp* guide in the *GeoTours Northern Ontario* series provides further explanation of the Discovery Site and Murray Mine. Nickel-copper ores were first discovered in the Greater Sudbury area near here during construction of the Canadian Pacific Railway (CPR) in 1883. The Murray Mine was the first producing mine in the Sudbury mining camp. After many years of production from underground workings, the shallowest ores were mined by excavation via a large open pit. This surface mining operation required both Regional Road 35 and nearby CPR railway to be rerouted to their present locations.

We hope you have enjoyed the tour!



**View 8:** Flooded Murray Mine open pit as viewed from Regional Road 35 beside the Discovery Site historic marker.

*Photo courtesy of the Ontario Geological Survey.*



**View 8:** Aerial view of the flooded open pit of the former Murray Mine. *Photo courtesy of Ontario Geological Survey.*

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