

Maintenance group is a third of work force

While most visitors to Island Copper are aware that there are support services to the main jobs of mining and milling the ore, many are surprised by the degree of importance attached to those "secondary" functions. A good case in point is the primary role played by maintenance in the operation of the mine. Most people naturally assume that there are mechanics around somewhere to tinker with all the heavy equipment — but are surprised to learn that more than one third of the mine's total work force is employed in mine and mill maintenance!

The maintenance functions are as numerous and as varied as the mine operations themselves, ranging from road and drainage construction in the pit, through repairs to the haul trucks and other heavy equipment, to maintenance of the complicated milling equipment in the concentrator.

The mine maintenance department alone is divided into no less than nine separate sections, each with its own area of responsibility. These are the haul truck section, "cat" section, pit maintenance, lubrication bay and the electrical, welding, tire, machine and gas shops. Then there are special sections such as the mobile crews which work on the big shovels and drills in the pit, and the special projects crew which tackles non-routine jobs in the mill.

All these sections are on the job 24 hours a day to keep up with the wear and tear to equipment. The big haul trucks, for example, are refueled and the oil level checked twice every 24 hours. They are brought into the shop every 84 hours for lubrication and a complete inspection of every moving part. Every 150 or 250 hours, depending on the type of engine, the trucks come in for a complete inspection and an oil and filter change.

The same kind of preventive maintenance and repair schedules apply to the big shovels, drills, dozers and graders — not to mention

the more than 90 small vehicles including pickups, fork lifts, dump trucks, lube and fuel trucks and small tractor units.

Some idea of how tough the road and weather conditions can be on the operating equipment can be seen in a comparison of the "life" of an ordinary pickup truck. Where a pickup might get 100,000 miles on the highway, it may be good for only 30,000-50,000 on the mine property. One of the jobs of the maintenance department is to modify the equipment wherever possible so it will stand up better.

Maintenance costs are an important factor in a mining operation. For example, Island Copper spends more than \$3 million a year on tires alone, ranging from \$40 for a pickup tire to more than \$10,000 for a Mark 36 tire which is 10½ feet in diameter and weighs 5,200 pounds.

The maintenance department depends on both the inventiveness and skills of the maintenance crews and



Close-up view of an Island Copper mechanic working on the wheel of a giant haul truck.

on modern technology to keep the wheels turning. For example, a sophisticated "load box" is used to simulate all conditions under which the haul trucks operate so they can be checked out in the shop. Space-age items like an ultrasonic flaw detector are used to check for cracks in truck wheels and mill bearings.

Environmentalists keep an eye on mine's effect

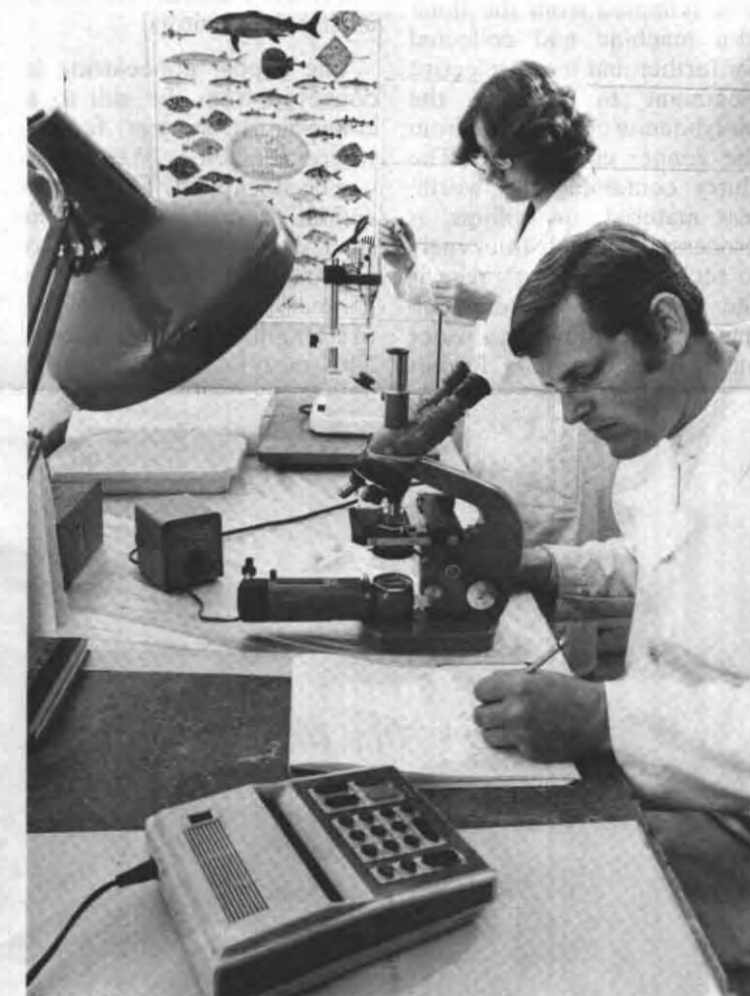
A mining operation of the size of Island Copper is bound to have a substantial impact on the local environment and ecology, and it is the job of the mine's environmental department to ensure that the negative effects are kept to a minimum.

This job began in 1969, before the mill was built, when Utah initiated an environmental program to obtain base data against which future data could be measured. A monitoring program covering all parameters which could be affected by the mill effluent went into operation in March, 1971.

Major parameters include the physical characteristics of the bottom of Rupert Inlet which are monitored with seismic profiles, bottom photography, dredging and coring of the bottom for sediment analysis.

The environmental department also monitors meteorological characteristics and the chemical characteristics of the Inlet including measurement of dissolved oxygen, salinity, alkalinity and heavy metal content.

The biological characteristics of the plankton and other marine life in Rupert Inlet and the adjacent waters of Holberg Inlet and Quatsino Sound are also monitored. Atomic absorption, photomicrography



Environmental department personnel analyze data as part of an extensive monitoring program at Island Copper.

and similar sophisticated techniques are standard to the control program.

Oceanographers, marine biologists and other scientists from the University of British Columbia, Simon Fraser University and University of Victoria oversee the mine's environmental monitoring program and make recommendations. The program also is

evaluated by scientists employed by the provincial and federal governments.

While there has been an obvious change in the configuration of the bottom of Rupert Inlet from the tailings disposal, the impact on marine life has been much as expected.

The main changes have taken place in a small area around Hankin Point where the original rock bottom has been covered with sediment. The effect has been the replacement of marine life which lives on rock algae by marine life which lives on the eel grass growing in the sediment.

Marine organisms continue to inhabit those areas of Rupert Inlet covered by mine tailings and the productivity of higher forms of marine life such as shellfish, salmon, crab and shrimp does not appear to have been affected. One potential seen by the scientists, however, is that a changing habitat might bring in different species, although this would happen only in a limited area.

The mill tailings themselves are composed mainly of siliceous material — quartz and feldspar. The only elements of significance present in the Inlet in higher than natural amounts are copper and molybdenum and these

have not been taken up into the marine food chain to a degree which would be harmful. Most of the chemical reagents used in the milling process adhere to the concentrates which are shipped for sale. Those remaining in the tailings are at innocuous concentrations.

On the land side of the operation, most of the overburden and waste rock removed from the pit is dumped as land fill along the shore of the Inlet, adjacent to the pit. As the pit is mined to the outer limits of the ore body at various points, these areas are seeded and planted in an on-going reclamation program.

While some reseeded of logged-over areas adjacent to the property was done as early as 1971, the first major reclamation project began in April, 1978, at the area known as the north dump, when the pit reached its limit at that point. The new growth is quite evident.

The objectives of the reclamation program are to ensure that natural erosion and siltation will be stabilized and vegetation provided to make a habitat for wildlife. This involves reseeded to produce grasses and shrubs, and reforestation with various types of trees including alder, hemlock and shade-tolerant firs.

Big find came with large financial investment

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which came up the west coast from Victoria. From Jeune Landing they were taken by pack horses the six miles to Alice Lake. There they were transferred to small boats to cross the lake, repacked on horses for the route to Kathleen Lake, back into boats to travel the length of the lake, and finally onto horses again for the last lap to the mine site.

Work at Coast Copper continued through the years, with considerable development occurring in the 1920s. However, it was shut down in 1931 and it wasn't until 1960 that the company decided to revive operations. A road was built to Port McNeill and the first load of copper concentrate left for Japan on August 27, 1962.

The only other copper property to be brought into production back then was that at Yreka, on the west side of Neroutsos Inlet. It was worked for a time prior to the First World War, closed during the war and managed to ship a couple of

loads to a smelter at Tacoma after the war before work stopped again. The mine started up again in 1965 under Noranda's management and a concentrator was built which turned out 15 to 20 tons of concentrate a day until the mine was worked out and closed in 1969.

The Hardy Bay News hadn't been wrong when it promoted the presence of "immense copper fields" in the North Island area — but the statement had been based more on hope than on knowledge. The North Island is pockmarked with the empty holes left behind by the hundreds of prospectors who tried their luck — laboriously chipping at outcrops and hand drilling the holes to blast their tunnels in the sidehills — only to end up with nothing.

The big strike, when it was made, was to be the work of a team of scientists using sophisticated instruments and backed by thousands of dollars. It was, however, an individual prospector's findings which brought the team to the area where they were to make their discovery.



Years of hope for large copper finds on the North Island were eventually proved well-founded. Now large vessels are a common sight in Rupert Inlet carrying concentrate to customers in Japan and Europe.

Exploration over Construction began in 1970

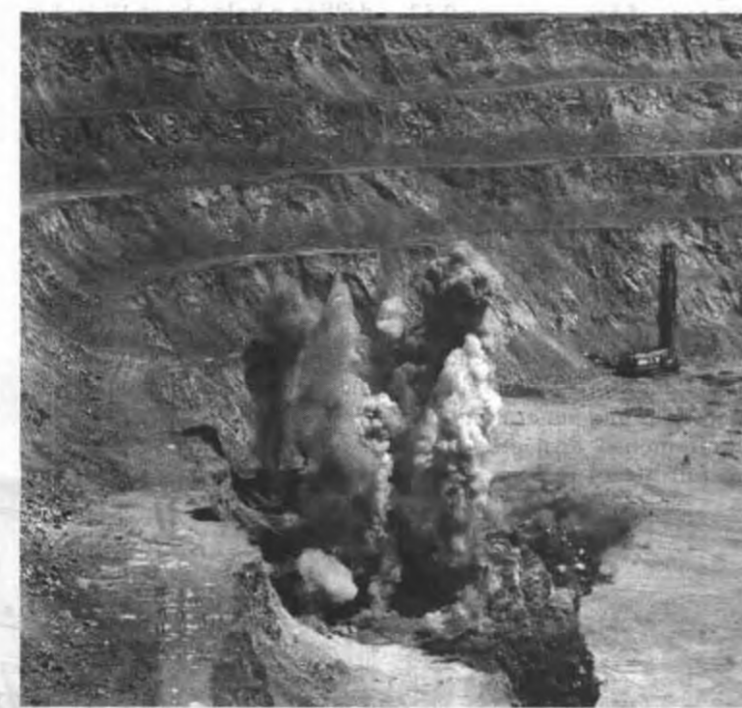
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area and a large tract was staked on the north side of Holberg Inlet. But the main interest was in iron. This was the mineral in which the company had the most experience and for which it already had markets.

Meantime, prospector Paddy Storey had taken up an old copper property on Red Island in Rupert Inlet and in 1962 brought it to Utah's attention. The property originally was staked by a prospector named Reynaldo who sank a shaft there before disappearing from the local scene about 1915. Utah's assays showed 0.5 per cent copper which, in 1962, was still below the borderline of economic feasibility.

With Mr. Milbourne's find, the earlier information became significant. There was now a new dimension, with showings two miles apart. Diamond drilling and trenching were started in the vicinity of Mr. Milbourne's original pits.

"I remember that first January when we were drilling the Bay claims," said Maurice Young, Utah's exploration manager, North American Metals. "We were all living at the barracks at the Port Hardy airport. It was cold, and it rained every day. We got out to the claims about 9:30 in the morning and in the bush you could barely see



Blasting in the pit is a sophisticated daily process to expose the ore first discovered by prospectors such as Gordon Milbourne.

at that time. We'd slip around in the muck and get brushed in the face by the wet brush and fall over the windfalls."

An intensive drilling program was started, extending through May, 1969, with a total of 128 holes being drilled to depths adding up to 116,783 feet, or 22 miles. The drill cores were bagged and shipped to Vancouver for assaying and long before the drilling was finished it was obvious that there was an orebody. The toughest part was over.

Construction of the mine and mill was begun early in

1970 and continued through 1971. More than 600 men were employed during the construction phase which included putting in systems for water, power and sewage disposal and building a road to connect the mine site with the provincial highway.

As construction activities neared completion, mining and milling operations were begun in the fall of 1971. Two months later, in December, 1971, the first shipload of copper concentrate destined for customers in Japan sailed from Rupert Inlet.

QUICK FACTS

- Ownership** Island Copper is owned and operated by Utah Mines Ltd., a subsidiary of Utah International Inc., of San Francisco. Utah International is an autonomous subsidiary of General Electric.
- Employees** More than 850 men and women are employed in the pit, mill and support departments including maintenance, warehousing, shipping, environmental, metallurgy, engineering, geology and administration.
- The Pit** Projected over 25 years of operation, the pit eventually will occupy an area of about 740 acres, being 8,000 feet long and 4,000 feet wide to a depth of 1,000 feet below sea level.
- Mining Equipment** Everything about the mine is large-scale. The PH2100 shovels, for example, have a capacity of 25 tons and the haul trucks are of 120-ton and 170-ton capacity. The largest trucks weigh 120 tons empty.
- Ore Reserves** Reserves are estimated at 280 million tons of copper-molybdenum ore with an average grade of 0.52 per cent copper and 0.017 per cent molybdenum. Small amounts of gold and rhenium are mined.
- Pit Production** Some 150,000 to 180,000 tons of ore and waste are removed from the pit each day depending on mining conditions at the time.
- Grinding Mills** The six semi-autogenous grinding mills which reduce the ore to fine particles are among the largest in the world. They are 32 feet in diameter, weigh 600 tons and can process some 300 tons of material per hour.
- Mill Production** The mill has a rated capacity of 41,000 tons per day. Annual rated output is 230,000 tons of copper concentrate, sold to Japanese customers on long term contracts; and 1,800 tons of molybdenum concentrate, sold to U.S. and European steelmakers.
- Environment** The mine has its own environmental department which continuously monitors the discharge of mill tailings into Rupert Inlet. The pollution control program is also monitored by scientists from University of B.C., Simon Fraser University and University of Victoria. The first land reclamation project started in 1971.



Aerial view of Island Copper's open pit mine near Port Hardy as it looks today. The pit eventually will occupy an area of about 490 acres.

Prospectors flocked to North Island in 1960s

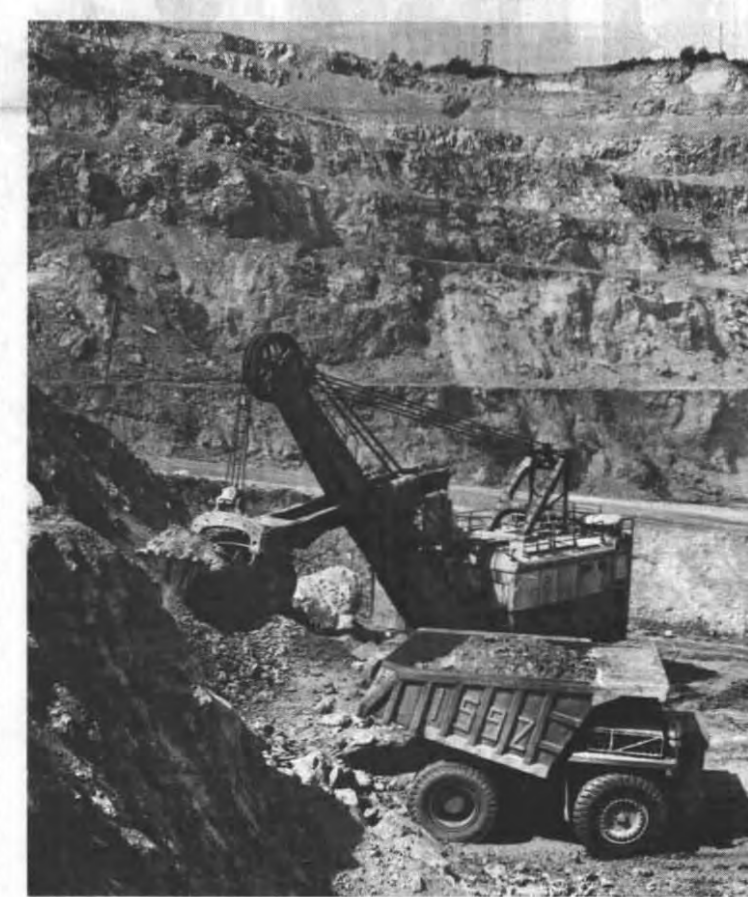
In 1963, when the federal Department of Mines published maps based on an aerial magnetometer survey of the North Island, there was an immediate rush of interest among the mining fraternity. Individual prospectors and companies flocked to the area to make a closer study of the many anomalies shown on the maps. (An anomaly is not an indication of ore. It is only a sign of something different to the surrounding country, where there just might be something.)

Most of the searchers were looking for iron. They didn't find it and, within the next two years, most of them had given up and left to look for greener fields. One who didn't leave was Gordon Milbourne. "I had prospected on the coast, including northern Vancouver Island, for a few years prior to 1963 mainly for iron or iron-copper prospects," said Mr. Milbourne. "The first four claims on what is now the Island Copper mine were staked in May, 1963.

"The interest was based on a low-grade magnetic anomaly as shown on the aero-magnetic maps. It was for the iron-copper possibilities that I further prospected the mine area in 1964 and 1965, staking additional claims in each of these years." In all, he staked about 150 claims.

It was in 1965 that Mr. Milbourne found a small piece of high-grade copper float a short distance south of the west end of Bay Lake. Laboriously, he dug two pits down to bedrock and there he found ore-grade material.

"Several major companies were contacted in 1965," he said. "A few, including Japanese interests, made field examinations of the claims, but most couldn't see any potential in the prospect." Utah had been working on the west coast of the Island since 1961 and had conducted studies along the coast starting at Port Renfrew. In 1962, some reconnaissance was done on some claims in the Zeballos



Today giant shovels and trucks operate around the clock at the heart of the mine operation — a far cry from the laborious excavation efforts of early prospectors.

In early papers Optimism for copper finds

The North Island's first mining operation dates back to 1849 when the schooner "Harpooner" arrived with a group of Welsh and Scottish miners to work the coalfields at Squash, midway between Port Hardy and Port McNeill. That operation didn't last long once the big deposits of higher grade coal were found at Nanaimo, but Squash opened up again in 1909 under the name of Pacific Coast Coal Mines Ltd. That operation folded shortly after the Second World War after producing only a few thousand tons.

Iron mining also had a relatively brief fling in the area. Nimpkish Iron Mines was in production just south of Nimpkish Lake during the 1950s and Empire Development Co. started another iron operation at Benson Lake in 1957 which lasted for 10 years.

Copper mining got its start on the North Island about 1900 when the Yreka mine went into production. The mine was on the west shore

of Neroutsos Inlet, almost opposite Jeune Landing. About 1911, the Old Sport mine near Benson Lake was discovered. This later came under the control of Cominco Ltd. and was operated under the name of Coast Copper Company. There was a lot of optimism surrounding the Coast Copper operation and much of that optimism flowed from the pages of the Hardy Bay News. The News, published sporadically during 1913 and 1914, was put out by a group of real estate swindlers selling property in Port Hardy, which at that time was located on the east side of Hardy Bay.

"Very few people on the outside realize the vast area of copper-bearing rock adjacent to Hardy Bay," the News trumpeted in one report. "The coming spring we expect a big move in the north end of the Island in the copper industries."

Access to the mine in those days was through Jeune Landing where supplies were brought in aboard CPR ships

All about Island Copper

This is your guide to the copper mining operation at the Island Copper Mine near Port Hardy on northern Vancouver Island. We hope it will help you to understand the complexities of the copper recovery process and serve as an introduction to the people employed here.

- In this guide you will find:
 - Pages 3-5 — Details of the mine and mill operations.
 - Page 6 — Quick facts about Island Copper.

Island Copper people are key to success

More than 850 men and women from across Canada and from countries such as Britain, the Philippines, Australia, India and the U.S. are employed at the Island Copper Mine.

They are truck drivers, mechanics, electricians, pollution control technicians, heavy equipment operators, warehousemen, mining engineers, carpenters, cooks, secretaries, computer technicians... just about the whole range of job and career classifications are represented.

The main division in the work force is between those employed in the pit and those in the mill, but there are also major groups in the support services including the environmental and metallurgical departments, mine and mill maintenance, warehousing, shiploading, engineering, geology department and administration.

Island Copper offers a training program for the various classifications in both the pit and the mill and also encourages employees to take part in apprenticeship programs and government-sponsored courses leading to professional, technical and administrative positions. Financial assistance is provided by both government and the company to this end.



Women are employed in all departments at Island Copper at jobs ranging from truck driver to roddman, computer operator to accounting clerk.

In addition to their regular jobs, a large number of Island Copper personnel are involved in mine safety programs. Personnel trained in first aid and mine rescue techniques are on call on all shifts and the mine also has its own firefighting crews. These teams are backed up with a complete range of first aid and rescue equipment

apartments, and a trailer park. These are available on both a purchase and rental basis and buyers enter a re-purchase arrangement with the company.

Island Copper, with a large number of employees and their families living in the community and with its purchases of supplies and services from North Island merchants,

Utah Mines owned by General Electric

Utah International Inc., the parent company of Utah Mines Ltd., has Canadian roots dating back to the 1880s, when two brothers who were later to play a role in establishing the company undertook a sub-contract to participate in construction on the Canadian Pacific Railway near Calgary.

From its early beginnings in railroad construction, the company expanded its activities to include dams, canals, bridges and highways in Canada and the United States, as well as many other parts of the world.

In the 1940s Utah participated in the construction of the Alaska Highway, stretching some 1,600 miles to link British Columbia with Alaska. A decade later Utah opened the Argonaut mine on Vancouver Island to develop known iron ore deposits and to prospect for other reserves. A small and not very profitable mine, the Argonaut was a pioneer supplier of iron ore to Japan.

Land development

During the mid 1950s Utah took part in the construction of the St. Lawrence Seaway and participated in a joint venture to build the Grass River Lock. Construction of homes on Lulu Island near Vancouver and of the 19-storey Burrard Building, one of the first postwar highrise buildings in downtown Vancouver, were among Utah's land development projects.

In 1969, Utah International divested itself of all its construction assets to concentrate on mining and ocean shipping activities. These mining interests today include coal, copper, uranium, iron ore and petroleum, with operations in Canada, the U.S., Australia and Brazil. Utah Mines Ltd. was formed in 1971 as a subsidiary of Utah International and is responsible for all Canadian operations, including the Island Copper Mine and an active exploration program throughout Canada.

In 1976, Utah International merged with General Electric — the largest corporate merger in U.S. history. Utah International now operates as a wholly-owned subsidiary of General Electric but with its own board of directors and management structure.

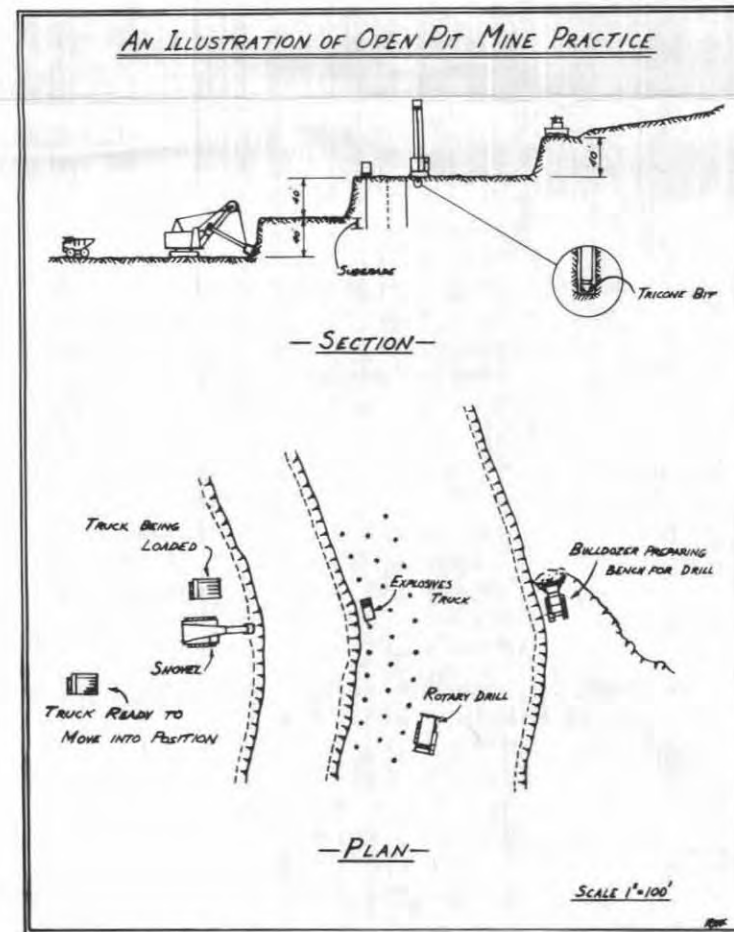


Island Copper's employees come from all over the world and make their contribution to the operation in numerous jobs.

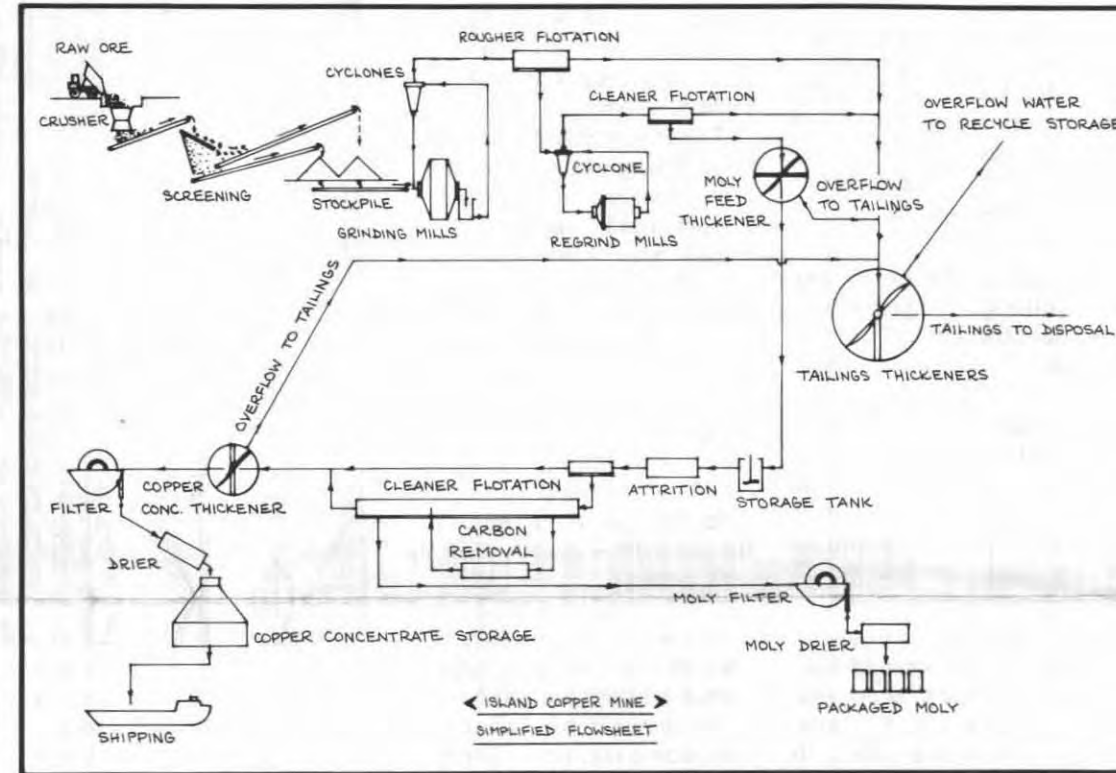
It's a 24-hour business / Mining process described in detail



Electric shovels can load 120-ton and 170-ton capacity trucks in minutes, ready for transportation to the crusher.



A typical mining operation viewed from two angles.



Flow chart showing copper and molybdenum recovery process from start to finish.

Twenty-four hours a day, seven days a week, ore containing copper and significant amounts of molybdenum, gold, silver and rhenium is mined and concentrated at Island Copper.

The ore body, which originally contained 280 million tons of ore averaging 0.52 per cent copper and 0.017 per cent molybdenum, is mined using conventional open pit methods. This means drilling and blasting to loosen the overburden and rock, and removal of the ore by shovels and trucks.

Some 150,000 to 180,000 tons of ore and waste are removed each day depending on the depth worked, weather conditions and general mining requirements. Projected over the full life of the operation,

the pit will eventually occupy a total area of about 740 acres, being 8,000 feet long, 4,000 feet wide and 1,000 feet below sea level.

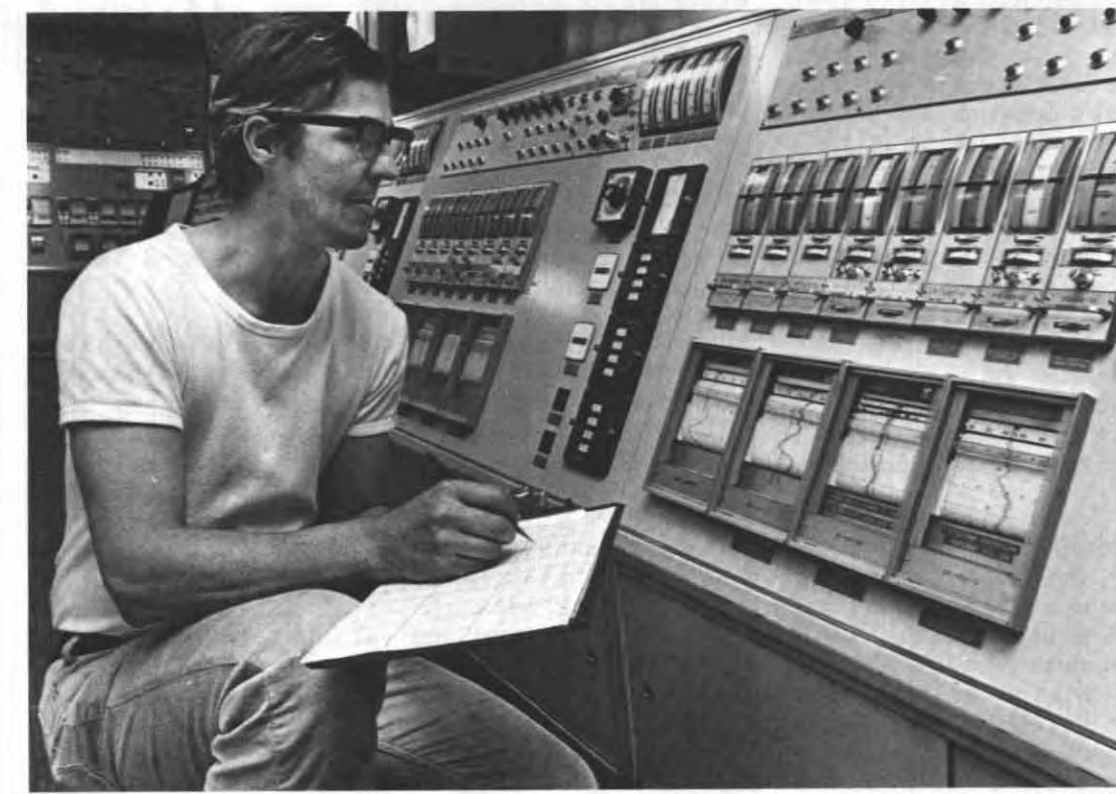
Drill holes for explosives are cut through the overburden and rock by five big electric drill rigs capable of drilling a hole about 10 inches in diameter to a depth of 45 feet. The holes are loaded with 600 to 1,100 pounds of high explosive, depending on the rock type.

The explosive used in the pit is mixed right on the property. Ingredients are partially mixed at a plant operated by Canadian Industries Limited and carried to the holes in a special truck. The ingredients (not yet an explosive) are combined in liquid form just before being

pumped into the drill hole. In the hole the explosive quickly 'sets up' to a consistency much like Jello. About 70,000 pounds of this 'slurried' explosive is used each day.

The broken material from the pit is loaded into trucks by five P&H electric shovels and two Marion shovels with 15 cubic yard buckets. (The metal archways to be seen at shovel locations support the electric cables to the shovels).

The shovels, each with a bucket capacity equivalent to about 25 tons, load the ore and waste rock into a fleet of 18 haul trucks of 120-ton capacity and 26 trucks of 170-ton capacity. These massive vehicles are diesel-powered (1,600 h.p. V-16 engines in the bigger trucks)



Operators in the mill's central control room (CPI) monitor the entire milling operation using closed-circuit TV cameras and other electronic devices.



Six semi-autogenous grinding mills each process 300 tons of material per hour.

but the final drive is provided by electric motors in each wheel. Despite their size, these trucks are relatively easy to drive, being equipped with a sophisticated system of electrical and hydraulic controls. (As an indication of their size, consider that the driver's eye level is 14 feet above the road). The maximum speed of the trucks is 20 m.p.h.

The truck-and-shovel operations take place on 40-foot high terraces called "benches" which are linked to the rim of the pit by 100-foot wide haul roads angled at up to a 10 per cent grade. The haul from the lowest bench currently being worked involves a vertical climb of some 440 feet to the top of the pit.

The haul trucks move the ore to a primary crusher located about a mile by road from the pit entrance and carry the waste rock to a landfill area at the northern edge of the pit and a beach dump on the shore of Rupert Inlet. An average three tons of waste rock are currently being removed for every ton of ore-bearing rock.

The dumping operations, and the difficult road conditions caused by trucks moving constantly in an area of heavy rainfall, make it necessary to have a large fleet of auxiliary vehicles. These include seven graders, three rubber-tired dozers, five D-8 and five D-9 (or bigger) dozers. Also used for auxiliary and back-up work are a six-yard loader and four 35-ton trucks. A gradall and backhoe are on hand for ditch work.

Most of these vehicles and the associated services are controlled through a pit dis-

patch system which is unique in British Columbia. The dispatch tower (a converted airport control tower) is the nucleus of a three-channel radio network that links drills, shovels, trucks, the crusher, the concentrator and every department on the property.

The pit operation ends at the primary crusher which breaks the ore down into pieces small enough to be handled in the concentrator operations. The crusher can handle pieces of rock as large as 54 inches on a side. Depending on the hardness of the rock, production of between 2,500 and 3,000 tons per hour can be maintained — reducing the rock to a maximum size of about nine inches.

The crushed rock is transported along a system of conveyors to two vibrating screens which separate the ore into plus four inch and minus four inch fractions. From there, the ore is stockpiled until it is fed into the six semi-autogenous grinding mills in the concentrator building.

Each of these revolving mills weighs 600 tons and is driven by two 3,500 horsepower motors. Among the largest in the world, these mills can each process 300 tons of material per hour. Steel balls and water are added to facilitate the grinding process which reduces the ore to fine particles about the consistency of coarse sugar. Additional grinding capacity is available from three secondary ball mills. Approximately 15 million tons of ore is milled each year.

At this stage the primary ground ore is in a slurry form and is further prepared by classifying, regrinding and conditioning by the addition of

reagents before being processed through a network of flotation cells. In the cells, the ore particles are treated with flotation reagents which render the mineral aerophilic, or "attractive" to air bubbles generated by mechanical agitators.

Attached to the bubbles, the copper material floats to the surface of the cells where it is skimmed from the flotation machine and collected for further and more selective treatment to separate the molybdenite concentrate from the copper concentrate. The slurry containing the worthless material, or tailings, is processed through thickeners to reclaim water for reuse in the mill. The remaining tailings are mixed with sea water and discharged into Rupert

Inlet 165 feet below the surface.

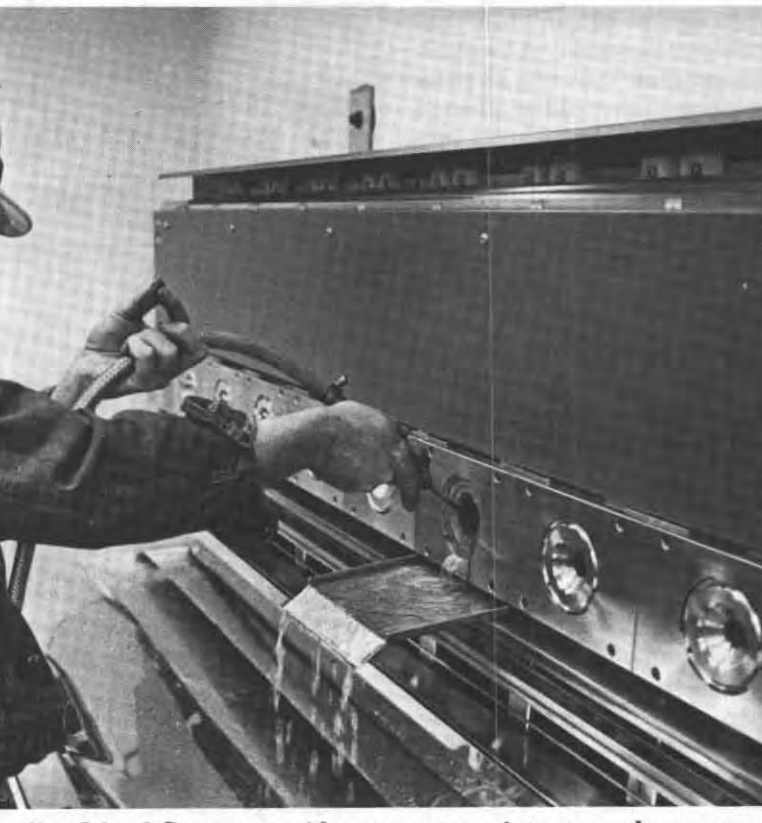
Modern scientific apparatus such as an on-stream x-ray analyzer and atomic absorption spectrophotometers are used to monitor the metal content and quality. The entire milling operation is controlled from a central control room equipped with closed-circuit television cameras and other electronic monitors.

The copper concentrate is conveyed from the mill to a cone-shaped storage facility where as much as 35,000 tons can be stockpiled. The molybdenum product is packed in steel drums for shipment to customers in Europe and the United States for use primarily to strengthen and harden steel. The molybdenite contains

rhenium, a rare heavy metal used in electronic and bi-metallic catalytic applications such as the production of low-lead gasoline.

Location of the mine and mill on Rupert Inlet has made ocean shipment advantageous and the deep-sea dock can accommodate vessels up to 35,000 deadweight tons. Ships are loaded with copper concentrate at a rate of 1,000 tons per hour — the final step in the operation of Island Copper.

Island Copper holds two sales contracts with Japanese firms. Mitsui Mining & Smelting Co. Ltd. is taking about two-thirds of the copper production and the remainder is committed to Mitsubishi Shoji Kaisha and the Dowa Mining Company.



An on-stream analyzer in the mill at Island Copper provides computer printouts on the recovery and quality of the various products.