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EXPLORATION AND MINING IN BRITISH COLUMBIA 2013



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EXPLORATION AND MINING
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EXPLORATION AND MINING IN THE SOUTH AND WEST COAST REGIONS, BRITISH COLUMBIA

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SUMMARY AND TRENDS

This report covers the provincial government's Coast Area natural resource sector, comprising the South Coast and West Coast regions, including Haida Gwaii. The area has one major metal mine, Myra Falls, and one coal mine, the Quinsam Mine, which have been in operation for 47 years and 27 years respectively. Both had ongoing and active exploration programs in 2013, as they had in 2011-12. There are also numerous industrial minerals and aggregates operations in the region serving local and international markets. Nearly all major mines and quarries continued producing at or near recent levels, with some aggregate producers and industrial minerals quarries increasing production and sales over 2012 levels.

Large scale exploration programs in 2013, at least in terms of dollars expended and metres drilled, were limited to areas in and around operating mines. Estimated exploration expenditures in the Coast Area in 2013 are just over \$7 million (Figure 1). Efforts aimed at environmental certification of proposed mines accounted for nearly \$2 million.

Exploration drilling is estimated at over 30 000 m (Figure 2). A precise figure for underground exploration at Myra Falls was unavailable at the time of writing. As this was by far the largest program in the area, the overall figure is only approximate (Figure 2).

Expenditures broken down by exploration stage and target type are given in Figures 4 and 5. Exploration expenditures on advanced stage projects (other than at mine sites) fell the sharply in 2013.

MINES

The location of operating mines and selected exploration projects are shown in Figure 3. Mine production and reserves statistics are given in Table 1.

METALS

The South and West Coast Regions' one major metal mine, **Myra Falls Operations** (MINFILE 092F 071-73, 330), is a an underground polymetallic mine located in Strathcona-Westmin Class B Provincial Park, surrounded by Strathcona Provincial Park, a Class A park, and located on Buttle Lake, part of Campbell River's water

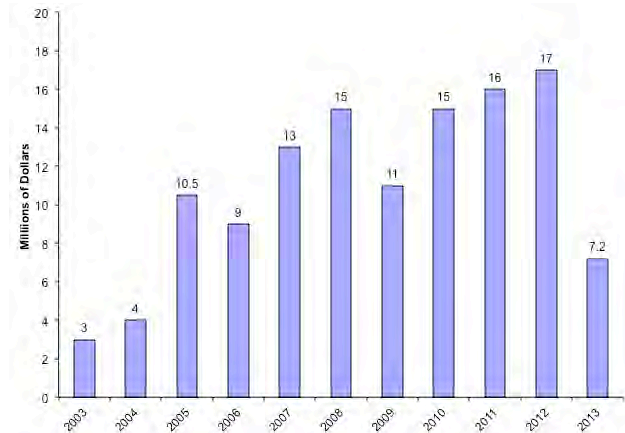


Figure 1. Exploration spending estimates for the Coast Area 2003-2013. The addition of Haida Gwaii to the region in 2010 had negligible impact on the statistics.

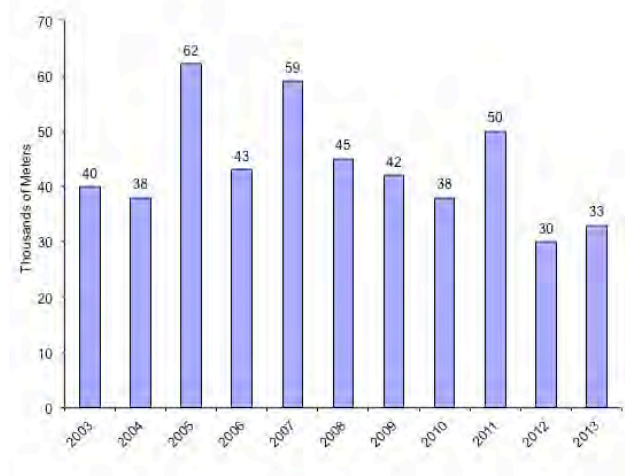


Figure 2. Exploration drilling in the Coast Area 2003-2013.

supply. At the end of a 90 km road that winds through the park, the operation generates hydroelectric and auxiliary diesel power as necessary. From this seemingly precarious position, it has operated through most of the past 48 years.

In the first 3 quarters of 2013, Myra Falls milled 387 000 t of ore, down approximately 10% from 2012. Nyrstar reported interruptions at the mill and hydroelectric power supply this year. Concentrate, zinc, copper and lead in concentrate were also lower. Typical annual throughput in recent years has been approximately 500 000 t. The company did not forecast whether and to

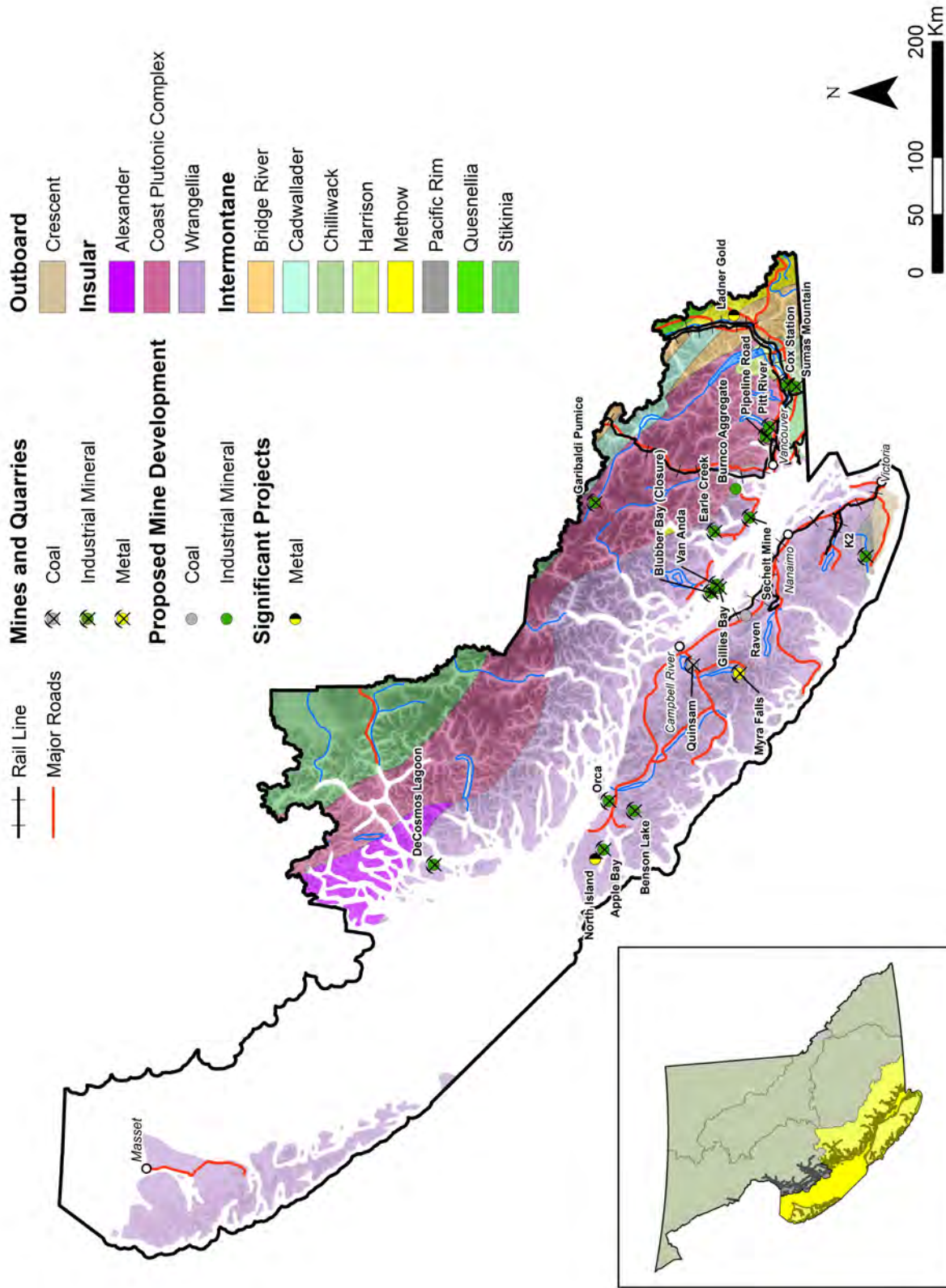


Figure 3. Operating mines and selected major exploration projects in the Coast Area, 2013.

TABLE 1. RESERVES, FORECAST MINE PRODUCTION, COAST AREA, 2013

Mine	Operator	Commodities	Mine Workforce	Forecast Production 2013	Production 2012	Reserves as of Dec 31, 2012
Metals						
Myra Falls Operations	NVI Mining Ltd (Nyrstar N.V.)	Zn-Cu-Pb-Au-Ag	315	Approx 0.5 Mt throughput 5.35% Zn (88.1% rec) 0.49% Pb (29.2% rec) 0.83% Cu (67.5% rec) 1.36 g/t Au (70.0% rec) 50.63 g/t Ag (80.2% rec)	Zn 32 000 t Pb 1100 t Cu 3800 t Au 423 kg Ag 18 040 kg (metal in concentrate)	5.43 Mt 5.62% Zn 0.56% Pb 0.94% Cu 1.6 g/t Au 58 g/t Ag
				(average head grades and recoveries in first 9 m 2013)		
Coal						
Quinsam	Quinsam Coal Corporation (Hillsborough Resources Ltd)	Thermal coal	approx 140	Approximately 365 000 t clean coal	365 000 t clean coal	N/A
Industrial Minerals						
Apple Bay (PEM 100)	Electra Gold Ltd.	Chalky geyserite	8	Approx 75 000 t	40 301 t	~ 5 million t
Benson Lake	Imasco Minerals Inc.	White marble	4	50 000 t	36 300 t	100+ years
Blubber Bay	Ash Grove Cement Company	Limestone aggregate, dolomitic limestone	Care and Maintenance 2011-12			100+ years
Garibaldi Pumice	Garibaldi Pumice Ltd.	Pumice	2	5000 m ³	21 500 m ³	100+ years
Gillies Bay	Texada Quarrying Ltd. (Lafarge North America Inc)	Limestone, aggregate	70	4.0 Mt	4.2 Mt	100+ years
K2	K2 Stone Quarries Inc	Building Stone	5	15 400 t	16 000 – 18 000 t	N/A
Mount Meager	Great Pacific Pumice Ltd	Pumice	Care and Maintenance 2012-13			100+ years
Sumas Mountain	Sumas Shale Ltd. (Clayburn Industrial Group and cement manufacturer partners)	Sandstone and shale	10	420 000 t	~ 400 000 t	~ 70 years
Van Anda	Imperial Limestone Company Ltd (JA Jack & Sons Inc.)	Limestone	9	250 000 t	250 000 t	50+ years

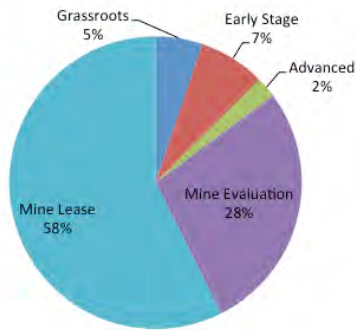


Figure 4. Coast Area exploration spending by exploration stage, 2013.

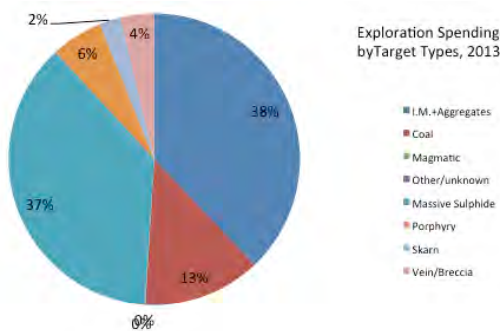


Figure 5. Coast Area exploration spending by primary target type.

what extent the 4th quarter would catch up, though there was an effort to do so. The mine employs 315 people (Figure 6).

On-lease exploration at the mine is typically one of the largest exploration projects in the South and West Coast Regions, and it was the largest again in 2013. Details are lacking at the time of writing, but underground exploration drilling exceeded 20 000 m in 2013.



Figure 6. Underground equipment maintenance area at Myra Falls. The mine is in a topographically challenging area surrounded by Class A Park. With limited underground access, mining equipment is assembled and maintained in workshops such as this.

Starting with a small open pit at the Lynx deposit in 1966, the long-lived operation has a history of success in replacing reserves. Limited tailings storage capacity is perhaps more likely to ultimately limit mine life than exhaustion of reserves.

The deposits at Myra Falls are hosted in the Middle Paleozoic Sicker Group volcanics, an oceanic arc assemblage that forms the basement of Vancouver Island. Devonian Myra Formation rocks host the mineralization at Myra Falls, which is in the Buttle Lake uplift, where Sicker Group basement is exposed along a northwest trending antiform roughly in the centre of Vancouver Island. Ore bodies are found in two horizons in the Myra Formation. The Myra Falls camp is generally considered a Kuroko type or bimodal felsic type VMS environment.

COAL

Vancouver Island has a history of underground coal mining dating back to 1849, and in terms of remaining resources it has the potential to continue for many more years.

Near the top of Vancouver Island stratigraphy, the **Quinsam** Thermal Coal Mine (MINFILE 092F 319) near Campbell River has been in operation since 1986 and is currently the only active coal mine in the South-West Coast Regions (Figure 7). It is the only underground coal mine in the province, though others are proposed, including the Raven underground metallurgical coal project near Comox.

The Quinsam Mine is operated by Quinsam Coal Corporation, a subsidiary of Hillsborough Resources Ltd., which itself is part of the Vitol Group, an international energy trading company. In operation since 1986, Quinsam expects to produce an amount similar to 2012, which was 365 000 t of clean thermal coal. Most of the product has gone to local cement plants in 2013, although the mine also supplies the circum-pacific energy market. Direct employment at the underground room and pillar operation is approximately 140 people (Figure 8).

In early 2012, Quinsam obtained a permit and began developing 7 South, a new area located approximately 3.5 km byroad from the previous mine site. This area is now in production. While commonly referred to as an expansion, 7 South essentially allowed the operation to continue producing at recent levels.

The Quinsam mine produces from coal seams of the Upper Comox Formation, which is part of the Upper Cretaceous Nanaimo Group. Historical production has focused on number 1, 2 and 3 seams, but current production at 7 South is from the number 4 seam. The mine is capable of producing over half a million tonnes a year. Mine site drilling in 2013 tested the number 3 seam at areas 4 South and 6 South, where future development is proposed. The company did not return to the Quinsam East exploration area in 2013.



Figure 7. Loading a truck at the Quinsam Mine site. Coal is trucked to a barge facility at Middlepoint near Campbell River.



Figure 8. Quinsam Mine uses continuous miners in a room and pillar mining method.

As a private company, Hillsborough does not publish reserve and resource figures, except in its applications to government. Prior to acquisition by Vitol, Hillsborough did publish an estimate of substantial resources at the Quinsam North area, however these are not part of the current mine plan. It appears unlikely that the mine's potential resources will be depleted in the near future, however timely permitting and development of those resources would be important to avoiding gaps in production going forward.

Located only 20 km west of the City of Campbell River, the Quinsam Mine is at once a significant local employer and a subject of close scrutiny. Hillsborough has been testing and researching underground waste and tailings disposal for several years. The mine recently began disposing of coarse rock rejects underground in disused flooded workings. PAG tailings are also disposed of subaqueously. Underground tailings injection infrastructure is in place.

INDUSTRIAL MINERALS

Large quarries on the coast are well placed to serve the Lower Mainland, Vancouver Island and US Pacific Northwest markets by barge. Those with access to

freighter loadout facilities can also supply the eastern Pacific international markets, California, Mexico, and Hawaii. Most of the companies mentioned in this section maintain websites with product specifications to which the reader is referred for more information.

The largest limestone quarry on the coast is **Texada Quarrying** operation near Gillies Bay (MINFILE 092F 395). Texada Quarrying Ltd is a subsidiary of Lafarge North America. Most of its projected 4.0 million tonnes of production in 2013 supplies local cement plants. The quarry also produces aggregate, mainly from dike s, which would otherwise be waste rock. The site also hosts a white carbonate quarry, which is one of only a few sources on the coast (along with Benson Lake). Lafarge carried out a drill program around the existing operations on Texada Island in 2013 to collect limestone quality data. Results are not yet available. The quarry has extensive reserves, and production capability in excess of 100 years at current rates. The quarry has been in operation 61 years and employs 70 people directly.

The Imperial Limestone Co. Ltd. quarry near **Van Anda** (MINFILE 092F 394) on Texada Island produces approximately 250 000 t annually, with similar production forecast for 2013. The product is barged to parent company J.A. Jack & Sons Inc. in Seattle, where it is processed and distributed for a wide variety of potential end uses. Currently much of the product is used in glass making and roofing manufacture. The white products have applications as fillers and extenders. Agriculture uses of limestone include soil sweeteners, animal feed additives, acid neutralization and environmental remediation. Quarrying at the Imperial site dates back to the 1930s, and the current owners have operated it since the early 1950s. They anticipate reserves will last in excess of a further 50 years (Figure 9).

Ashgrove Cement Company's **Blubber Bay** limestone quarry (MINFILE 092F 479) on Texada Island has remained on care and maintenance since 2010, after more than 100 years of operation. It could re-open for sufficiently large contracts. It recently supplied mainly limestone aggregate and lesser amounts of dolomite to Lower Mainland and North Western US markets.

On Northern Vancouver Island, Electra Gold Ltd. continued to mine chalky geysersite at the **PEM 100** or **Apple Bay Quarry** (MINFILE 092L 150) in 2013. Electra Gold expects to almost double its shipments of chalky geysersites from the PEM 100 quarry on Northern Vancouver Island in 2013 over 70 000 t, as compared to just over 40 000 t in 2012. The quarry ships raw silica-alumina product by barge to Ash Grove Cement Company in Seattle for use in cement manufacture.

Also on Northern Vancouver Island, Imasco Minerals Inc. increased sales of its **Benson Lake** (MINFILE 092L 295) white carbonate. Quarry production is expected to be approximately 50 000 t, representing an increase over last year. The operation employs 4 directly, plus two trucking contractors. The product has a high dry brightness (95)



Figure 9. Imperial Limestone Co Ltd has operated this quarry on Texada Island since the 1950s. Prior to going on care and maintenance in 2010, the neighbouring Blubber Bay quarry operated for more than 100 years.

and is used mainly as a white CaCO_3 filler and extender, available in a number of size gradations from Imasco's Surrey location. The carbonate is barged to Surrey from Port Alice.

The **Sumas Shale** quarry on Sumas Mountain (MINFILE 092GSE024, 092GSE004) is owned by Clayburn Industrial Group Ltd, operated by contractor Fraser Pacific Enterprises Inc and delivers its sandstone and shale product to cement plants in Richmond and Seattle through a joint venture with Lafarge North America (Sumas Shale Ltd). Forecasted 2013 production is approximately 420 000 t, which is similar to previous years (approximately 400 000 t in 2012). Since Clayburn's brick and refractory products plant closed in Abbotsford, fireclay is no longer produced separately.

The Ironwood Clay Company Inc.'s increasing exports to Korea and China, together with British and American sales, made it a winner in the 2012 BC Export Awards in the Consumer Products category. Their products are based on glacial marine clay mined on the Central Coast. Recent production has been from **DeCosmos Lagoon** (MINFILE 092M 019) south of Bella Bella. Ironwood produces value-added cosmetic products at its Richmond plant.

The company extracted 500 t at De Cosmos quarry in 2013, and reclamation at that site is ongoing. Ironwood also has a new quarry site at Hvidsten Point, and plans to test another site at the head of Bute Inlet with Glacial Bay Organic Clay Inc. Depending on initial testing and permitting extraction of 400-500 t of material is planned for 2014.

Other individuals and companies supply the growing cosmetic clay market at smaller scales from locations on the Central Coast and Vancouver Island. Generally, no Mines Act permits are required where material is collected by hand, and therefore these small quantities are typically not reported.

Materials marketed as cosmetic clays are generally mixtures. Cosmetic clays have cleansing properties, exfoliating the skin, absorbing oils and other contaminants. Clays from some deposits elsewhere in the world have antibacterial properties which make them suitable for medical applications.

In the Mount Meager area, Garibaldi Pumice Ltd. shipped approximately 5000 cubic metres of pumice from the **Garibaldi Pumice** quarry (MINFILE 092JW 039) in 2013. Reclamation and infrastructure improvements employed two workers. The majority of pumice from the Mt Meager area is used as lightweight fill, but also used in lightweight concrete, landscaping and horticulture (including green roofing). Pumice may have additional applications including fillers, grinding compounds, and cosmetics. Garibaldi's 2012 exploration extended the deposit in measured and indicated categories by 8.2 million cubic metres (coarse pumice) over a 2.35 square km area. There is an additional inferred 6.8 million cubic metres, plus additional finer material.

Neighbouring Great Pacific Pumice Inc (MINFILE 092JW 040) did not produce at their **Mount Meager** quarry in 2013. Local producers face some competition with US suppliers. Transportation is a significant component of the cost.

K2 Stone is a vertically integrated natural stone product supplier with quarries near Port Renfrew on Vancouver Island, (**K2**, MINFILE 092C 159), and in Montana. K2 Stone quarries, processes and distributes their products. Their Ocean Pearl colour comes from the Port Renfrew quarry. In 2013, K2 Stone shipped approximately 15 400 t from Port Renfrew with a 5 person crew. The rock is trucked to Nanaimo for processing into masonry and landscaping products. Other smaller producers of slate are also quarrying rocks of the Leech River Complex. **Van Isle Slate** (MINFILE 092C 154) is one that started from a very small operation over the past few years, and has been offering a line of hand cut products.

Matrix marble and Stone Inc. continues to quarry marble on Vancouver Island and fabricate a line of products including countertops, sinks, tiles and building products. They quarry their Carmanah Black near Port Renfrew (**Gordon River** MINFILE 092C 086) and Tlupana Blue Grey and Vancouver Island White near **Hisnit Inlet** (MINFILE 092E 020). They worked at their Hisnit Inlet location through most of 2013.

Landscaping stone is quarried in the Sea-to-Sky Corridor. The largest operator is Northwest Landscape and Stone Supply, with the **Spumoni Quarry** (MINFILE 092GNW100) and other sites, some of which are to be upgraded to full mining leases.

Haddington Island (MINFILE 092L 146) and **Hardy Island** (MINFILE 092F 425) are two small but regular producers of dimension stone on the coast (Figure 10). The Haddington Island product is a durable, resistant Miocene volcanic rock (70.5% silica) with a dry crushing



Figure 10. Haddington Island Andesite is found on historic buildings and monuments in Vancouver and Victoria. These are details on the Vancouver Art Gallery, constructed as the Provincial Court House in 1906-1912. The quarry on Haddington Island re-opened in 2004 and supplies material for restorations as well as new buildings and monuments.

strength of 18 428 psi, valued for its ability to sustain carving and hold edges. Hardy Island produces from a uniform grey Coast Plutonic Complex granodiorite unit, which is used mainly for residential and commercial construction. The Haddington Island and Hardy Island products are available through Adera Natural Stone Ltd and Bedrock Granite Sales, respectively, along with other local products.

Alpine Natural Stone Ltd is another producer of stone in the Squamish-Whistler corridor extracting at several locations. Elsewhere, several other small quarrying operations continued extracted bulk samples. Mines Act permitting and tenure regulations allow extraction of up to 10 000 t once every 5 years from a claim without upgrading tenures to leases, enabling producers to test marketing and small scale production.

Aggregates are an important part of the mining industry on the south coast, generating more employment in the region than metal and coal mining (Figure 11). The area hosts some of the largest aggregate pits and quarries in Canada. The availability of water transportation is a factor in the million tonne per year and larger operations, making shipment of this low unit value commodity more efficient than by overland means. Most quarries serve local markets, but three have the capability to load Panamax class bulk freighters and export to markets such as California and Hawaii where sand and gravel are in shorter supply.

Several producers do not want yearly sales or production reported publicly, but there are enough respondents to our informal survey to track general trends, which follow construction industry trends.

Peak production on the South Coast was in 2007-08. Volumes dropped dramatically from late 2008 and into



Figure 11. Aggregate is a major part of the mining industry in southwestern BC. The photograph is from Upland Excavating Ltd's pit near Campbell River.

2009. Since then the limited and informally-collected data for this yearly report indicates a recovery, though not to 2008 levels. The reader is referred to Natural Resources Canada and Ministry of Energy and Mines statistics for year-to-year data for the province overall.

The construction materials industry's two largest participants on the coast are also among the world's largest: Lafarge North America and Lehigh Hanson. The third largest on the coast is a local company, Mainland Sand and Gravel Ltd., followed by a number of smaller companies and individual operations. The majority of British Columbia's aggregate production and use occurs on the coast, with some exports from three of the largest mines. In total there are hundreds of producing pits and quarries in the region. Only a few of the largest are profiled here.

One of the largest aggregate-only mines on the coast is the **Sechelt Mine**, operated by Lehigh Hanson. The company no longer makes production figures public, but volumes have been in the 3-5 million tonne range in recent years. A ship loading facility capable of accommodating Panamax class freighters handles most of the shipments.

Lafarge North America's **Earle Creek** (MINFILE 092GNW102) operation will produce 1.3 million tonnes in 2013, and employs 26. There were \$1.5 million in capital upgrades in 2013. Product is shipped by barge.

Pitt River Quarries (MINFILE 092GSE007) will produce 2.0 million tonnes and employs 45. That operation saw 1.0 million in capital upgrades in 2013. Product moves by truck and by barge.

Other large Lafarge aggregate operations in 2013 include:

- Central Aggregates (Bradner Road Abbotsford), which will produce 870 000 t and employs 25

- Ward Road (Sumas Mountain) which will produce 1.05 million t. There were \$600,000 in capital improvements
- Lafarge's Coquitlam (Pipeline Road) operation, which produced 200 000 t before suspending production. It has 8 employees

Also on Pipeline Road are large operations by Jack Cewe Ltd and Allard Contractors Ltd. Together they produce in excess of one million tonnes per year most years.

Polaris Minerals Corporation operates the **Orca Quarry** (MINFILE 092L 220) near Port McNeill, which produces sand and gravel mainly for export in Panamax class freighters. Orca had shipped 2 083 000 t by the end of the third quarter 2013, which represents a 38% increase over the same period in 2012. Shipments in 2012 were 30% higher than in 2011. The increases are largely attributed to an improved Northern California target market. Sales for 2013 are therefore likely to exceed 2 500 000 t.

One of the largest operations in the area is the **Cox Station Quarry**. It is located on the north side of Sumas Mountain, and is operated by Mainland Sand and Gravels Ltd. Over 95% of the product, which is a crushed quartz diorite, goes to the Lower Mainland market via barge on the Fraser River. The quarry also has two CN Rail spur lines which allow shipment by rail. Production and shipments are typically in excess of 2 million tonnes per year. From start of December 2012 to end of November 2013, they shipped 3 074 052 t by barge, approximately 77 000 t by rail and truck. The quarry directly employs 45-50 people.

MINE DEVELOPMENT

There are no major new mining projects in development in the South or West Coast regions. However, as described above, there has been significant exploration and development work at existing mines and quarries.

MINE EVALUATION

There are two major South-West Coast Region mining projects in the pre-application phase of Environmental assessment, a proposed coal mine and a large aggregate operation.

The **Raven Underground Coal Project** (MINFILE 092F 333) is a proposed mine south of Comox on Vancouver Island. As projected in the feasibility study, the main product is to be a semi soft coking coal with a thermal by-product. Forecast production is approximately 830 000 t clean coal per year, over 16 years.

Compliance Energy Corporation is the majority partner in the Comox Joint Venture, and is focused on

getting the project beyond pre-application, and into Environmental Assessment. The project received its terms of reference (Application Information Requirements for the EAO and Environmental Impact Statement Guidelines for the CEAA) in June 2012. (Figure 12). The company then submitted its application for an Environmental Assessment Certificate for the proposed Raven Underground Coal Project in 2013, but the Environmental Assessment Office determined that the application did not contain all required information. Compliance plans to re-submit a revised application in 2014 (Figure 12).

The **BURNCO Aggregate Project** in the McNab Creek Valley is also in the pre-application stage of environmental assessment with both the provincial and federal agencies. That proposed mine would ramp up to a 1 million tonne-per-year operation, initially barging product to BURNCO Rock Products Ltd.'s ready-mix concrete plants in South Burnaby and Port Kells.

BURNCO is in public comment and consultation processes. They submitted Draft Application Information Requirements in September 2013

As of 2013 Canadian Dehua International Mines Group Inc. no longer proposes the imminent re-opening of a small magnetite operation, **Iron Ross**, near Sayward. They have advised Ministry of Energy and Mines staff that the project is returning to exploration stage – now one of several properties Dehua plans to explore for magnetite.

The Iron Ross project includes a cluster of magnetite skarn deposits (MINFILE 092K 043). Iron Ross deposits occur along a contact between Upper Triassic Karmutsen Formation basalts, and overlying Quatsino Formation limestone. The last continuous production was in the 1960s, and a small amount was produced in 2005, when a 4800 tonne bulk sample was used for X-ray shielding concrete. The deposits are among numerous iron skarns on the coast hosted by Vancouver Group volcanics and carbonates.

The **Tasu Aggregate** project of Coastal Construction Aggregates Ltd. is now permitted and the company is seeking contracts. Aggregate products consist of waste from the past producing Tasu magnetite mine



Figure 12. Raven Underground Coal Project Application for Environmental Assessment Certificate.

(MINFILE 103C 003) on Moresby Island (Figure 14). They may also assess the viability of marketing magnetite fines also found in waste dumps at the site. Coastal Construction Aggregates Ltd. plans to ship by barge to markets on the coast. Product should be suitable for applications such as railway ballast, marine fill, armour and rip-rap and may find use in various port expansion projects. The original Tasu iron mine operated between 1967 and 1983, producing tens of millions of tonnes of largely limestone, marble, basalt and diorite waste rock, in addition to more than 23 million tonnes of ore. Waste from past-producing iron skarns has served as aggregate before, with examples on Texada Island and the Brynnor mine near Ucluelet (MINFILE 092F 001).

EXPLORATION PROJECTS

Significant exploration projects are summarized in Table 2.

COAL PROJECTS

The largest coal projects were the proposed Raven Underground Coal mine (in the environmental assessment process) and on-site exploration at Quinsam Mine, as discussed above.

PRECIOUS METALS

Near Port Alberni Lu'an Canada Capital and Energy Investment Inc purchased the **Mineral Creek** property (MINFILE 092F 079, 331) in 2012. Sona Resources Corporation then optioned the property in 2103. The property has been subject of significant exploration in the 1980s, test mining in the mid 1990s, and more recently, drilling, geophysics and initiation of a bulk sample between 2005 and 2010. The property has a recently approved Notice of Work.

North Bay Resources Inc reported work at its **Mount Washington** (MINFILE 092F 116, 206, 365) and **Zeballos** properties (MINFILE 092L 012 including some rock geochemistry and gold values (Figure 13). Assessment reports are filed but not yet public. Results of Mount Washington area work include a geological and historical compilation, and are published on the company's website. Qualitas Holdings Corp reported geochemical work on their Tahsis property southeast of Zeballos, following up a 2011 program (MINFILE 092E 004, 24, 85). The recent work is unpublished. Mineralization at both Mount Washington and Zeballos areas are related to Eocene to Oligocene magmatism.

After a long period of consultation, the Ministry of Energy and Mines issued a permit for drilling at the **Fandora** gold prospect (MINFILE 092F 040, 41, 205). Imperial Metals Corporation, with a number of active

TABLE 2. SIGNIFICANT EXPLORATION PROJECTS COAST AREA, 2013

Property	Operator	MINFILE (NTS ref.)	Commodity	Deposit Type	Work Program	Metres Drilled
Gillies Bay	Texada Quarrying Ltd.	092F 395	Limestone, Aggregate	Sedimentary	DD; GC	6100
Ladner Gold	New Carolin Gold Corp	092HNNW007, 003, 018	Au	Veins	MS	
McNab Valley	BURNCO Rock Products Ltd	(092G.053)	Aggregate	Sand and Gravel	EN; FS	
Myra Falls	NVI Mining Ltd (Nyrstar Mining N.V.)	092F 071,072,073, 330	Zn, Cu, Pb, Au, Ag	VMS	DD; UG	~ 25 000
Quinsam Mine	Hillsborough Resources Ltd	092F 319	Coal (thermal)	Sedimentary	DD; PD; CQ	2211.81
Raven	Comox Joint Venture (Compliance Energy Corporation, Itochu Corporation, LG International Corp)	092F 333	Coal (met +/- thermal)	Sedimentary	EN; FS	

Work Program Abbreviations:
CQ = coal quality testing; DD = diamond drilling; EN = environmental baseline studies / environmental monitoring; FS = feasibility studies; G = geology, mapping, etc.; GC = geochemical sampling (rock, soil, silt, etc); GP = geophysical (gravity or magnetics); MS = metallurgical studies; PD = percussion drilling; PF = pre-feasibility studies; R = reclamation; RC = RC drilling; UG = underground development; TR = trenching



Figure 13. Epithermal textures at Mount Washington overprint porphyry copper mineralization at the former mine site. Nearby is the undeveloped Domineer high sulphidation epithermal gold prospect.

projects around the province, has not announced imminent plans for the property although they reported geochemical sampling for assessment in 2013.

On the Mainland, near Squamish, additional geophysics, geochemistry and prospecting are reported in 2013 on the **Ashlu** property (MINFILE 092GNW045, 47, 55, 62) of Ashlu Mines Inc, a private company, which has assembled a land position around the former Ashlu Mine (MINFILE 092GNW013). A rock, soil and silt sampling program has been ongoing for 4 years, successfully relocating showings around the former mine. The Ashlu Mine is a past producer which exploited a narrow gold quartz vein (< 1 m to 4.6 m) over a strike length of 90 m and 85 m down dip. In 1981 reserves were just under 90 000 t of 8.57 g/t Au and 12.31 g/t Ag. The property is largely underlain by the Jurassic Cloudburst pluton, with a pendant of Gambier Group rocks in the southwestern portion of the property.

The **Abo**, or **Harrison Lake Gold** project (MINFILE 092HSW092) is located roughly 5 km northeast of the village of Harrison Hotsprings. The property was optioned in late 2011 by Sierra Madre Developments Inc, doing business as Bear Mountain Gold Ltd. Since then they have repaired the core logging/storage facility, rehabilitated the Jenner portal and conducted orientation soil geochemistry surveys. There is a five-year permit in place that allows for drilling.

In the Harrison Lake Gold deposit area, Brokenback Hill Formation sediments and volcanic rocks are intruded by quartz diorite stocks. One of these, the Jenner stock, gives a sericite K-Ar age of Oligocene to early Miocene, as reported in the BC Geological Survey's Geological Fieldwork 1984. Mineralization in the Jenner stock is characterized as disseminated pyrrhotite, minor pyrite, chalcopyrite and traces of molybdenite. The current exploration is based on an intrusion-hosted gold model (Fort Knox type Au). Gold occurrences related to Tertiary

quartz diorite or diorite stocks are also known to the southeast (**Blue Chip**, MINFILE 092HSW017) and northwest (**Doctor's Point**, MINFILE 092HNW071 probably **Providence**, MINFILE 092HNW030 and the **Fire Mountain** cluster of occurrences) proximal to the Harrison Fault. There was some geological work reported at Doctors Point for assessment purposes.

Near the north end of Harrison Lake, Electra Gold Ltd. optioned the **Golden Ridge** project in 2012, formerly the Quet or Hotspring Claims (MINFILE 092GNE027, 33, 38). Check assays on historical drill core were consistent with 1990 and 1997 results. Still at an early stage of exploration, the target is a near-surface low grade gold deposit. The Ministry of Energy and Mines approved a permit for exploration in 2013 (Figure 14).

On the **Dot-Apex** gold property (MINFILE 092ISW055, 79, 90) D.G. Cardinal and J.T. Shearer filed geological assessment work in 2012 and 2013. Electra Gold Ltd had a small drill program at the property in 2010-11.

New Carolin Gold Corp's work at the **Ladner Gold Project** was limited in 2013. Results of 2012 drilling were reported, and historic occurrences were re-visited in the field. There was also dewatering and additional metallurgical sampling of the Carolin Mine tailings (Figure 15). As part of the project, the company is evaluating the economics of re-processing the Carolin Mine tailings. A March 2012 preliminary economic assessment showed high price sensitivity with positive project economics above \$600/oz gold. At \$1100/oz gold the project was estimated to have NPV of \$8 million at a 5% discount rate. The average recovery in the 1982-84 Carolin Mine period of production was slightly better than 50%. At a cut off grade of 1.0 g/t, the indicated resource is approximately 23 700 oz. There is a further inferred resource (5000 oz), and also a portion of the tailings (approximately 40%) which remain untested and are not included in the estimate.

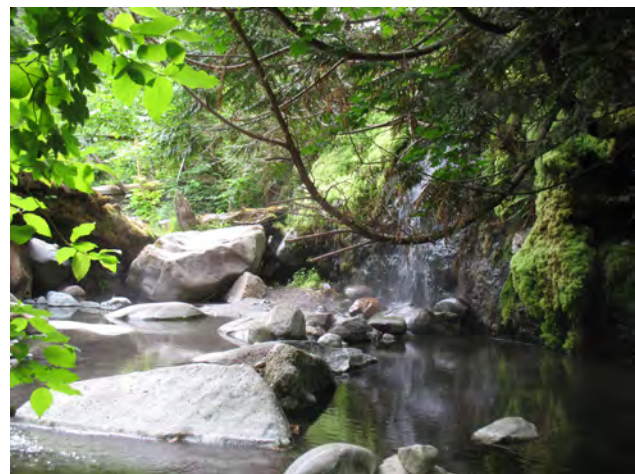


Figure 14. Modern hydrothermal activity in the Harrison Lake area. Much of the gold and Cu-Mo mineralization of current interest in the area appears to be related to Oligocene-Miocene magmatism.



Figure 15. Partially dewatered Carolin Mine tailings were sampled for metallurgical testing.

New Carolin Gold Corp hopes to resolve uncertainty surrounding part of its land position. It had an option agreement with Century Mining Corporation that entered into receivership. New Carolin plans to either acquire the assets relevant to its project, or make arrangements with the ultimate purchaser.

To the northwest, Alexandra Resources Inc. reported a small geochemical and prospecting program on its **Alexandra** property (MINFILE 092HNW031, 092HNW079), a little-explored area northwest of New Carolin Gold's Coquihalla Gold Belt property.

Small amounts of assessment work were filed on **Tasu Global** (MINFILE 103B 076) and **Sandspit Gold** (MINFILE 103G 005 and others) properties on Haida Gwaii in 2013. Although the islands are prospective, with several historical gold producers, early stage and grass roots prospects and one significant defined resource (Taseko Mines' Harmony project), the Islands are generally considered ecologically and culturally sensitive and unwelcoming to mining and exploration. Despite this, recent permitting of the Tasu Aggregate project and a small drill program at Sandspit Gold in 2010 suggests that while an operator will face close scrutiny, Haida Gwaii is not closed to the exploration and mining industries.

BASE METALS AND POLYMETALLIC

The best known Vancouver Island porphyry prospects were inactive, or minimally active in 2013. There are two main ages of porphyry mineralization: Jurassic (Island Copper and neighbouring deposits north of Rupert and Holberg Inlets), and Eocene as seen at Mount Washington and north of Tofino. Recently Miocene porphyry-style Cu-Mo mineralization has been recognized south of Quatsino Sound.

One of the largest projects on the coast in 2012 was the North Island Project of Northisle Copper and Gold Inc. The project was placed on care and maintenance in 2013. The company has a large land package on northern Vancouver Island with several porphyry and epithermal style occurrences along a prospective belt that hosted the

past-producing Island Copper Mine. Between 1971 and 1994, the mine produced 345 million tonnes with average head grades of 0.41% Cu, 0.017% Mo, and 0.19 g/t Au. The company's most advanced target at present is the **Hushamu** deposit (MINFILE 092L 240), which was drilled in 2012. A resource estimate at a 0.3% Cu equivalent cut off yielded:

	Mt	Cu (%)	Au (g/t)	Mo (%)	Re (ppm)
Indicated:	304.0	0.21	0.29	0.010	0.55
Inferred:	205.6	0.18	0.26	0.008	0.38

This resource is comparable in size to the neighbouring **Island Copper** past producer (MINFILE 092F 138), however with lower copper grades and higher gold. There is also an untested IP anomaly to the northwest, and the deposit remains open to the southeast.

Northisle began preliminary engineering studies toward a preliminary economic assessment (PEA) and obtained a notice of work for additional drilling, but chose to put the project on hold pending better market conditions for venture capital.

The Hushamu and Island Copper deposits are broadly similar in that they are related to Middle Jurassic Island Plutonic Suite intrusions of approximately the same age in Jurassic Bonanza Group rocks, and both occur in a prospective belt north of the Holberg Fault. New Rhenium-Osmium molybdenite ages suggest however, that the Hushamu mineralization is slightly older than that of Island Copper. Furthermore, the geology, mineralogy and paragenesis as interpreted to date suggest that the deposits are similar, but not directly comparable. The Hushamu deposit shares some of the advantages of its Island Copper Mine predecessor in its proximity to tidewater, infrastructure and skilled labour.

Catface Copper (MINFILE 092F 120) north of Tofino is another Vancouver Island porphyry copper project at a similar advanced stage of exploration. Imperial Metals Corporation published resource figures in 2009, but has not yet announced its plans for the project. They further defined the main resource area, the Cliff zone, with additional drilling in 2010. No new resource figure has been published. Porphyry mineralization at Catface is related to the Eocene Tofino Intrusive Suite rather than the Jurassic Island Plutonic Suite.

Also inactive in 2013 was Compliance Energy Corporation's **NIC** (MINFILE 092L 266 and others) project on Northern Vancouver Island. Here, disseminated Cu-Mo mineralization is spatially related to Miocene intrusions. Vale Exploration Canada Inc carried out some reconnaissance work on tenures to the northwest, seeking new porphyry targets.

No new exploration is reported at the **Merry Widow** (MINFILE 092L 044 and others), a copper-gold skarn property which was active up until 2008. Former operator Grande Portage Resources Ltd. has forfeited most of their tenures.

Northwest of Gold River, newly-listed Red Hut

Metals Inc. reported some further reconnaissance work on their grass roots **Conuma** property, following a 2011 airborne magnetic survey over part of the property along with mapping, prospecting and soil geochemistry. Targets include VMS style mineralization. The company also acquired an adjacent VMS polymetallic prospect, **Norgate** (MINFILE 092E 083).

On the Preston property, (**Nimkish Copper**, MINFILE 092E 025) Santa Fe Metals Corp conducted a preliminary program of geological mapping and rock sampling, including channel sampling, and packsack drilling.

Northeast of Gold River, another new property with a reconnaissance program in 2011 and 2012 is the **TIB**, recently optioned by Universal Ventures Inc. As is often the case in the densely forested region, new logging roads have revealed mineralization in an area of otherwise poor exposure. Following the discovery, a 585 line km airborne survey was flown in 2011, and further prospecting, mapping, rock geochemistry and a 20-km closely-spaced 3D IP survey was done in 2012. Exploration is in a very early stage, but styles of mineralization so far include possible replacement and vein high grade copper-gold (for example 2.7% Cu over 3.5 m including 0.5 m > 10 g/t Au) and stockwork showings spread over several hundred square metres. The showings occur in Karmutsen volcanics, near an intrusive stock. Intrusives in the area are mapped as Jurassic Island Plutonic Suite. Previous operators believed that known occurrences in the area (MINFILE 092E 050, 092F 401) were porphyry-related. Universal Ventures Inc. has not yet proceeded with the drilling that was proposed on the TIB property to follow up on 2012 geology, geochemistry and geophysics. They have however, optioned properties to the west covering the **Oktwanch** skarn showing (MINFILE 092E 019) and the **Numa** molybdenum showing (MINFILE 092E 062).

North of Alberni Inlet, Equitas Resources Corp optioned the **Nahmint** property from Nahminto Resources Ltd and began a preliminary program that included remote sensing, geochemistry and geological mapping. This follows a 2012 aeromagnetic survey. The company identified four new non-outcropping targets in the Three Jays area based on the results of the 2013 work (Figure 16). They are proposing a follow up program of access construction, mechanized trenching and drilling.

The Nahmint property includes past producers Cascade (MINFILE 092F 157), Monitor (MINFILE 092C 007), and Three Jays (MINFILE 092F 140). All are skarns that produced in the late 19th and early 20th century. Exploration since that time has been preliminary in nature.

To the north of the Nahmit property, Nahminto Resources Ltd holds most of the Macktush property. 2103 inversion and interpretation of existing aeromagnetic data identified targets for further investigation. Drilling has been proposed for the **Rex** area (MINFILE 092F 221), which is an untested porphyry Cu-Mo target in the



Figure 16. Consulting geologist Jacques Houle at the Nahmint property near Port Alberni. Equitas Resources Corp. is the new operator.

approximate centre of the property.

World Organics Inc. has an option on the Macktush North, which includes the **Cous Creek** (MINFILE 092F 360) target area

The **Old Joe**, held by prospector Dan Bruner is a grass roots stage property north of the eastern end of Great Central Lake. It has several MINFILE showings (092F 293, 415, 340, 430) and previously undocumented quartz-calcite copper-gold-silver bearing veins, and other occurrences, including the recently discovered Cadillac Road vein (Figure 17). There has been little exploration beyond prospecting and surface sampling on the property. There was a very limited (170 m) drill program west of Patterson Lake in 1990 and ground geophysics in the 1980s. While individual showings documented to date have appeared to be limited in extent, new roads in the area are uncovering further potential. The area underlying the Old Joe property is mapped as Vancouver Group (Karmutsen Formation), however a magnetic high in the regional magnetic survey crosses the northwestern portion of the property. This anomaly may be related to Island Plutonic suite mapped to the northwest around Thunder Mountain. The property is available for option.

Newly-listed Golden Peak Minerals Inc. filed geochemical and geophysical work for assessment on its **Columbia Shear** property (MINFILE 092F 282, 311, 339, 461 and others) in 2013. Results are not yet published. In the previous year they filed technical reports with results of 2011 and minor 2012 work, including a 261 line km airborne survey (VTEM and magnetometer).

The property covers a reverse fault bounded body of Sicker Group rocks. Nitinat, McLaughlin Ridge, and Duck Lake Formations have been mapped within the bounds of the property, as well as Island Plutonic Suite granodiorites. Mount Washington Suite intrusive, Vancouver Group, Mount Hall Gabbro and Buttle Lake Group are also exposed in the area. The property covers 10 MINFILE showings, several of which are assigned to BC deposit type I06, Cu+/- Ag quartz veins. Stockworks



Figure 17. Top and bottom - The Cadillac Road Vein is a recent discovery on the Old Joe property. A logging road exposed it for long enough that prospectors were able to record and sample the new copper showing.

and lenses of massive sulphide and semi-massive sulphide of inferred VMS origin are also reported. Of the 10 showings about half are described as volcanogenic, occurring in Sicker Group rocks.

Treasury Metals Inc did not report new activity at its **Lara** polymetallic property (MINFILE 092B 129 and others), although the land package has been re-assembled since portions of it lapsed in 2011. The company is currently focused on a gold project in Ontario and would consider either selling or entering into a joint venture to advance the Lara. Meanwhile they propose a small mapping and sampling program. Assessment work was filed on neighbouring properties along the WNW-ESE trend between the past-producing Mount Sicker area and RCR Mining LLP's property, which includes the **Sognidoro** prospect (MINFILE 092C 144).

The past producing **Sunro** Cu-Au-Ag mine (MINFILE 092C 073) is offered for sale by the Sunro Copper partnership. A U.S. junior company, Golden Global Corporation signed a letter of intent to acquire the property. No new work is reported.

On Texada Island, apart from the work by Lafarge in the north, there was a modest amount of exploration on the central and southern properties held by Northstar

Mining Ltd/D.A. Bombardier. Northstar is a private corporation. Work has proceeded on Texada at a relatively low level over a number of years with results published in Assessment Reports. Best known for limestone and skarn deposits in the north (e.g. **Yellow Kid – Texada Mines** MINFILE 092F 258, **Little Billie** MINFILE 092F 105), the island also has less well-explored vein and porphyry-style showings on the central and southern areas of the island (e.g. MINFILE 092F 276).

North of Powell River, the **Okeover** or **OK** property (MINFILE No 092K 008, 57, 155; 092F 302) is owned 40% by Eastfield Resources Ltd, 60% by Prophecy Coal Corp. Work in 2012 consisted of additional soil geochemistry and rock sampling. The last drill program was in 2007. Since then, soil surveys, IP and ground-based magnetic surveys have identified new drill targets on this Cu-Mo porphyry prospect. Prophecy reported modest exploration activity in 2013 to assess these target areas untested by drilling. A resource in the northern part of the property (North Lake Zone) remains open: the soil geochemistry and IP surveys since 2010 suggest that mineralization may open to the east, west, and south of the inferred resource area at North Lake. The 2006 inferred resource has 86.80 Mt grading 0.31% Cu and 0.014% MoS₂, at a 0.2% Cu cut off.

Miocene Metals Limited reported 2013 work on its **Rogers Creek** (MINFILE 092JSE033) porphyry Cu project. This included interpreting existing data, re-examining over 5000 m of drill core, and collecting physical and geophysical property data from the existing drill core. The information is intended to help constrain a geophysical inversion model and help plan future exploration.

East of Harrison Lake, the **Cogburn Magnesium Project** (MINFILE 092HNE307, 092HSW081, 092HNW041) reverted to the vendor and is available for sale or option. Coast Mountain Geological Ltd filed assessment work on the **Lekcin** (MINFILE 092HSW 082, 143, 168) property, which is owned by John Chapman and Gerald Carlson. Exploration has continued at a modest level with prospecting, geology, geochemistry and geophysics on the Lekcin, and nearby properties to follow up on targets from a multi-property IP survey in 2011. Discoveries of massive and semi-massive sulphide mineralization on this, and nearby properties like the Jason, have raised curiosity, but not sufficient funds to thoroughly test targets. Lekcin is one of several Ni-Cu-PGE/Magnesium properties located near the past-producing Giant Mascot nickel mine. The **Giant Mascot**, or **Pacific Nickel** Mine (MINFILE 092HSW 004, 93, 125) operated in the area between 1958 and 1974, and exploited a number of pipe-like ore bodies. In total more than 4.3 million tonnes of ore were mined, yielding 26.6 million kilograms of nickel, and 13.2 million kilograms of copper, cobalt, silver and gold by-products. The former nickel mine itself is held by Barrick Gold Corporation who acquired it incidentally through a corporate takeover.

They propose a ski resort on the property. Other area properties with Ni-Cu PGE targets include Jason, Cogburn, Krof and Stokke Creek to the northwest.

Natan Resources Ltd reported results of 2012 assessment work on the **Highland South Copper Property**. Reconnaissance geochemistry expanded the previously-identified Central Zone coincident Cu-Mo anomaly, and also identified other areas for follow-up. The property remains at an early stage of exploration, with little reported work beyond soil geochemistry and limited rock sampling (MINFILE 092HNW049). The property is currently held by A.A. Walus as the **Pilsudski** property.

Southeast of Hope, Savoy Ventures Inc deferred a 2013 exploration program on the **Big Range** property (MINFILE 092HSW145) on Sowaqua Creek, to 2014. Savoy completed an airborne (VTEM and magnetic) survey in 2012, and preliminary mapping and sampling since 2010 revealed molybdenum veining and alteration. Historical work in the 1930s and 1980s returned Cu, Mo and Au values.

The Hozameen Fault runs through the property, hosts serpentine, and is setting similar to Carolin Mine to the north. Associated with the fault, a felsic stock with arsenic, molybdenum and copper mineralization in quartz veins has been documented. Other mineralization occurs as orogenic gold, and porphyry Cu-Mo or Mo mineralization. Savoy Ventures Inc began trading on the TSX Venture exchange late in 2013. The company holds an option on the Big Range property.

OTHER INDUSTRIAL METALS

Several Vancouver Island magnetite iron skarn properties have changed hands over the past two years. Canadian Dehua International Mines Group Inc has acquired iron ore prospects on Vancouver Island, including **Iron Ross** (MINFILE 092K 043), **Pearson** (MINFILE 092C 022), **Argonaut** (MINFILE 092F 075) and **Head Bay** (MINFILE092E 001). They expect the Port Renfrew area (Pearson Project) to be the initial focus. Reconnaissance work began in 2013 and the Ministry of Mines is processing a Notice of Work that includes drilling. The vendor, Pacific Iron Ore Corp published an inferred resource for the Bugaboo Creek area in 2011 consisting of 14.3 million tonnes averaging 60% magnetite at a cut off of 20% magnetite.

As noted above, the **Cogburn Magnesium** project is now offered for sale. This project had a positive 2003 feasibility study by Hatch Associates Ltd. As a silicate Mg resource, the economics would be sensitive to electricity costs as well as magnesium price.

INDUSTRIAL MINERALS

Industrial minerals exploration activity is often either carried out by private companies or very large

construction materials companies for which exploration activity is not considered material and not necessarily disclosed publicly. Texada Quarrying Ltd, a subsidiary of construction materials giant Lafarge, falls into the latter category. They did however report a 6100 m drill program around their **Texada Island Quarry** (or **Gilles Bay**, MINFILE 092F 395). Reserves at the site are sufficient for over 100 years, and therefore the program was largely for quality testing purposes and assessment work, to keep tenures in good standing.

On Vancouver Island, Graymont Western Canada Inc reported geophysical work on its limestone property near **Nimpkish Lake** (MINFILE 092L 349). Results are unpublished. This follows a small geochemical and geophysical program in 2012.

PUBLIC GEOSCIENCE

Geoscience BC released results of the Northern Vancouver Island project in May 2013. This was followed by staking and reconnaissance exploration in the survey area. Among several active local explorationists attracted to the area was a newcomer to British Columbia exploration, Vale Exploration Canada Inc. . The 2012 survey was funded by Geoscience BC and the Island Coastal Economic Trust. It included a large airborne magnetometer survey over part of Northern Vancouver Island, extending nearly to Port McNeill in the east and Zeballos in the west. In addition, there was a stream sediment and till sampling and re-analysis program that covered the airborne survey area, plus additional territory. This project complements recent mapping by Graham Nixon and others of the BC Geological Survey.

On the mainland, as part of Natural Resources Canada's Targeted Geoscience Initiative 4, the Geological Survey of Canada, BC Geological Survey and UBC (M.Sc. candidate Matt Manor) are collaborating on a study of the Giant Mascot Ni-Cu deposit, the origin and setting of which remain controversial.

OUTLOOK

Exploration continued at the major mines Myra Falls and Quinsam, as well as the region's largest quarry on Texada Island. Each of these operations could continue for many more years: the Texada quarry already has a vast resource, and both Myra Falls and Quinsam have exploration potential. With infrastructure in place and production ongoing, both mines have the ability to turn targets into resources, and resources into reserves.

With a few exceptions, industrial minerals and aggregate producers have either held steady or improved shipments over last year. Generally this has been the case since the downturn of 2009. These operations are closely tied to the construction industry, which is largely driven by the local and western US economies. Many have made

significant capital investments in their operations, signalling a degree of confidence in the long term outlook.

The exploration targets and proposed mines of the region remain ready to advance, however for most projects, exploration progress is limited by lack of funds. Early stage and grass roots projects will advance slowly until the appetite for risk in venture capital markets changes. On a positive note, prospectors continue to make discoveries and geologists and prospectors continue to compile and review their data when funds are scarce.

Advanced projects and proposed mines are generally not announcing definite timelines as they are also facing uncertainties such as debt financing, permitting/environmental certification and the near term future of commodity prices.

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