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Canada Centre for Mineral and Energy Technology
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Summary Report No. 1: Barite

R.K. Collings and P.R.A. Andrews
Mineral Sciences Laboratories

CANMET Report 88-2E

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MINERAL SCIENCES LABORATORIES
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SUMMARY REPORT NO. 1: BARITE

by

R.K. Collings* and P.R.A. Andrews**

Abstract

More than 150 occurrences or deposits of barite (barium sulphate, $BaSO_4$) have been recorded in Canada; however, deposits of economic significance are confined largely to Newfoundland, Nova Scotia, Ontario and British Columbia. There are three main producers of barite at present: one with a mine at Brookfield, N.S., another with mines near Matachewan, Ont., and the third with mines near Golden, B.C.

Barite occurs in the form of vein, replacement, and residual deposits; vein deposits predominate and form the chief source of commercial barite. Although some deposits are relatively high grade, most ores require beneficiation. Beneficiation commonly includes gravity concentration, e.g., jigging and tabling, magnetic separation and, occasionally, flotation.

Barite's high specific gravity (4.5), opaqueness to X–rays, inertness, and whiteness make this mineral suitable for many diverse uses. Barite is used as a weighting agent in drilling–mud fluids in oil– and gas–well drilling, as a flux in glass and ceramics, and as a filler and extender in paints and plastics. It is also used in pharmaceutical formulations and chemicals manufacture.

Barite has been the subject of many laboratory studies by CANMET and other organizations. This report references 51 barite studies by CANMET and eight by others. Summaries of the most important CANMET studies are presented in the Appendix.

Keywords: Barite, Deposits, Production, Trade, Consumption, Uses, Specifications, Mining, Processing, Research, CANMET Reports.

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RAPPORT SOMMAIRE NO. 1: BARYTINE

par

R.K. Collings* et P.R.A. Andrews**

Résumé

Plus de 150 manifestations ou gisements de barytine (sulfate de baryum, $BaSO_4$) ont été relevés au Canada; cependant, les gisements d'importance économique sont confinés principalement à Terre-Neuve, Nouvelle-Écosse, Ontario et Colombie-Britannique. Il y a actuellement trois grands producteurs de barytine : un possédant une mine à Brookfield (N.-É.), un autre possédant des mines près de Matachewan (Ont.) et le troisième possédant des mines près de Golden (C.-B.).

La barytine se présente sous la forme de gisements filoniens, de substitution et résiduels; les gisements filoniens dominent et constituent la principale source de barytine commerciale. Même si certains gisements ont une teneur relativement élevée, la plupart des minerais doivent être enrichis. L'enrichissement comprend en général la concentration par gravité (criblage et tablage), la séparation magnétique et parfois la flottation.

La densité élevée de la barytine (4,5), son opacité aux rayons X, son inactivité chimique et sa blancheur en font un minéral qui se prête à un grand nombre d'utilisations variées. Elle sert de tare dans les eaux de boues de forages pétroliers et gaziers, comme fondant dans la fabrication du verre et des céramiques et comme matière de charge et extendeur dans les peintures et les plastiques. Elle entre aussi dans la fabrication de préparations pharmaceutiques et de produits chimiques.

La barytine a été le sujet de nombreuses études de laboratoire effectuées par CANMET et d'autres organismes. Le présent rapport renvoie à 51 études de CANMET et à 8 études d'autres organismes. Des résumés des études de CANMET les plus importantes sont présentées en annexe.

Mots clés : barytine; gisements; production; commerce; consommation; utilisations; spécifications; exploitation minière; traitement; recherche; rapports de CANMET.

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INTRODUCTION

A 1983 CANMET survey of Canadian industrial mineral producers and meetings with industrial mineral specialists in the federal and provincial governments (1) identified a number of problems specific to the industrial mineral segment of the Canadian mineral industry, as well as potential opportunities for further development and expansion. The response to this survey and discussions with industry and government specialists identified a requirement for information in a number of areas, including mineral deposits, ore mineralogy, past and current beneficiation studies, new developments, as well as product specifications and potential markets for Canadian industrial minerals.

In response to this requirement and in light of the fact that CANMET and its predecessor, Mines Branch, have been directly involved in R&D studies on mineral samples from many of the industrial mineral deposits of Canada, a decision was made to compile related information available in CANMET and EMR generally, in provincial government offices and, as available, from the private sector, in a series of Summary Reports on industrial minerals. Separate reports for each mineral would contain information pertaining to mineral occurrences, deposits of specific interest, current activities, product uses and specifications, process technology, and summaries of past R&D on specific deposits by CANMET and Mines Branch. This report – *Summary Report No. 1: Barite* – is the first in this planned series; a brief summary, without details of test work, has been previously published (6).*

TYPES OF DEPOSITS (2, 3, 4, 7)

More than 150 barite occurrences have been recorded in Canada, deposits being found in all provinces except Alberta, Saskatchewan and Prince Edward Island. Many of these are small and of limited commercial interest; however, others have been or are being developed as producing mines.

Barite deposits can be classified into three groups: vein, replacement and residual.

Vein

Most of the known Canadian barite occurrences are of the vein type. The vein deposits in the Atlantic provinces contain barite that is mostly coarse grained with a platy texture. The barite–fluorite veins that comprise the Lake Ainslie system (Nova Scotia) are developed along strong fault cavities and subsidiary tension fractures. The majority of the veins are concentrated in three specific areas east of Lake Ainslie (11). The barite vein deposits of Ontario are compact, coarsely granular and massive. Barite from the Kootenay district of British Columbia varies from friable and finely granular, to compact and platy, to fine grained and compact.

Analyses of samples from vein deposits range from 50 to 60% $BaSO_4$ but can be >80% $BaSO_4$. Impurities typically include quartz, fluorite, calcite, galena, dolomite, celestite and siderite.

Replacement

Most domestic production has come from replacement deposits, which are similar in many respects to vein deposits, but which replace in whole or in part certain beds of sedimentary formation (2). Limestone is often the host rock and these deposits are usually more extensive than vein types, although the $BaSO_4$ content may not be as uniform or as high.

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*The references at the end of this report are arranged essentially on a province–by–province basis as are the summaries of research in the Appendix; because of this, the reference numbers that appear throughout the report are not in the usual numerical sequence.

There are four main replacement orebodies in Canada: the Walton orebody in Nova Scotia, the Giant Mascot and the Mineral King orebodies in British Columbia, and the Buchans orebody in Newfoundland. Although the Buchan's deposit was mined primarily for lead and zinc, the barite tailing, containing 30 to 50% $BaSO_4$, has been stockpiled.

Typical impurities in replacement deposits include quartz, fluorite, calcite, galena, dolomite, celestite and siderite.

Residual

Residual deposits are formed by the weathering of barite–bearing rocks and consist of barite fragments in a layer of soil or clay. The barite is derived from vein or replacement bodies in soft sedimentary host rocks. Barite fragments from sand size to boulder size are usually concentrated in a zone overlying the source of barite. There are no known residual deposits in Canada.

MINERALOGY

Mineralogically, barite ($BaSO_4$) resembles celestite ($SrSO_4$) not only in crystal habit, hardness and colour, but also to some degree chemically. Barium can substitute for strontium since the atoms have a similar ionic radius. Barium is commonly deposited as the sulphate, barite, and less commonly as the carbonate, witherite.

Although most commonly coarse grained, barite also occurs as platy crystals or fine–grained compact masses, which may be white, light yellow, light grey, brown, pink or blue. Aggregates of thin platy crystals in parallel orientation often form botryoidal masses or cockscomb structures that are referred to as crested barite. Fine–grained compact varieties may have the appearance of massive gypsum. Barite crystallizes in the orthorhombic system and has three good cleavages. It has a specific gravity of 4.5 and a hardness of 2.5 to 3.5. Because of its softness and textural characteristics, barite is a relatively friable mineral. Some barite deposits may be classified as hard or soft depending on the ease with which the mineral may be ground.

PRINCIPAL OCCURRENCES

As noted previously, occurrences of barite have been recorded in most provinces, but deposits of economic significance are confined largely to Newfoundland, Nova Scotia, Ontario and British Columbia. These deposits are located on the map, Figure 1, and described below on a province–by–province basis.

Newfoundland (8, 9, 10)

The principal occurrence of barite in Newfoundland is in the interior of the province at Buchans. Other occurrences include those at Colliers Point on the east coast, and at Ronan, near Port–au–Port, on the west coast.

Buchans

At Buchans the barite is closely associated with a lead–zinc–copper ore that was mined by ASARCO Incorporated between 1928 and 1985. The ore reportedly contained an average of 23% $BaSO_4$. This was concentrated to about 35% $BaSO_4$ during metallic mineral recovery operations and discharged. as

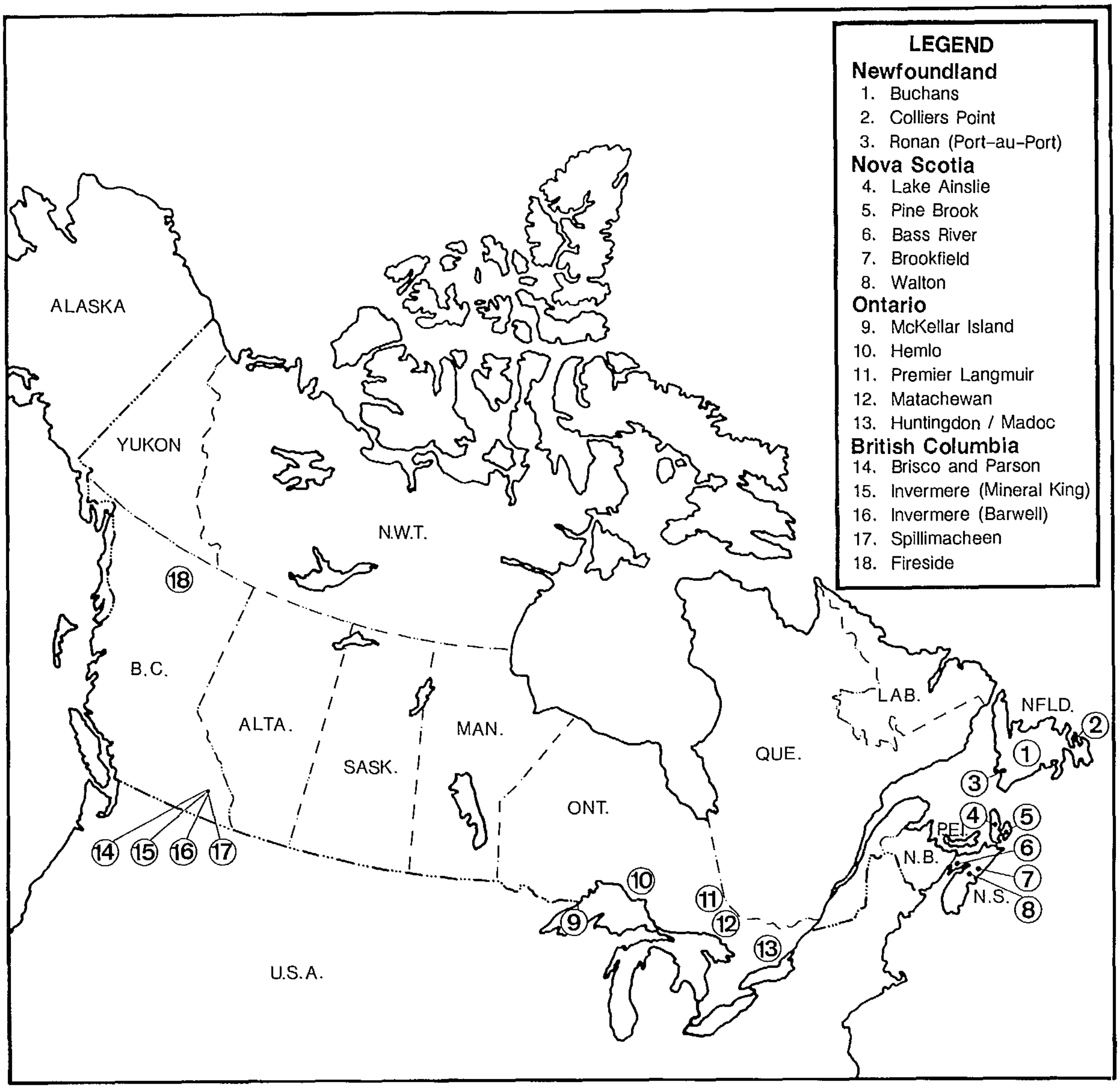

Fig. 1 – Principal barite deposits in Canada

tailings, to two impoundment or dump areas. These dumps contain an estimated 500 000 t of barite in 1.5 million t of tailings.

Metallurgical bench–scale test work (20) has demonstrated the technical feasibility of recovering a high–grade barite product with good recovery from the sulphide tailings. However, recovery has been limited to some 4000 t, which were produced in 1982 in response to demand by offshore oil– and gas–well drilling companies.

Colliers Point

An interesting barite deposit occurs at Colliers Point in the western Avalon peninsula. Although of good grade, >95% $BaSO_4$, this deposit is relatively small and the barite occurs in a fault zone with numerous stringers and veinlets cutting through surrounding arkose sediments. Celestite, strontium sulphate, is associated with this occurrence; grab samples contain up to 6.5% $SrSO_4$.

This deposit was open–pit mined from 1902 to 1904 when 3000 t of barite were produced. A further 15 000 t were mined during the early 1980s in response to barite requirements for offshore drilling. Current reserves have been estimated at 20 000 t.

Ronan (Port–au–Port)

The Ronan deposit, discovered in 1923, appears to be zoned with alternating barite–rich and celestite–rich layers.

The barite is pinkish white when fresh and mainly white when weathered. It may be fine grained, vuggy, massive, sugary or finely crystalline. The celestite is often bluish white or white and coarse grained. It occurs as vuggy aggregates of bladed or tabular crystals and, less commonly, in granular or fibrous forms.

Beneficiation studies have shown that it is difficult to separate the celestite from barite, possibly because there are solid solutions of barium in the celestite.

Reserves have been estimated at 150 000 t.

Nova Scotia (11–15)

The first recorded mining of barite in Canada took place in 1866 at Bass River near Five Islands, Colchester County. The Magnet Cove Barium Corp. near Walton, once the largest Canadian barite mine, accounted for more than 90% of the barite production in Canada between 1940 and 1978. Other important deposits include one at Brookfield on the mainland and those near Lake Ainslie and at Pine Brook on Cape Breton Island.

Walton

The Walton barite deposit is located near the town of Walton on the south shore of Minas Basin. The barite is massive, fine to coarse grained, compact, and red to brown in colour because of iron staining and iron oxide inclusions. The deposit was developed and operated from 1940 to 1978 by Canadian Industrial Minerals Ltd., initially as an open pit but later by underground mining. The ore was trucked to Walton where it was washed, crushed and pulverized in a 100 tpd mill, then shipped for use as drilling mud; grade of ore averaged 90% $BaSO_4$. The mine and quarry are flooded at present; however. interest has been expressed in the recovery of barite from surrounding waste dumps. This is described more fully in a later section of this report.

Brookfield

The Brookfield barite deposit, located near the town of Brookfield in central Nova Scotia, has been described as a pipe-like body dipping 65° northwesterly and plunging 50° easterly. The deposit contains beds of brecciated, ferruginous shales and siltstones up to 30 cm thick. The ore zone is an intergrowth of white, coarsely crystalline barite and brown siderite, generally contained within shale, siltstone and sandstone sediments. This deposit was first explored by diamond drilling and trenching in 1944. A concentrator was constructed in 1951; however, little barite was processed. The deposit is currently worked on a seasonal basis to supply barite to the pharmaceutical-grade barite plant of Nystone Chemicals Ltd. at Debert. This operation is described in greater detail later in this report. Reserves have been estimated at about 40 000 t, grading 45% $BaSO_4$.

Lake Ainslie

Barite occurrences have been recorded at several locations in the Lake Ainslie area of west central Cape Breton Island. The two most important deposits occur near the eastern shore of the lake, one 3 km southeast of the village of Scotsville, the other near East Lake Ainslie (Trout River).

The Scotsville deposit was acquired by Scotsville Mineral Resources in 1980. Exploratory drilling and trenching indicated a 100 000 t orebody amenable to open-pit mining and averaging 65% $BaSO_4$. Gangue minerals were principally calcite, quartz, feldspar and fluorite. Preliminary estimates indicated a product recovery of 40% of feed containing 70% of the total barite. Mine development work was initiated and equipment installed to process this ore for the offshore drilling industry. Unfortunately, no significant production was achieved before the 1985–86 slump in offshore markets, and the property was placed in receivership in 1986.

The Trout River deposit is comprised of several vein systems. The Campbell-MacMillan and the Upper Johnson vein systems contain the major tonnage of economic barite-fluorite and are the two most important deposits.

The principal vein minerals are barite and fluorite. Gangue minerals are mainly calcite with minor to trace amounts of manganiferous limonite, pyrite and chalcopyrite. The barite varies from white to creamy white to pink. It occurs in comb-like crystals and rosettes but is mainly massive. Significant amounts of strontium are present as a solid solution in the barite. Fluorite occurs in many varieties and is commonly green to colourless. The enclosing wall rock is impregnated with disseminations of the purple variety that occur as granular aggregates. Reserves of the Upper Johnson vein are estimated at 1 Mt, averaging 50% $BaSO_4$ and 17% CaF_2; reserves of the Campbell-MacMillan vein are estimated at 3 Mt, averaging 27.8% $BaSO_4$ and 19.0% CaF_2. Apart from a small but continuous production before 1931, there has been no major production of either barite or fluorite from these deposits.

Pine Brook

The Pine Brook barite deposit is near the hamlet of Lake Vist, Richmond County, Cape Breton Island. The ore occurs in a 1 m thick bed that is overlaid and underlaid by siltstones, the whole dipping 10°. The ore zone contains an estimated 85% $BaSO_4$, and finely divided calcite is the principal impurity. Diamond drilling and bulk sampling by Novex Mining and Exploration Co. Ltd. in 1980 indicated 80 000 t of ore, grading 70% barite and 30% calcite. Novex acquired the then-dormant celestite processing plant at Lake Enon and processed 12 000 t of ore, recovering 5700 t of mud-grade barite. The operation closed in 1984 as a result of inconsistent product quality and a general softening of the drill-mud market.

Bass River

The Bass River barite deposit is located in Colchester County, about 3 km north of the village of Bass River, on the north shore of Cobequid Bay. The barite at this location is interlayered with siltstone and fine-grained sandstone in a shallow bed, measuring 2.5 m thick. A drill program by Magcobar Dresser Canada, Inc. in 1983 indicated barite in excess of 3000 t. About 700 t were shipped to the Walton mill in 1983 for processing to mud grade and a further 2800 t in 1984; thus, present reserves at this site are minimal.

Ontario (17–19)

Barite occurrences in Ontario are located in three main regions: Lake Superior, Timmins–Matachewan, and southeastern Ontario.

In the Lake Superior region, twelve deposits have been noted, of which four were at one time worked for barite. An important barite deposit is located on McKellar Island near Thunder Bay. In the Timmins–Matachewan group, five deposits are known, of which four, including the Premier Langmuir mine, were worked for barite. Today there is only one operator in this area, Extender Minerals of Canada Ltd., which has mines near Matachewan. In southeastern Ontario, eighteen deposits have been noted, of which seven were worked for barite; the principal source of barite was a barite–fluorite vein at the Noyes mine in the Madoc area. The barite occurrences in southeastern Ontario are either barite or barite–fluorite veins.

McKellar Island

A large, white, barite–calcite vein cutting diabase was discovered on McKellar Island in 1869. This vein consists of two sections: a coarsely banded, almost massive, assemblage of very coarse barite and calcite, which forms the major part of the vein, and a narrow, distinctly banded portion. Barite in the main body of the vein is present as white, radiating, tabular aggregates. The calcite is also white but easily distinguished by its blocky cleavage and grey, weathered colour. Minor quartz and fluorite are present. From 1869 to 1894, 8902 t of barite were mined by hand–cobbing methods. Reserves have been estimated at 50 000 t, grading 88% $BaSO_4$.

Premier Langmuir

In 1910 a barite deposit was staked near Langmuir, 32 km southeast of Timmins. There are two veins of economic importance; barite in the main vein is generally white and of high grade but the smaller vein is less pure. The texture is coarse grained, dense and compact. In addition to calcite, minor impurities include quartz, fluorite and base–metal sulphides. Typical samples contain 85 to 90% $BaSO_4$. Between 1911 and 1948, 2000 t of barite were reportedly produced by various companies.

Huntingdon–Madoc

Barite–fluorite veins in the Huntingdon–Madoc area in eastern Ontario have been worked mainly for fluorite. Some of the fluorite deposits that lie south of Moira Lake contain 40 to 50% $BaSO_4$. The barite may be concentrated in distinct lenses or zones, but it is more commonly finely interbanded with fluorite. Concentrates of barite and fluorite have been produced at the Noyes mine near Madoc.

Hemlo

The recent discovery of major gold deposits near Hemlo, east of Thunder Bay in northern Ontario, also resulted in the identification of large stratiform barite deposits associated with the gold. At the

Golden Giant mine, operated by Noranda Mines Ltd., it is anticipated that up to 300 tpd of by-product barite could be recovered when full production is achieved. This barite is apparently of sedimentary origin and has been identified over a distance of 10 km.

British Columbia

The principal deposits of barite in British Columbia occur as veins and lenses in basic schists and limestone, which are usually associated with metallic sulphides.

Brisco and Parson

Vein deposits near Brisco and Parson in southeastern British Columbia are mined by Mountain Minerals Ltd. The ore is shipped by rail to the company's plant at Lethbridge, Alta., for crushing and grinding. Barite ore from the Parson deposit is white to creamy white, coarse grained, compact, and contains minor impurities, including hematite, quartz, pyrite, siderite, chalcopyrite and calcite. The Brisco deposit consists of light–grey to white, fine–grained compact barite, and black carbonaceous gangue as disseminations and streaks. The barite commonly has a brecciated appearance and contains minor impurities, including quartz, carbonaceous minerals, pyrite, hematite and chalcopyrite.

Invermere (Mineral King)

Several companies have recovered barite from sections of the Mineral King lead–zinc deposit near Invermere. The crude barite was shipped to plants in Alberta where it was ground for use in oil– and gas–well drilling muds.

This barite is reportedly exceptionally white, of high quality and has a friable, sugary texture; grade is estimated at 50% $BaSO_4$.

Invermere (Giant Mascot)

Baroid of Canada Ltd. has recovered barite by open–pit methods from a vein in the Larrabee claim near Invermere. The company also mined a small tonnage from the open pit of the Giant Mascot deposit near Spillimacheen. The barite was shipped to Onoway, Alta., for grinding.

MINOR OCCURENCES

Minor Canadian occurrences of barite are summarized in Table 1.

CURRENT ACTIVITY

Barite production and exploration closely follows oil– and gas–well drilling activity, as significant quantities of barite are required for use as a weighting agent in drilling muds. In recent years, the use of barite in mud formulations in Canada has accounted for more than 90% of total consumption.

Rising world oil prices in the early 1980s and government incentive programs resulted in a marked increase in well–drilling activity in Alberta, in the Beaufort sea, and offshore Newfoundland and Nova Scotia. A concomitant increase in barite demand was met by imports from Ireland and Morocco, particularly for drill–mud markets in Eastern Canada. This stimulated a renewed interest in undeveloped barite resources in Newfoundland and Nova Scotia, as well as in British Columbia.

Table 1 – Minor occurrences of barite in Canada

Province	Region	Location	Production	Mineralogy
New Brunswick		Memramcook	Minor	Stockwork of narrow veins up to 25 cm wide, consisting of barite and minor quartz and fluorite.
Quebec	Hull County	Ironside	2 000 t	Vein of barite, about 1 m in width and 100 m in length; mined to a depth of 15 m.
Ontario	Lake Superior	Glen	Unknown	Veins of barite in a fracture zone in sedimentary rocks and granite.
		Jarvis Island	Unknown	White calcite–barite vein in diabase.
		Thompson Island	Unknown	Composite vein, barite and minor calcite and quartz.
	Timmins–Matachewan	Penhorwood	440 t	Massive compact, white barite in a composite vein cutting granite.
		Lawson	225 t	Lens of white barite in diabase.
		Yarrow	Unknown	Several veins of grey–white barite in sedimentary rocks.
	southeastern Ontario	Kingston	100 t	Barite vein.
		Portland	200 t	White barite cement in a brecciated zone in Ordovician limestone.
		Lavant	75 t	Barite vein with accessory quartz and base–metal sulphides.
		North Burgess	400 t	Clean white barite in a granite gneiss.
Yukon	Teslin River to MacMillan Pass	Canal Road	None	Two types of vein material: a coarsely crystalline white barite marked by occasional flecks of dark colour, and a pure white, finely crystalline barite. Reserves $\simeq$ 45 000 t of 99.5% $BaSO_4$.

Producers

There are three current producers of barite in Canada: Nystone Chemicals Ltd., which obtains barite from a deposit at Brookfield, primarily for pharmaceutical barite manufacture; Extender Minerals of Canada Ltd., which mines barite near Matachewan, south of Timmins, Ont., for use in the production of filler and extender pigments for paints and plastics; and Mountain Minerals Ltd., which produces mud–grade barite for oil–well drilling at Lethbridge, Alta., using barite from mines at Brisco and Parson. Mountain Minerals also recovers barite intermittently from base–metal tailings from the Mineral King mine. Several other companies are interested in barite deposits in British Columbia. These include Barwell Resources Ltd., which operates an underground mine south of Windermere; Baroid of Canada Ltd., which recovers barite from the Giant Mascot mine near Spillimacheen; and M–I Drilling Fluids Canada Inc., which owns a barite property near Fireside in the northern part of the province. These deposits are operated intermittently to supply mud–grade barite for oil– and gas–well drilling operations. Scotsville Mineral Resources closed its mine and processing plant at Scotsville, on Cape Breton Island, shortly after opening in 1986 because of financial problems.

Production, Trade and Consumption

Production of barite in 1987 was 40 550 t. Imports at 10 519 t in 1986 were well below the previous year's total of 26 587 t; the demand for barite in 1988, however, is expected to show a modest increase (5). Increased demand will undoubtedly result in a resurgence of interest in several of the previously noted deposits, particularly in Newfoundland, Nova Scotia and British Columbia.

A compilation of available statistical data on Canada's production, trade and consumption of barite is presented in Table 2.

Barite Studies

Recent government initiatives to promote increased interest in and further development of the mineral industry in Canada included the two–year, federally sponsored START program (Short Term Aid in Research and Technology, 1983 to 1985) and the five–year, federal–provincial MDA programs (Mineral Development Agreements) initiated in 1984–85. A number of barite studies was carried out under the terms of these programs.

START Program

Two in–house studies of barite in British Columbia were carried out under the START Program: the first study looked at the recovery of barite by dry gravity concentration using a barite–dolomite ore from Invermere (69); the second examined the recovery of barite by both dry and wet gravity concentration techniques using a barite–quartz ore from the Parson mine (70).

MDA Programs

Two contract studies were commissioned under the Canada–Nova Scotia Mineral Development Agreement: the first, in 1985, was a study of deposits, developments and markets for Nova Scotia barite (14); the second, in 1986, was an investigation of the recovery of mud–grade concentrate from Pine Brook barite (15). The first study provided an overview of barite deposits as well as interest and developments in Nova Scotia. The second study indicated that jigging, followed by regrind and table concentration of the jig tails, was the best approach to the production of mud–grade barite from Pine Brook.

Table 2 – Canada's barite production and trade, 1985–87, and consumption, 1983–86*

	1985		1986		1987(p)	
	(tonnes)	($000)	(tonnes)	($000)	(tonnes)	($000)
Production (mine shipments)	71 049	5 503	36 888	4 635	40 550	3 886
					(Jan.–Sept.)	
Imports						
United States	7 033	820	10 030	1 032	2 581	372
Ireland	8 011	381	–	–	–	–
Netherlands	489	170	489	185	692	190
Morocco	11 020	808	–	–	–	–
Other	34	13	7	1	–	–
Total	26 587	2 192	10 526	1 218	3 273	562
Exports						
Madagascar	–	–	–	–	200	50
West Germany	–	–	..	1	–	–
United States	1 679	479	5 072	982	4 674	1 790
Total	1 679	479	5 072	983	4 874	1 840
Apparent Consumption	95 957		42 342		38 949	

	1983	1984	1985	1986(p)
Consumption[1]				
Well drilling (e)	60 000	64 000	51 000	15 000
Paint and varnish	1 484	1 449	1 526	1 298
Other[2]	4 200	6 119	6 758	6 403
Total (e)	65 684	71 568	50 284	22 701

Sources: Energy, Mines and Resources Canada; Statistics Canada

[1] Available data reported by consumers with estimates by Energy, Mines and Resources Canada; does not include inventory adjustments.

[2] Other includes plastics, bearings and brake linings, foundries, chemicals, explosives, glass and glass products, etc.

(p) preliminary; (e) estimated; – nil; .. not available

*These data are from the Annual Mineral Preprint (1986) published by the Industrial Minerals Division, Mineral Policy Section, Energy, Mines and Resources Canada, Ottawa, Ontario (5).

Recent in-house studies by CANMET included an examination of the recovery of barite from the Buchans lead–zinc mine tailings in central Newfoundland and beneficiation studies of barite samples from Lake Ainslie, Pine Brook and Brookfield (43). These studies demonstrated the technical feasibility of the recovery of mud-grade products from the noted ores by a variety of concentration methods.

USES AND SPECIFICATIONS

Barite's high specific gravity (4.5), low abrasiveness, chemical inertness, and opaqueness to X-rays ensure its continued use for various diverse applications. These include use as a weighting agent in oil- and gas-well drilling mud, as a filler and extender in paint, linoleum and rubber, as an ingredient in glass batches, and as a heavy aggregate for gamma-ray shielding in concrete. Barium is also used in pharmaceutical formulations and ceramics, and in the manufacture of barium chemicals. Product uses with available specifications are outlined below.

Oil- and Gas-Well Drilling

Barite is the principal ingredient of the drilling mud used in oil- and gas-well exploratory drilling. Drilling mud, a heavy mixture of barite, bentonite, water and other materials, is used in down-hole drilling operations to lubricate the drill stem, to remove drill cuttings from the hole, and to seal well cavities. Consumption of barite varies from well to well and according to the depth of hole and geological formation, but averages about 1500 t/5000 m hole.

General specifications for drill-mud barite are as follows:

Specific gravity	4.2 min
$BaSO_4$ content	92% min
Soluble alkaline earth content, as calcium	250 ppm max
Particle size	95% −45 µm (325 mesh)

Ref: American Petroleum Specification 13A for Oil-Well Drilling-Fluid Materials, 1981.

Filler and Extender

Barite is an important ingredient in some paint formulations where it provides bulk, controls prime pigment settling, and improves viscosity, application properties and surface finish.

General specifications for paint-grade barite are as follows:

Particle size	99.98% passing 37 µm (400 mesh)
Hegman number	6.5
Brightness (green filter)	81%
Oil absorption	5 kg/45 kg
$BaSO_4$ content	95% min
Iron content	0.05% max
Water soluble compounds	0.2% max
Foreign matter	2.0% max
Moisture	0.5%
pH	6.4

Ref: American Society for Testing and Materials, ASTM D-1366 (size), D-281 (oil absorption), D-280 (moisture), D-1208 (water insoluble), D-1208 (pH).

Barite is also used as a filler in other products, including rubber, plastic, tile and linoleum, car undercoating compositions and brake linings.

General specifications for such applications are as follows:

$BaSO_4$ content	95% min
Particle size	95% −45 μm
Colour	colour specifications vary depending on application, usually a near-white product is required

Glass and Ceramics

Barite acts as a flux in the glass batch to lower melting temperature and improve workability of the molten glass. It further acts as a decolourizer and increases the lustre and brilliance of glass.

General specifications for glass-grade barite are as follows:

$BaSO_4$ content	95% min
SiO_2	1.5% max
Iron (as Fe_2O_3)	0.15% max
Al_2O_3	0.15% max
Particle size	100% −850 μm with less than 5% −150 μm fines

Barium is finding interesting applications in the field of ceramics. Barium titanate, for example, has special electromechanical properties that are ideal for applications in the electronics industry, and barium ferrites are being used increasingly in the manufacture of high-strength permanent magnets.

Pharmaceutical Applications

Because of its opacity to X-rays, barite (or derivatives thereof) is used in the preparation of pharmaceutical formulations used in X-ray examination of the throat, stomach and intestinal tract.

General specifications for pharmaceutical-grade barite are as follows:

$BaSO_4$ content	97.5% min
Heavy metals (as Pb)	0.001% max
Sulphides	<0.1 ppm
Arsenic	<0.1 ppm
Particle size	90% −20 μm
Colour	white or near white
Odour	odourless

Heavy Aggregate

Barite is used as an aggregate in heavy concrete used to weigh down pipelines buried in marshy lands. It is also used in concrete construction at nuclear reactors where it acts as a shield to absorb emitted gamma radiation.

General specifications for barite as heavy aggregate are as follows:

$BaSO_4$ content	95% min
Particle size	gravel size

Barium Chemicals

Barite is the basic raw material in the manufacture of a host of barium compounds, including barium carbonate, barium chloride, precipitated barium sulphate, lithopone (barium sulphate–zinc sulphate), barium nitrate and barium oxides. These chemicals are used in a wide variety of applications: barium carbonate and barium chloride are used in clay brick and tile manufacture to reduce efflorescence and scumming; barium oxide is used in glass, especially optical glass and television tubes, to increase density and improve brilliance; barium carbonate is used in the manufacture of barium titanates for the electronics industry and as a filler in paper, linoleum and rubber.

Specifications for barite for barium chemicals manufacture vary but generally are as follows:

$BaSO_4$ content (lump material)	92 to 96% min
$BaSO_4$ content (flotation concentrate)	96 to 98% min
Fe_2O_3 content	1.0% max
$SrSO_4$ content	1.0% max
CaF_2 content	0.5% max
Particle size	–5.0, +0.5 mm

Barium compounds are made from barium sulphide, which is produced directly from barite by the black ash process. The barium sulphate (i.e., barite) is reduced by being mixed with finely powdered coal and heated to a temperature between 1250 and 1350°C in a rotary kiln. The end product contains 80 to 85% barium sulphide, depending on the impurities in the starting materials. Further impurities are removed by countercurrent leaching of the furnace clinker with water, and by filtration to produce a concentrated barium sulphide solution and a leach residue containing most of the impurities.

Miscellaneous

Barite has been added, in small quantities, to small plastic toys to render them visible, under X–ray, if accidentally swallowed. Other potential applications for barite include use as replacement for lead in protective aprons and clothing for X–ray technicians.

MINING, PROCESSING, CONCENTRATION

Mining and Processing

Commercial barite is mined from surface or near–surface deposits by open–pit or underground mining methods. The broken ore is trucked to the processing plant where it may be washed by log washer or trommel screen to remove adhering clay and low–grade fines before reduction by jaw or impact crusher to 25 cm or finer for further processing. The degree of further processing and concentration will depend on grade of ore, identified end use, and liberation size, i.e., the size at which the barite is essentially free of contaminating impurities. If further size reduction is required, this can be accomplished by jaw, impact, cone or roll crushers.

Concentration

Gravity methods of concentration. including heavy–media drums or cones, wet or dry mineral jigs, wet or dry tables, and spiral classifiers, may be used to separate high specific gravity barite (4.5) from lower specific gravity gangue minerals (<3.5) such as calcite, dolomite, quartz or shale. The choice of technique is dependent on liberation size; if coarser than 2 mm, for example, heavy–media separation and wet or dry jigging are usually applicable, the upper size being approximately 50 mm for heavy–media separators and 12 mm for wet or dry jigs. Barite ore that must be reduced to 2 mm or finer for liberation may be concentrated by wet or dry tables, spirals, rake and cone classifiers. In most instances, it is advisable to remove very fine, −75 µm material, by hydrocyclone before further concentration.

Electronic or colour sorting of coarse, +5 mm ore may be employed, provided the barite ore is liberated and there is an adequate colour difference between the barite and gangue minerals. For finer, −1 mm size ore, electrostatic or magnetic separation techniques may be considered. Wet or dry high–intensity magnetic separation is useful in removing iron–containing minerals, such as siderite, and acid leaching may be employed where a low–iron product is required as, for example, in barium–based pharmaceuticals manufacture.

When the liberation size is very fine, e.g., 75 µm, flotation is the preferred concentration method. Flotation is used to concentrate the fines that are present in coarse–grained ores. The fines are usually separated by screening before gravity concentration of the coarse fraction. Barite ores may be concentrated by either direct or reverse flotation. The preferred collector–type reagents are alkyl sulphate, specifically Dupanol L.S. (sulphonated fatty acid), and alkyl sulphonates, specifically the Aerofloat 800 series. Collector concentration may vary between 250 and 500 g/t.

Modifiers and depressants typically used include Na_2CO_3, Na_2SiO_3, Quebracho, $BaCl_2$ and citric acid. The function of Na_2CO_3 is mainly as a pH modifier; Na_2SiO_3 is used both as a slime dispersant and a quartz depressant. $BaCl_2$ is reported to be a barite activator; Quebracho, a calcite depressor; and citric acid, a depressant for fluorite. If the quantity of calcite in a barite ore is high, e.g., 40% or more $CaCO_3$, it may be necessary to float the calcite, which can be achieved using sodium oleate collector at neutral pH. If calcite is not sufficiently depressed or removed by flotation, the presence of dissolved calcium carbonate can be detrimental to the selectivity of barite flotation.

In general, barite rougher flotation is fairly rapid (<5 min), although, with finer sizes, flotation time is increased. Barite is floated under slightly alkaline conditions and multistage cleaning is necessary to achieve high grades. Sliming of barite should be kept to a minimum as barite slimes cause flotation of fluorite.

Finish Grinding

The concentrated barite may be ground to final size specifications by roller mill, paddle mill or other suitable unit. As previously noted, a 45 µm product is normally specified for drill–mud barite; however, a much finer product may be required for other applications, such as chemical and pharmaceutical preparations.

PLANT DESCRIPTIONS

The following plant descriptions and generalized flow diagrams (Fig. 2 to 4) provide information relative to the processing of barite. A flow diagram for the recovery of barite from waste dump materials at Walton, N.S., is also included.

Nystone Chemicals Ltd., Debert, N.S.

Barite ore grading 40 to 50% $BaSO_4$, mined by open–pit methods from a hillside deposit near Brookfield, is crushed and screened on site to −1.3 cm in a mobile plant. The crushed product is trucked to a pharmaceutical–grade barite processing facility at Debert, or it may be further processed by wet jigging at the mine site. The jig concentrate, grading 90% $BaSO_4$, is sold to drill–mud companies, whereas the hutch product, grading 50% $BaSO_4$, is trucked to Debert. At Debert, the barite is reduced by rod mill to −300 µm and passed over shaking tables. The table concentrate is fed to a Jones high–intensity wet magnetic separator to remove siderite, the main impurity, and the nonmagnetic fraction is acid leached to remove any remaining iron and acid–soluble minerals. Following neutralization, the residue is retabled and the concentrate, now grading 98% $BaSO_4$, is stored in tanks before wet attrition grinding in paddle mills to −2 µm. The ground product is spray dried and packaged for shipment to consumers in the United States. Figure 2 is a schematic of the Debert processing operation.

Extender Minerals of Canada Ltd., Matachewan, Ont.

Extender Minerals of Canada Ltd. mines barite from underground deposits at two locations in northeastern Ontario near Matachewan. Ore from both properties is crushed, sized and treated by jigs at the mine sites; the jig concentrates are trucked to a grinding mill at Matachewan where the barite is dried and ground to various sizes as required. Product size varies from 80% −45 µm to 99.9% −12 µm, and barite content from 93 to 97% $BaSO_4$. This high–quality product is used principally as an extender or filler in paint and plastic products. Figure 3 is a schematic of the Matachewan processing plant.

Magcobar Dresser Canada, Inc., Walton Mine Waste Dumps

The barite deposit near Walton was operated by open–pit and underground mines between 1940 and 1979 for the recovery of mud–grade barite. During that period, thousands of tonnes of waste, consisting of clay, sandstone, limestone and barite, were disposed of in adjacent dumps. Immediately before the mine's closure, approximately 80 000 t of 4.15 sp gr barite were recovered from 370 000 t of high–grade pockets of dump material by crushing, washing and wet jigging. An estimated 90 000 t of barite are contained in the remaining 670 000 m^3 of dump material.

Magcobar Dresser Canada, Inc., a drilling fluid services firm with offices in Dartmouth, N.S., has current interest in the further recovery of barite from these waste dumps. Plans call for the recovery of 15 000 t of mud–grade barite annually. The dump material will be crushed to 100 mm and washed to remove adhering mud and clay. The washed product will be crushed to 20 mm and treated in jigs to recover mud–grade barite; wastes from both the washing and jig circuits will be returned to the open pit. Figure 4 is a generalized flow diagram of this proposed operation.

Ref.: Walton Mine Dump Barite Recovery Project, January 1984, Magcobar Dresser Canada, Inc.

CANMET STUDIES

Background

Thirty–nine CANMET–Mines Branch studies relating to various aspects of beneficiation of barite were reviewed. A summary of each study is presented in the Appendix according to province. The title, report number, authors' names, and a summary of work and results are included.

The summary of each study includes, if known, the original sample weight, head analysis, mineralogy, beneficiation methods, beneficiation product sizes, concentrate grades and recoveries, and remarks or observations of particular interest. The original sample weight is indicative of the scale of investigation, whether bench, laboratory, semi–pilot plant or pilot plant. The head analyses provide data

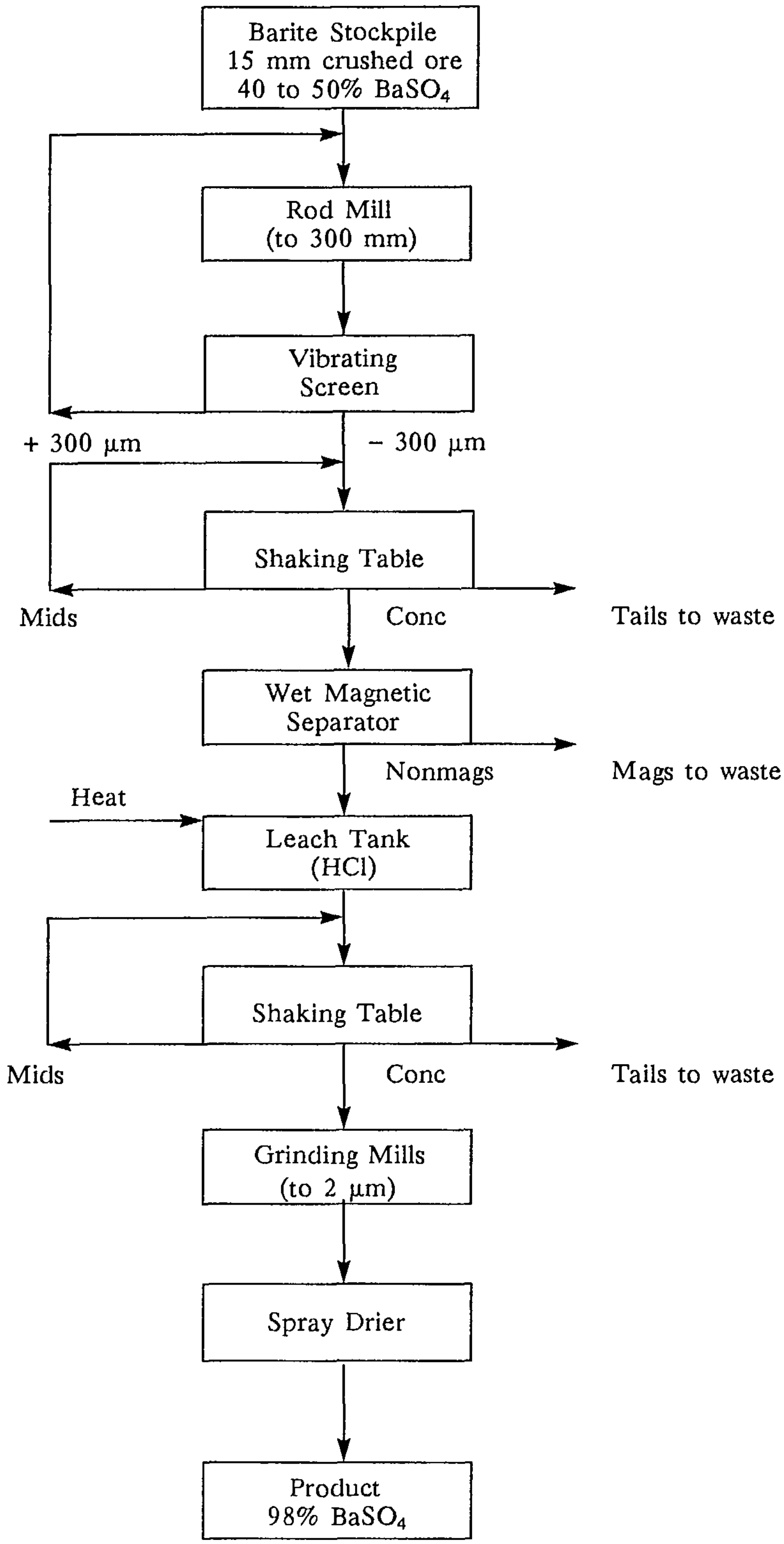

Fig. 2 – Flow diagram, Nystone Chemicals Ltd., Debert, N.S.

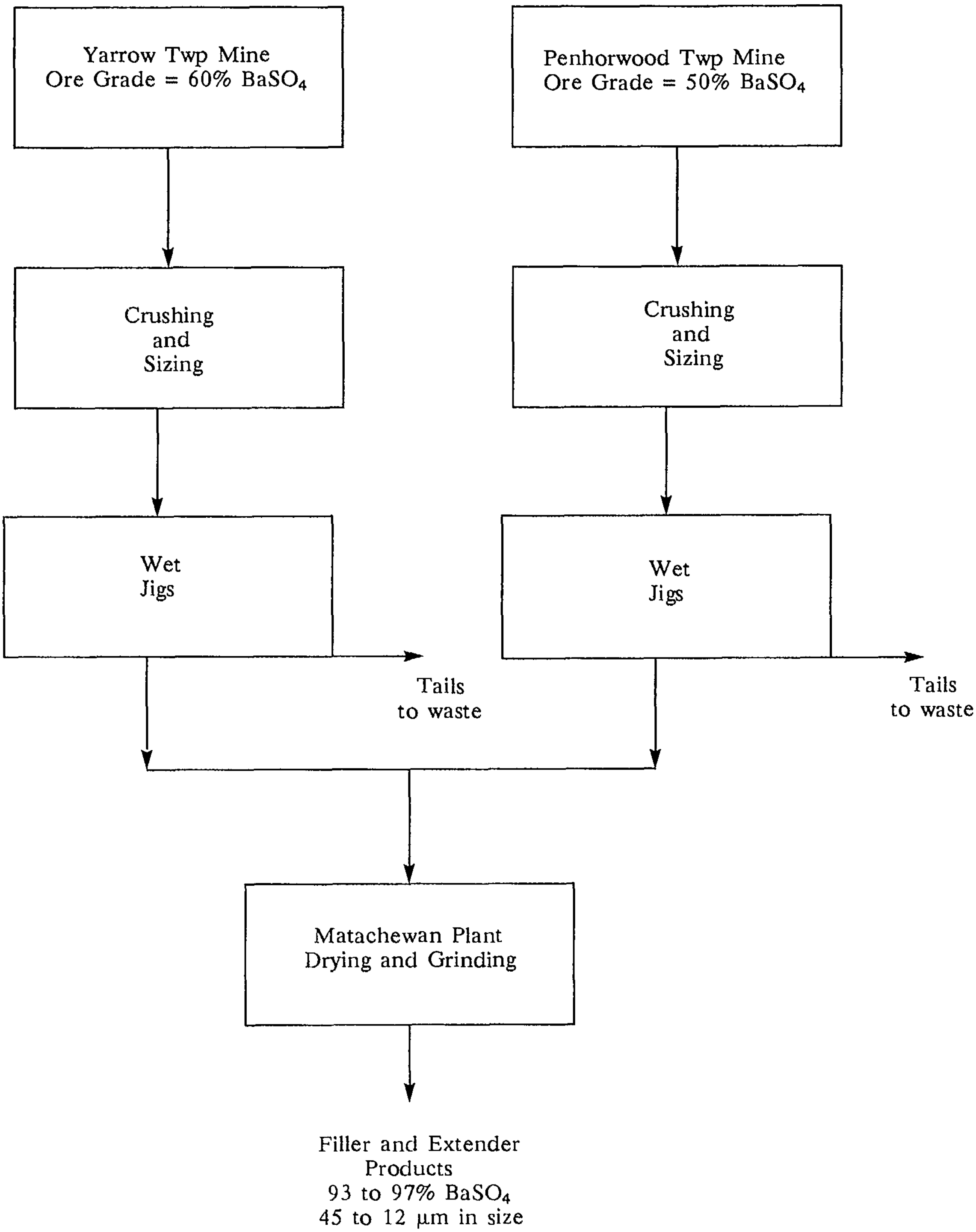

Fig. 3 – Flow diagram, Extender Minerals of Canada Ltd., Matachewan, Ont.

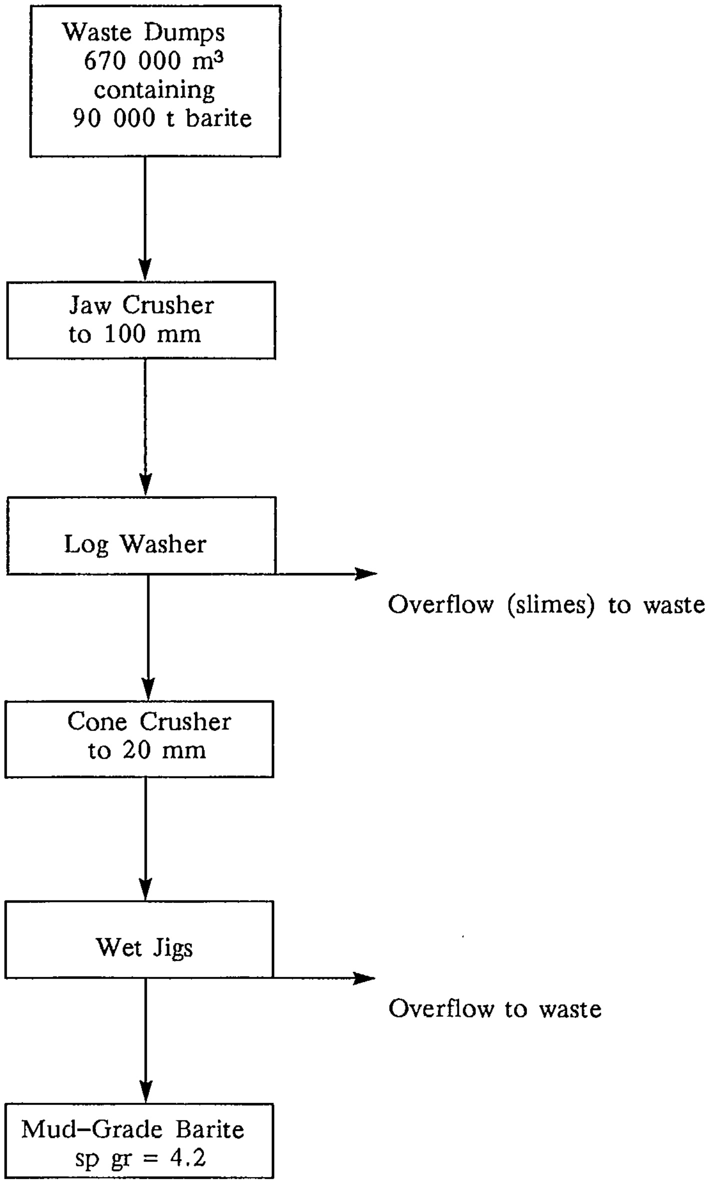

Fig. 4 – Flow diagram, Magcobar Dresser Canada, Inc., barite recovery, Walton, N.S., waste dumps

concerning the mineral content and whether the sample originates from a high- or low-grade deposit. Mineralogical information not only identifies major and minor minerals but also provides data regarding association between minerals and host rocks. In many cases, the liberation size is either not known or not stated; however, the beneficiation product size is quoted since, by inference, product size under optimum test conditions usually equates to liberation size. Beneficiation methods are important as a guide for future studies of ores with similar mineral assemblages, and concentrate grade and recovery figures provide an indication of how efficient the beneficiation methods were in achieving a specification product. Additional data regarding flotation parameter and reagent concentration are also reported. Flotation, either in conjunction with gravity concentration techniques or alone, is often an important part of a study. Although each beneficiation technique requires careful control of operating variables, flotation is the most complex since, in addition to operating variables, the chemical nature of collectors, activators and depressants often determines the successful separation of the valuable minerals.

Each study is categorized according to the principal mineral. In most cases, this presents no difficulty, but certain variable, multimineral deposits, present some ambiguity. The Lake Ainslie barite–fluorite deposit, for example, is quite variable and, depending on where the sample was obtained, can be either dominant in barite or fluorite.

Where possible, all studies common to a particular deposit are grouped together for continuity and convenience of reference.

The noted 39 studies of barite deposits were conducted by CANMET and its predecessor, Mines Branch, between 1920 and 1986. Most of the studies were on barite samples from Nova Scotia, Ontario and British Columbia, but also from Newfoundland and New Brunswick. A summary of process data for barite ores from eastern Canada is reported in Table 3, and analytical data, in Table 3a. Since 12 studies were made on barite from Walton, N.S., a separate summary of the process data is reported in Table 4, and analytical data, in Table 4a. Studies on barite ores from Ontario and British Columbia are similarly summarized; process data and analytical data are reported in Tables 5 and 5a, and 6 and 6a, respectively.

Scale of Studies

Generally most studies were conducted on feed material weighing less than 450 kg (1000 lb); five studies (21, 24, 41, 51, 68) were made on feed ore weighing in excess of 1 t. Two leaching studies were conducted on high-grade concentrates weighing 2 kg (30).

Head Sample Analyses

The barite content varied widely from 4.4% $BaSO_4$ for fluorite–barite ore from the Wallbridge mine at Madoc, Ont. (47), to more than 96% $BaSO_4$ for ore from the Walton mine operated by the Magnet Cove Barium Corp. (28, 29). The majority of ores contained between 30 and 85% $BaSO_4$. Low-grade ore from Godfrey, Ont. (58) and high-grade ores from Strathlorne, N.S. (21), and Yarrow, Ont. (59), are also included.

Mineralogy

The mineralogy of the barite ores studied generally conformed to the patterns previously outlined for vein and replacement deposits. Samples of barite ore from the Lake Ainslie deposit contained fluorite and calcite, with interpenetrations and inclusions of barite in the fluorite; minor minerals included quartz, celestite and iron oxides (41). Barite ore from the Madoc area contained fluorite, calcite and quartz.

Table 3 – Summary of beneficiation studies on barite from eastern Canada: process data

Deposit location	Sample no.	Sample wt (kg)	Product size	Process methods	Ref. no.
Nfld.					
Buchans	1	45	80% −44 µm	grinding, flotation	20
N.S.					
Strathlorne	1	1 820	100% −44 µm	grinding, air classification	21
	2	n.s.	−1.7 mm +710 µm; −710 +250 µm	screening, tabling	
	3	n.s.	−6.6 +1.7 mm; −1.7 mm	jigging of coarse fraction, classification and tabling of fine fraction	
Brookfield	1	23	100% −75 µm	magnetic separation, acid bleaching	31
Brookfield	1	908	−420 +150 µm	sizing, magnetic separation, acid bleaching, calcining	22
Scotsville	1	n.s.	−12 mm +150 µm; −150 µm	wet and dry jigging, tabling, flotation	43
Lake Ainslie	2	n.s.	−12 mm	wet and dry jigging, tabling	
Pine Brook	3	n.s.	−12 mm +150 µm; −150 µm	wet and dry jigging, tabling, flotation	
Brookfield	4	n.s.	−12 mm	wet and dry jigging, tabling, magnetic separation	
Lake Ainslie	1	1 230	n.s.	autogenous grinding	41
	2	29	n.s.	grinding, flotation	
Lake Ainslie	1	228	−500 +150 µm; −150 µm	sizing, tabling, magnetic separation	40
	2	228	−500 +150 µm; −150 µm	sizing, tabling, magnetic separation	
Lake Ainslie	1	18 t*	−300 µm	crushing, grinding, tabling, flotation	24
N.B.					
Memramcook	1	n.s.	−210 µm	grinding, flotation	45
Memramcook	1	n.s.	−420 +150 µm	sizing, electrostatic and magnetic separation	44

n.s. – not stated
*tonnes

Table 3a – Summary of beneficiation studies on barite from eastern Canada: analytical data

Deposit location	Sample no.	Head analysis %						Process performance				Ref. no.
								Grade %			Distn %	
		$BaSO_4$	CaF_2	$CaCO_3$	SiO_2	Fe_2O_3	Al_2O_3	$BaSO_4$	CaF_2	Fe_2O_3	$BaSO_4$	
Nfld.												
Buchans	1	33.6	–	–	–	–	–	91.3	–	–	75.5	20
N.S.												
Strathlorne	1	95.4	0.54	0.14	–	–	–	92.0	–	–	–	21
	2	86.4	7.03	2.55	–	–	–	96.6	–	–	–	
	3	75.3	18.09	2.97	–	–	–	87.5	–	–	–	
Brookfield	1	98.9	–	–	0.58	0.06	0.21	–	–	0.006	–	31
Brookfield	1	82.3	–	–	0.51	16.03*	0.45	99.5	–	0.02	–	22
Scotsville	1	60.0**	–	–	–	–	–	86.0	–	–	–	43
Lake Ainslie	2	40.0**	17.5	–	–	–	–	90.0	–	–	49.2	
Pine Brook	3	70.0**	–	13.5	–	–	–	91.0	–	–	77.2	
Brookfield	4	45.0**	–	–	–	–	–	95.0	–	–	–	
Lake Ainslie	1	Variable and not considered to be representative										
	2	45.9	19.3	15.1	–	–	–	95.0	–	–	90.0	41
Lake Ainslie	1	57.5	24.8	–	–	–	–	–	–	–	–	40
	2	82.5	10.3	–	–	–	–	91.0	–	–	68.0	
Lake Ainslie	1	52.4	34.5	13.4	–	–	–	93.6	–	–	94.7	24
N.B.												
Memramcook	1	42.5	4.5	–	–	–	–	94.8	0.54	–	77.0	45
Memramcook	1	45.0**	5.0**	–	40.0**	–	–	84.1	9.05	–	–	44

*as $FeCO_3$
**estimated

Table 4 – Summary of beneficiation studies on barite from Walton, N.S.: process data

Sample no.	Sample wt (kg)	Sample description	Product size	Process methods	Ref. no.
1	135	ground barite	−44 µm	air classification	39
1	2	barite conc	98% −44 µm	grinding, acid bleaching	30
2	2	barite conc	98% −44 µm	grinding, acid bleaching	
1	900	screen undersize	−2.4 +1.7 mm	spiral and rake classification, hydrosizing, Dorrclone and cone classification	32
1	n.s.	barite ore	−50 +1.7 mm	crushing, sizing, heavy–media separation	34
2	n.s.	barite ore	−50 +1.7 mm	crushing, sizing, heavy–media separation	
1	n.s.	screen undersize	1.7 mm	hydraulic and spiral classification, jigging	35
1	230	barite ore	−38 +1.7 mm	crushing, sizing, heavy–media separation	36
1	230	barite ore	−25 +1.7 mm	crushing, sizing, heavy–media separation	37
1	365	barite ore	−19 +4.8 mm	crushing, wet screening, heavy–media separation	38
1	50	classifier overflow	n.s.	tabling	27
1	30	barite ore	−25 mm to −1.7 mm	crushing, screening	28
1	30	barite ore	98% −44 µm	grinding, acid leaching	29
1	150	screen undersize	−1.4 mm	screening, hydrosizing, tabling	25
1	270	barite tailings	−1.7 mm	screening, hydrosizing, tabling, cone classification	26

n.s. – not stated

Table 4a – Summary of beneficiation studies on barite from Walton, N.S.: analytical data

Sample	Head analysis %					Process performance				Ref.
						Grade %			Distn %	
no.	$BaSO_4$	$CaCO_3$	SiO_2	Fe_2O_3	Al_2O_3	$BaSO_4$	Fe_2O_3	SiO_2	$BaSO_4$	no.
1	94.1	–	5.16	0.13	–	n.s.	0.03	n.s.	n.s.	30
2	93.6	–	5.14	1.83	–	n.s.	0.03	n.s.	n.s.	
1	90.2	–	–	3.56	–	93.2	n.s.	–	87.2	32
1	83.3	–	–	–	–	95.6	–	–	80.8	34
2	89.4	–	–	–	–	93.5	–	–	82.8	
1	n.s.	–	–	–	–	91.0	–	–	65.0	35
1	70.0*	–	–	–	–	82.2	–	–	88.4	36
1	78.0	–	–	–	–	86.1	–	–	97.5	37
1	63.4	–	–	–	–	85.5	–	–	70.1	38
1	59.5	–	–	–	–	95.3	–	–	27.4	27
1	96.7	0.93	3.44	2.41	0.92	n.s.	n.s.	n.s.	n.s.	28
1	96.7	n.s.	0.43	1.46	0.39	99.2	0.03	0.33	n.s.	29
1	92.1	–	1.96	1.66	0.78	95.7	n.s.	0.80	82.3	25
1	92.0	1.92	0.84	4.20	–	95.6	n.s.	0.39	87.8	24

*estimated
n.s. – not stated

Table 5 – Summary of beneficiation studies on barite from Ontario: process data

Deposit location	Sample no.	Sample wt (kg)	Product size	Process methods	Ref. no.
Port Arthur	1	10	97.5% −210 µm	tabling, flotation	55
McKellar Island	1	25	−25 +2.4 mm; −2.4 mm	heavy–media separation on coarse product and tabling of −2.4 mm fines	56
Parry (Madoc)	1	450	−1.7 mm +710 µm; −710 +425 µm	sizing, tabling	51
Moira (Madoc)	2	1 360	−1.7 mm +710 µm; −710 +425 µm	sizing, tabling	
Yarrow	1	135	−10 +6.7 mm; −10 mm	ore sorting, autogenous and vibration grinding	59
	2	410	−10 +6.7 mm; −10 mm	air classification (on −10 µm fines)	
Godfrey	1	n.s.	−4.8 mm +300 µm; −300 µm	jigging and tabling of coarse ore, flotation of fine ore	58
Langmuir	1	190	−850 +250 µm; −250 µm	screening, classification, tabling, flotation	48
Lanark	1	200	−500 µm to −150 µm	sizing, tabling, reverse flotation of base–metal sulphides	50

n.s. – not stated

Table 5a – Summary of beneficiation studies on barite from Ontario: analytical data

Deposit location	Sample no.	Head analysis %			Process performance: Grade %		Process performance: Distn %	Ref. no.
		$BaSO_4$	SiO_2	Fe_2O_3	$BaSO_4$	Fe_2O_3	$BaSO_4$	
Port Arthur	1	88.1	–	–	97.7	–	72.5	55
McKellar Island	1	87.3	–	–	91.1	–	80.5	56
Parry (Madoc)	1	n.s	–	–	n.s.	–	n.s.	51
Moira (Madoc)	2	n.s.	–	–	n.s.	–	n.s.	
Yarrow	1	86.1	–	–	n.s.	–	n.s.	59
	2	95.6	–	–	n.s.	–	n.s.	
Godfrey	1	12.6	–	–	88.9	–	63.5	58
Langmuir	1	84.7	–	–	98.0	–	70.0	48
Lanark	1	88.0	–	–	96.9	–	70.5	50
Marmora	1	32.0	–	–	76.7	–	n.s.	49
Wallbridge	1	6.0	–	–	52.5	–	16.0	46
Wallbridge	1	4.4	–	–	81.8	–	75.0	47

n.s. – not stated

Table 6 – Summary of beneficiation studies on barite from British Columbia: process data

Deposit location	Sample no.	Sample wt (kg)	Product size	Process methods	Ref. no.
Mineral King	1	1 820	−850 μm	hydrosizing, wet screening, tabling, reverse flotation of base–metal sulphides	68
Mineral King	1	135	−300 +75 μm; −75 μm	sizing, tabling	67
Summit Lake	1	455	n.s.	heavy–media separation	66
Giant Mascot	1	45	+44 μm; −44 μm	sizing, tabling of +44 μm product, flotation of −44 μm product	64
Giant Mascot	1	340	n.s.	bulk sulphide flotation, tabling, barite flotation	60
Giant Mascot	1	135	−210 +150 μm; −150 μm	sizing, tabling	61
Parson	1	230	−50 +1.7 mm; −1.7 mm	sizing, heavy–media separation on coarse ore, jigging	65
Brisco	2	230	−50 +1.7 mm; −1.7 mm	grinding, spiral and cyclone classification, wet and dry tabling on fine ore	65
Parson	1	75	−9.4 mm; −4.8 mm	wet and dry jigging and tabling, air classification of fines	70
Invermere	1	n.s.	−13 +2.5 mm; −2.5 +0.15 mm	air jigging and tabling	69

n.s. – not stated

Table 6a – Summary of beneficiation studies on barite from British Columbia: analytical data

Deposit location	Sample no.	Head analysis %			Process performance			Ref. no.
					Grade %		Distn %	
		$BaSO_4$	SiO_2	Fe_2O_3	$BaSO_4$	Fe_2O_3	$BaSO_4$	
Mineral King	1	32.0	30.0	–	98.3	–	99.5	68
Mineral King	1	35.0*	n.s.	–	n.s.	–	90.0	67
Summit Lake	1	n.s.	–	–	n.s.	–	75.0	66
Giant Mascot	1	50.0*	n.s.	–	92.0*	–	79.2	64
Giant Mascot	1	59.3	30.4	–	93.1	–	61.3	60
Giant Mascot	1	61.2	28.5	0.42	95.0	–	57.2	61
Parson	1	n.s.	–	–	n.s.	–	80.0*	65
Brisco	2	n.s.	–	–	n.s.	–	80.0*	65
Liard River	1	41.6**	6.9	–	94.2	–	n.s.	62
Liard River	1	41.6**	6.9	–	87.6**	–	63.8	63
Parson	1	80.0*	–	–	–	–	79.0*	70
Invermere	1	50.0	–	–	–	–	46.0*	69

n.s. – not stated
*estimated
**includes witherite

The replacement barite ores from Walton and from the Giant Mascot and Mineral King mines generally contained quartz, carbonates, iron oxides and alumina impurities.

Lead–barite ores, for example at Buchans (20), contained a variety of gangue minerals, including chlorite, quartz, mica and base–metal sulphides. The Godfrey barite ore contained quartz, feldspar, calcite, graphite, mica, biotite, sphene and base–metal sulphides (58). Barite ore from Brookfield (22, 43) was characterized by the presence of siderite.

Beneficiation

Gravity Concentration

Gravity concentration techniques in the noted CANMET studies were largely successful in concentrating barite ores to >90% $BaSO_4$. Failure to achieve 90% $BaSO_4$ was generally related to low–grade head samples, e.g., <30% $BaSO_4$.

Heavy–media separation and wet jigging were used on coarse–grained barite ores. Several studies on barite ore from Walton employed heavy–media separation. An interesting comparison between wet and dry jigging was demonstrated in a study of several barite ores from Nova Scotia (43). Electronic ore sorting was tried on a barite ore from Yarrow (59).

Flotation

Barite ore samples were concentrated by either reverse or direct flotation. Reverse flotation generally involved removal of a bulk, base–metal sulphide concentrate leaving a concentrated barite tailing. Direct flotation of barite was conducted on a number of barite ores; a summary of the principal parameter data is reported in Table 7, and reagent concentration data, in Table 7a. The collectors generally preferred were alkyl sulphate, specifically Dupanol L.S. (sulphonated fatty acid), and alkyl sulphonates, specifically the Aerofloat 800 series. In one study, oleoyl taurate (Igepon T33) was used (20), whereas oleic acid was used in another (57). The collector concentration was generally between 250 and 500 g/t.

The modifiers and depressants used included Na_2CO_3, Na_2SiO_3, Quebracho, $BaCl_2$ and citric acid. In general, barite rougher flotation was fairly fast, from 2 to 5 min, although with finer sizes, flotation time was longer (64). Flotation was conducted using slightly alkaline conditions, from pH 7 to 10, and multistage cleaning was necessary to achieve high grades. Pulp densities varied between 13 and 30% solids.

Miscellaneous Techniques

Barite was concentrated both directly and indirectly by a variety of miscellaneous techniques. Magnetic separation was used to separate magnetic material, followed by acid bleaching of the barite to further reduce iron staining (22). Electrostatic separation, using positive polarity, was used to separate barite from quartz (44). Although barite was concentrated to 84.1% in this latter study, the fluorite was also concentrated, as both minerals act as nonconductors. Apart from dry jigging and tabling, air classification was used to concentrate barite in the −44 µm range.

Table 7 – Summary of principal parameter data for barite flotation

Deposit location	Grind size µm	Rougher float min	pH	Pulp density % solids	No. of cleaner stages	Ref. no.
Buchans, Nfld.	80% −44	n.s.	n.s.	n.s.	2	20
Selected deposits, N.S.	100% −150	4	10.2	n.s.	rgh only	43
Memramcook, N.B.	100% −210	n.s.	n.s.	n.s.	3	45
McKellar Island, Ont.	98% −210	n.s.	9.2	n.s.	2	57
Godfrey, Ont.	100% −300	n.s.	8.6	13	3	58
Hastings, Ont.	100% −210	2	8.8	n.s.	n.s.	54
Madoc, Ont.	100% −150	n.s.	n.s.	n.s.	3	53
Liard River, B.C.	100% −210	n.s.	7.0	n.s.	2	62
Liard River, B.C.	100% −150	n.s.	8.5	n.s.	2	63
Giant Mascot, B.C.	100% −44	8	n.s.	17	4	64
Spillimacheen, B.C.	78% −75	n.s.	9.1	n.s.	1	60
Spillimacheen, B.C.	99% −420	5	8.4	30	4	71

n.s. – not stated

Table 7a – Summary of reagent concentration data for barite flotation

Deposit location and float	Oleoyl taurate	Alkyl sulphate	Alkyl sulphonate	Oleic acid	Modifiers, Depressants					Ref. no.
					Na_2CO_3	Na_2SiO_3	Quebracho	$BaCl_2$	Citric acid	
<u>Rougher</u>										
Buchans, Nfld.	2 000	–	–	–	–	–	–	–	–	20
Selected deposits, N.S.	–	–	203	–	–	2 029	–	–	–	43
Memramcook, N.B.	–	–	n.s.	–	–	n.s.	–	–	n.s.	45
McKellar Island, Ont.	–	–	–	400	500	650	200	–	–	57
Godfrey, Ont.	–	–	250	–	–	100	100	–	–	58
Hastings, Ont.	–	590	–	–	–	865	–	485	210	54
Madoc, Ont.	–	500	–	–	–	1 000	–	500	240	53
Liard River, B.C.	–	450	–	–	–	1 000	–	300	–	62
Liard River, B.C.	–	500	–	–	500	1 250	–	–	150	63
Giant Mascot, B.C.	–	450	–	–	–	225	125	–	–	64
Spillimacheen, B.C.	–	500	–	–	–	400	–	125	125	60
Spillimacheen, B.C.	–	–	600	–	–	250	–	–	–	71
<u>Cleaner</u>										
Buchans, Nfld.	400	–	–	–	–	–	–	–	–	20
Memramcook, N.B.	–	–	–	–	–	–	–	–	n.s.	45
McKellar Island, Ont.	–	–	–	–	–	800	150	–	–	57
Godfrey, Ont.	–	–	–	–	–	–	–	–	–	58
Hastings, Ont.	–	–	–	–	–	–	–	–	–	54
Madoc, Ont.	–	–	–	–	–	650	–	–	–	53
Laird River, B.C.	–	150	–	–	–	1 250	–	100	–	62
Laird River, B.C.	–	–	–	–	–	750	–	–	–	63
Giant Mascot, B.C.	–	–	–	–	–	220	150	–	–	64
Spillimacheen, B.C.	–	–	–	–	–	400	–	–	50	60
Spillimacheen, B.C.	–	–	–	–	–	65	–	–	–	71

n.s. – not stated

Walton Ore

Twelve studies were undertaken to concentrate either barite–feed ore or concentrator–plant products from the Walton operation of Magnet Cove Barium Corp. (25, 32, 35). These products were screen undersize, although a classifier overflow product was also studied (27). The feed ore samples and plant products responded to gravity concentration by heavy–media separation, hydrosizing, tabling, and cone, spiral and rake classification. A few bleaching studies were conducted on high-grade barite concentrates to remove iron staining. An investigation into concentration by air classification was also conducted (39).

Lake Ainslie Ore

The barite–fluorite deposit at Lake Ainslie has been the subject of several investigations, not only at CANMET; but also at several independent laboratories in Canada and the United States (72–78).

A summary of parameter data for barite flotation is reported in Table 8, and reagent concentration data, in Table 8a. The variability of feed grade is evident from the reported head analyses of the various studies. The barite content varied from 18.0% to 66.5% $BaSO_4$, but the concentrate grades, regardless of the head grade, were generally >90% $BaSO_4$, the highest grade being 96.9% $BaSO_4$. The primary grind size was generally fine, at 80% −44 µm, which indicated a fine liberation size, although grind sizes of 100% −300 µm were also reported. Rougher flotation time was generally fast, from 3 to 6 min; two pilot–plant studies (23, 24) generated longer flotation times. Pulp densities varied from 20 to 48% solids. Barite was floated under slightly alkaline conditions between pH 7.9 and 11.3, and multistage cleaning was used.

Collectors, modifiers and depressants similar to those employed for concentration of barite in other studies were used.

CONCLUDING COMMENT

As previously noted, this report is the first in a series of Summary Reports on industrial minerals. It is hoped that the information presented in this and subsequent reports on other minerals will be useful to all who are interested in industrial minerals.

A wide distribution of the Summary Report series is planned as a means of encouraging interest in and further development of industrial minerals, which are becoming of increasing interest for use in many diverse applications, for example, as fillers for everyday products such as paint and rubber and, in the high–technology sector, as high–performance plastics, silicon chips and fibre–optic filaments.

We would encourage feedback from this and subsequent reports in this series. Comments and suggestions for further R&D will be invaluable to CANMET and associated government and industry groups in planning and conducting research on industrial minerals.

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Table 8 – Summary of principal parameter data for barite flotation of Lake Ainslie barite–fluorite

Head analysis %			Grind size	Rgh float		Pulp density	No. of cleaner	Concentrate		
								Grade	Distn	
$BaSO_4$	CaF_2	$CaCO_3$	µm	min	pH	% solids	stages	% $BaSO_4$	%	Ref. no.
45.9	19.3	15.1	82% −44	5	n.s.	20	4	95.0	90.0	41
37.6	22.1	10.5	86% −44	6	10.1	n.s.	5	96.0	97.2	72
66.5	13.8	7.0	79% −44	4	10.7	n.s.	4	96.8	98.6	73
33.5	19.4	10.3	61% −44	4	10.6	n.s.	4	95.1	95.8	73
18.0	39.3	25.2	53% −44	4	10.7	n.s.	5	96.9	85.2	73
57.4	20.6	n.s.	100% −300	n.s.	8.8	20	1	90.8	41.1	74
49.6	13.3	n.s.	100% −210	6	9.8	n.s.	1	88.7	44.1	75
64.2	22.1	12.3	96% −75	3	7.9	48	3	96.2	34.8	76
60.7	22.2	n.s.	100% −75	n.s.	n.s.	n.s.	4	96.2	88.0	77
53.7	26.7	14.1	80% −44	n.s.	n.s.	25	3	93.5	58.1	42
55.0	20.2	9.5	85% −44	5	9.8	n.s.	2	96.6	92.5	78
23.4	47.2	26.5	93% −210	18	8.0	41	n.s.	94.8*	84.5*	23
52.4	34.5	13.4	100% −300	24	8.0	30	n.s.	93.6	94.7	24
n.s.	n.s.	n.s.	100% −150	3	11.3	n.s.	2	86.0	61.5	43

*combined table and flotation concentrate

n.s. – not stated

Table 8a – Summary of reagent concentration data for barite flotation of Lake Ainslie barite–fluorite

	Collectors*			Modifiers, Depressants						
Float	Alkyl sulphonate	Alkyl sulphate	Oleoyl taurate	Na_2CO_3	Na_2SiO_3	$BaCl_2$	$AlCl_3$	Citric acid	Quebracho	Ref. no.
Rougher	–	–	800	–	250	–	–	125	–	41
	300	–	–	–	2 700	–	–	125	–	72
	455	–	–	–	2 700	–	–	125	–	73
	250	–	–	–	2 700	–	–	125	–	73
	170	–	–	–	2 700	–	–	125	–	73
	250	–	–	500	2 000	500	–	–	–	74
	–	1 500	–	–	–	–	–	–	–	75
	–	1 700	–	–	–	–	–	–	–	76
	–	–	660	–	375	–	65	375	250	77
	–	–	600	–	250	–	–	125	–	42
	300	–	–	–	2 500	–	–	–	–	78
	–	275	–	–	1 325	350	–	125	–	23
	–	990	–	–	2 640	1 055	–	330	–	24
	106	–	–	–	2 637	–	–	–	–	43
Cleaner	–	–	200	–	–	–	–	–	–	41
	–	–	–	–	–	500	–	–	–	74
	–	–	–	–	–	–	60	–	–	76
	–	–	–	–	–	–	–	160	50	77
	–	–	100	–	–	–	–	–	–	42
	50	–	–	–	–	–	–	–	–	78
	–	–	–	–	350	–	–	–	–	23
	–	–	–	–	660	530	–	–	–	24
	58	–	–	–	–	–	–	–	–	43

*Alkyl sulphonate collectors include Aerofloat 845 and 825
Aklyl sulphate collectors include sodium octyl sulphate and sodium cetyl sulphate
Oleoyl taurate collectors are more commonly known as "Igepon"

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APPENDIX

SUMMARIES OF BARITE STUDIES BY CANMET

NEWFOUNDLAND

Identification	:	Nfld.–1 (Ref. No. 20)*
Report – Title	:	RECOVERY OF BARITE FROM TAILINGS, BUCHANS, NFLD.
– Authors	:	F.H. Hartman and R.A. Wyman
– No. and Date	:	*Division Report* 74–17 (1974)
Sample Description	:	45 kg of base–metal tailings; 99.7% –300 µm; head sample analysis 33.6% $BaSO_4$.
Mineralogy	:	Principally barite with chlorite, quartz and mica, and trace amounts of base–metal sulphides.
Beneficiation	:	Sample ground to 81% –44 µm followed by flotation using stage addition of collector and cleaning.
Results	:	Concentrate analyzed 91.3% $BaSO_4$; recovery of barite was 75.5%.
Potential Use	:	Drill–mud additive.

*CANMET identification with reference no. in brackets.

NOVA SCOTIA

Identification	: N.S.–1 (Ref. No. 21)
Report – Title	: EXPERIMENTAL TESTS ON BARITE FROM STRATHLORNE, N.S.
– Author	: R.K. Carnochan
– No. and Date	: *Ore Dressing Investigation Report* 471 (1933)
Sample Description	: 1.82 t of barite ore in three lots: Lot 1: 95.38% $BaSO_4$, 0.14% $CaCO_3$, 0.54% CaF_2; Lot 2: 86.44% $BaSO_4$, 2.55% $CaCO_3$, 7.03% CaF_2; Lot 3: 75.30% $BaSO_4$, 2.97% $CaCO_3$, 18.09% CaF_2.
Mineralogy	: Principally barite with variable amounts of fluorite and calcite in the different lots.
Beneficiation	: Lot 1, from Scotsville, was ground in a pebble mill and classified using a Sturtevant air separator. Lot 2 was crushed to 1.7 mm and screened at 710 µm and 250 µm. Each fraction was then tabled, which demonstrated that screening rather than classification before tabling was more successful. Lot 3 was crushed to 6.6 mm and sized at –6.6 +1.7 mm; the –6.6 +1.7 mm fraction was jigged. The –1.7 mm fraction was classified and tabled.
Results	: Lot 1 produced a –44 µm concentrate analyzing 92.02% $BaSO_4$. Lot 2 produced concentrates analyzing between 96.00 and 97.12% $BaSO_4$. Lot 3 produced a jig concentrate analyzing between 83.0 and 90.0% $BaSO_4$. The –1.7 mm portion, when tabled, produced a concentrate analyzing between 84.0 and 93.0% $BaSO_4$.
Potential Use	: Lot 1 concentrate was tested and found suitable as a drill–mud additive. Lot 2 concentrates would probably be suitable for most applications for barite.

Identification	: N.S.–2 (Ref. No. 22)
Report – Title	: METALLURGICAL EVALUATION OF BARITE/SIDERITE ORE FROM BROOKFIELD, N.S.
– Author	: W.R. Penman
– No. and Date	: *Ore Dressing Investigation Report* M–949–E (1945)
Sample Description	: 900 kg of barite–siderite ore; 82.34% $BaSO_4$, 16.03% $FeCO_3$, 0.51% SiO_2, 0.45% Al_2O_3.
Mineralogy	: Principally barite with siderite and trace amounts of limonite.
Beneficiation	: Crushing using rolls, rod, ball and hammer mills to determine the most efficient method of size reduction to −420 +150 µm range with a minimum of −150 µm fines. After crushing and sizing, magnetic separation was used to remove siderite. Further removal of siderite was effected by sulphuric acid leaching of the nonmagnetic barite concentrate. Calcining and tabling were also investigated.
Results	: The best crushing method was hammer milling. Magnetic separation reduced the siderite content to 0.6% $FeCO_3$. Acid treatment resulted in a product analyzing 0.02% R_2O_3, 0.44% SiO_2 and 99.52% $BaSO_4$.
Potential Use	: Suitable for most applications for high–purity barite.

Identification	: N.S.–3 (Ref. No. 24)
Report – Title	: CONCENTRATION TESTS ON BARITE/FLUORITE ORE FROM THE JOHNSON MINE, LAKE AINSLIE, N.S.
– Author	: E.L. Carr
– No. and Date	: *Ore Dressing Investigation Report* 1851 (1945)
Sample Description	: 16 t of Johnson ore; 77.9% $BaSO_4$, 19.2% CaF_2, 2.4% $CaCO_3$; 1.8 t of Trout river ore; 25.0% $BaSO_4$, 48.0% CaF_2, 27.0% $CaCO_3$; blended ore 1:1 analyzed 52.4% $BaSO_4$, 34.5% CaF_2, 13.4% $CaCO_3$.
Mineralogy	: Buff–coloured barite, green fluorite and white calcite.
Beneficiation	: Pilot–plant treatment: crushing blended 1:1 ore to 12 mm, screening at 300 µm, and grinding to −300 µm; gravity concentration, followed by barite flotation and fluorite flotation.
Results	: A combined table and barite flotation concentrate analyzed 93.6% $BaSO_4$, with a recovery of 94.7%. A fluorite concentrate treatment resulted in a product analyzing 97.6% CaF_2, with a recovery of 83.3%.
Potential Use	: Barite suitable as drill–mud additive; fluorite suitable for fluorine chemicals manufacture.

Identification	: N.S.–4 (Ref. No. 25)
Report – Title	: INTERIM REPORT ON THE CONCENTRATION OF BARITE FROM WALTON, N.S.
– Author	: E.L. Carr
– No. and Date	: *Ore Dressing Investigation Report* 1965 (1945)
Sample Description	: 150 kg of −4.8 mm screen undersize; 92.05% $BaSO_4$, 1.66% Fe_2O_3, 1.96% SiO_2, 0.78% Al_2O_3, 0.24% MnO.
Mineralogy	: Not stated.
Beneficiation	: Screening at 1.4 mm, hydrosizing of the −1.4 mm products, tabling of the three spigot products.
Results	: Combined table concentrates from each of the three spigot products produced a concentrate analyzing 95.7% $BaSO_4$ and 0.8% SiO_2, with a recovery of 82.3%.
Potential Use	: Drill–mud additive; filler and extender; heavy aggregate in concrete.

Identification	: N.S.–5 (Ref. No. 26)
Report – Title	: FINAL REPORT ON THE CONCENTRATION OF BARITE TAILINGS FROM WALTON, N.S.
– Author	: E.L. Carr
– No. and Date	: *Ore Dressing Investigation Report* 1992 (1946)
Sample Description	: 270 kg of −4.8 mm screen undersize (a larger sample of previous report); 92.00% $BaSO_4$, 4.20% Fe_2O_3, 0.84% SiO_2, 1.92% $CaCO_3$.
Mineralogy	: Not stated.
Beneficiation	: Screening at 1.7 mm, hydrosizing of the −1.7 mm product in a Richards vortex classifier; tabling of spigot 2 and combined spigots 3 and 4 with cone underflow. The cone underflow was obtained by passing the hydrosizer overflow over an Allen–type cone.
Results	: +1.7 mm screen oversize and hydrosizer spigot 1 required no further beneficiation since they were >95% $BaSO_4$. Tabling of the remaining products produced concentrates >94% $BaSO_4$; combined barite concentrates were 95.56% $BaSO_4$ and 0.39% SiO_2, with a recovery of 87.8%.
Potential Use	: Drill–mud additive; filler and extender; heavy aggregate in concrete.

Identification	:	N.S.–6 (Ref. No. 27)
Report – Title	:	CONCENTRATION OF BARITE FROM A CLASSIFIER OVERFLOW PRODUCT OBTAINED FROM WALTON, N.S.
– Author	:	E.L. Carr
– No. and Date	:	*Industrial Minerals Report* (not numbered) (1946)
Sample Description	:	50 kg of classifier overflow product; 59.53% $BaSO_4$.
Mineralogy	:	Not stated.
Beneficiation	:	Tabling.
Results	:	A high–grade concentrate analyzing 95.32% $BaSO_4$ was obtained but with a recovery of only 27.4%.
Potential Use	:	Unknown; low recovery.

Identification	:	N.S.–7 (Ref. No. 28)
Report – Title	:	SCREEN ANALYSIS OF BARITE FROM WALTON, N.S.
– Author	:	W.S. Johnson
– No. and Date	:	*Ore Dressing Investigation Report* 2106 (1946)
Sample Description	:	30 kg of barite ore in three samples; 0.92% Al_2O_3, 0.52% CaO, 2.41% Fe_2O_3, 2.95 to 3.93% SiO_2.
Mineralogy	:	Principally barite with minor silica, alumina and iron oxides.
Beneficiation	:	Crushing and screening through 25 mm to 1.7 mm with analysis of individual fractions.
Results	:	There was no reduction of impurities in any of the screen fractions to within specification limits.
Potential Use	:	Unknown.

Identification : N.S.-8 (Ref. No. 29)

Report - Title : BLEACHING OF BARITE ORE FROM WALTON, N.S.
- Author : H.L. Beer
- No. and Date : *Ore Dressing Investigation Report* 2161 (1947)

Sample Description : Barite from previous investigation; 96.72% $BaSO_4$, 1.46% Fe_2O_3, 0.39% Al_2O_3, 0.43% SiO_2.

Mineralogy : As for previous investigation.

Beneficiation : Grinding to 98% −44 µm and leaching with 16 kg/t H_2SO_4.

Results : Bleached white barite of acceptable purity was obtained analyzing 99.16% $BaSO_4$, 0.03% Fe_2O_3, 0.33% SiO_2 and trace Al_2O_3.

Potential Use : Suitable for most applications requiring high-purity barite.

Identification : N.S.-9 (Ref. No. 30)

Report - Title : BLEACHING TESTS ON BARITE SAMPLES FROM WALTON, N.S.
- Author : H.L. Beer
- No. and Date : *Ore Dressing Investigation Report* MD 521-OD (1951)

Sample Description : Lot 1: 2.3 kg of partially bleached barite; 94.12% $BaSO_4$, 5.16% SiO_2, 0.044% Fe, 0.32% $SrSO_4$.
Lot 2: 2.3 kg of high-grade ore; 93.60% $BaSO_4$, 5.14% SiO_2, 0.64% Fe, 0.30% $SrSO_4$.

Mineralogy : Not stated.

Beneficiation : Grinding to between 96 and 99% −44 µm, separate leaching tests, first with only H_2SO_4 and then with a mixture of NaCl and H_2SO_4.

Results : When using only H_2SO_4, the Fe was reduced to 0.02% Fe in both concentrate and high-grade ore. When using a mixture of NaCl and H_2SO_4, the Fe was reduced to 0.01% Fe in both concentrate and high-grade ore.

Potential Use : Organic matter present with the barite carbonized with H_2SO_4 and discoloured the barite. The high content of SiO_2 rendered the barite unsuitable for lithopone and barium chemicals.

Identification	:	N.S.–10 (Ref. No. 31)
Report – Title	:	BLEACHING TESTS ON BARITE FLOTATION CONCENTRATES FROM BROOKFIELD, N.S.
– Author	:	H.L. Beer
– No. and Date	:	*Ore Dressing Investigation Report* (not numbered) (1952)
Sample Description	:	23 kg of flotation concentrate; 99.5% –44 µm; 98.85% $BaSO_4$, 0.58% SiO_2, 0.21% Al_2O_3, 0.06% Fe_2O_3.
Mineralogy	:	Trace contaminants of deep brown magnetic material, average size 35 µm.
Beneficiation	:	Screening at 75 µm; magnetic separation of –75 µm material using the Franz ferro filter; hot agitation of nonmagnetic portion with tetra sodium pyrophosphate to remove flotation reagents; sulphuric acid bleach.
Results	:	Densichron brightness was improved from 82 to 100%, and the iron oxide level was reduced to 0.006% Fe_2O_3.
Potential Use	:	Suitable for most applications requiring high–purity barite.

Identification	:	N.S.–11 (Ref. No. 32)
Report – Title	:	RESULTS OF TESTWORK ON BARITE SAND FROM WALTON, N.S.
– Author	:	V.A. Haw
– No. and Date	:	*Industrial Minerals Report* 225 (1954)
Sample Description	:	900 kg of –2.4 +1.7 mm screen undersize; 90.21% $BaSO_4$, 3.56% Fe_2O_3.
Mineralogy	:	Not stated.
Beneficiation	:	Spiral and rake classification, hydrosizing, Dorrclone and cone classification.
Results	:	Some degree of concentration was achieved with the mechanical classifiers. The best results were obtained with the Richards hydrosizer, which produced a concentrate analyzing 93.2% $BaSO_4$, with a recovery of 87.2%.
Remarks	:	The high head sample analysis resulted in the gravity concentration technique's being inefficient when compared with lower grade barite head analyses.
Potential Use	:	Drill–mud additive.

Identification	:	N.S.–12 (Ref. No. 34)
Report – Title	:	HEAVY–MEDIA SEPARATION OF BARITE ORE FROM WALTON, N.S.
– Author	:	V.A. Haw
– No. and Date	:	*Industrial Minerals Report* 396 (1956)
Sample Description	:	Lot 1: –150 to –200 mm lumps of ore; 83.3% $BaSO_4$. Lot 2: –150 to –200 mm lumps of ore; 89.4% $BaSO_4$.
Mineralogy	:	Principally barite with minor amounts of quartz, carbonates and iron oxides.
Beneficiation	:	Crushing and sizing to –50 +1.7 mm; heavy–media sink–float analysis in a drum separator using 1:1 ferrosilicon to magnetite at sp gr 2.80.
Results	:	For Lot 1 a concentrate analyzing 95.6% $BaSO_4$ was produced, with a recovery of 80.8%. For Lot 2 a concentrate analyzing 93.5% $BaSO_4$ was produced, with a recovery of 82.8%.
Potential Use	:	Drill–mud additive.
Remarks	:	To separate barite effectively at sp gr >2.90, a coarser grade of ferrosilicon is necessary; the viscosity will be lower than with finer grades of ferrosilicon.

Identification	:	N.S.–13 (Ref. No. 35)
Report – Title	:	GRAVITY CONCENTRATION OF MINUS 1.7 mm BARITE SCREENINGS FROM WALTON, N.S.
– Author	:	V.A. Haw
– No. and Date	:	*Industrial Minerals Report* 405 (1956)
Sample Description	:	1.7 mm screen undersize from previous investigation.
Mineralogy	:	Same as for previous investigation.
Beneficiation	:	Hydraulic classification, jigging and Humphrey spiral classification on classified feed.
Results	:	Difficulty was encountered with the Richards hydraulic classifier. All three techniques produced high–grade concentrates >91.0% $BaSO_4$ but at low recoveries. The hydraulic classifier produced a concentrate analyzing 91% $BaSO_4$, with a recovery of 65%.
Potential Use	:	Unknown.

Identification	: N.S.–14 (Ref. No. 36)
Report – Title	: CONCENTRATION OF BARITE FROM WALTON, N.S., BY HEAVY–MEDIA SEPARATION
– Author	: V.A. Haw
– No. and Date	: *Industrial Minerals Report* 423 (1956)
Sample Description	: 230 kg of reddish–brown barite ore; $\simeq$ 70% $BaSO_4$.
Mineralogy	: Not stated.
Beneficiation	: Crushing and sizing to −38 +1.7 mm, heavy–media sink–float analysis in a Wemco drum separator using a media sp gr of 2.90 to 2.95 and feed rate of 136 to 182 kg/h.
Results	: A concentrate analyzing 82.16% $BaSO_4$, with a recovery of 88.4%, was obtained.
Potential Use	: Unknown.

Identification	: N.S.–15 (Ref. No. 37)
Report – Title	: HEAVY–MEDIA SEPARATION OF BARITE FROM MAGNET COVE, WALTON, N.S.
– Author	: V.A. Haw
– No. and Date	: *Industrial Minerals Report* 435 (1956)
Sample Description	: Recombined sink–float products from previous investigation; 78.0% $BaSO_4$.
Mineralogy	: Not stated.
Beneficiation	: Crushing to −25 mm and sizing at 1.7 mm, heavy–media sink–float analysis at sp gr 2.90 to 2.95, using a Wemco drum separator.
Results	: The sink concentrate was upgraded to 86.14% $BaSO_4$; recovery was 97.5%.
Potential Use	: Unknown.

Identification	:	N.S.–16 (Ref. No. 38)
Report – Title	:	HEAVY–MEDIA SEPARATION OF BARITE FROM MAGNET COVE, WALTON, N.S.
– Author	:	V.A. Haw
– No. and Date	:	*Industrial Minerals Report* 460 (1957)
Sample Description	:	365 kg of coarse size lumps of reddish–brown barite; 63.4% $BaSO_4$.
Mineralogy	:	Principally barite with minor quartz and carbonates.
Beneficiation	:	Crushing and wet screening to –19 +4.8 mm, heavy–media sink–float analysis using a Wemco drum separator with a media sp gr of 3.10 to 3.20.
Results	:	A sink concentrate analyzing 85.5% $BaSO_4$, with a recovery of 70.1%.
Potential Use	:	Unknown.

Identification	:	N.S.–17 (Ref. No. 39)
Report – Title	:	AIR CLASSIFICATION TESTS ON GROUND BARITE FROM WALTON, N.S.
– Author	:	R.A. Wyman
– No. and Date	:	*Mineral Processing Test Report* 66–34 (1966)
Sample Description	:	135 kg of ground barite.
Mineralogy	:	Not stated.
Beneficiation	:	Air classification at 44 μm using the Hardinge air classifier.
Results	:	A product of 99.5% –44 μm was achieved, with greater than 90% recovery of the –44 μm in the feed.
Potential Use	:	Suitable for most applications requiring high–purity barite.

Identification : N.S.–18 (Ref. No. 40)

Report – Title : TABLING TESTS ON BARITE/FLUORITE SAMPLES FROM LAKE AINSLIE, N.S.
– Author : R.A. Wyman
– No. and Date : *Division Report* 66–100 (1966)

Sample Description : 230 kg of ore from the MacMillan vein; 57.5% $BaSO_4$, 24.8% CaF_2; 230 kg of ore from the Johnson vein; 82.5% $BaSO_4$, 10.3% CaF_2.

Mineralogy : As for following investigation.

Beneficiation : Tabling, sizing and magnetic separation.

Results : Tabling separately sized fractions, −500 +150 µm and −150 µm was better than tabling unsized ore. By combining both ores and treating the two sizes separately, a concentrate of 91% $BaSO_4$ (mud grade) was obtained, with a recovery of 68%. Magnetic separation was used to remove manganese.

Potential Use : Drill–mud additive.

Identification : N.S.–19 (Ref. No. 41)

Report – Title : BENEFICIATION OF BARITE/FLUORITE FROM LAKE AINSLIE, N.S.
– Author : R.A. Wyman
– No. and Date : *Division Report* 68–70 (1968)

Sample Description : 1225 kg of −125 mm lump ore, variable and not considered representative; 30 kg of −4.8 mm drill ore; 45.9% $BaSO_4$, 19.3% CaF_2, 15.1% $CaCO_3$.

Mineralogy : Barite, fluorite and calcite with interpenetration and inclusions of barite in the fluorite; minor quartz, celestite and iron oxides.

Beneficiation : Lump ore was used to assess the potential of autogenous grinding; flotation was used to produce separate barite and fluorite concentrates after multistage cleaning.

Results : A barite concentrate analyzing 95.0% $BaSO_4$, with a 90% recovery, and a fluorite concentrate analyzing 97.5% CaF_2, with an 85.8% recovery, were obtained. Autogenous grinding was an efficient method of size reduction.

Remarks : Flotation scheme (reported in Table 8a) was developed by CANMET personnel; Igepon T33 (oleoyl taurate) was used to float barite selectively.

Potential Use : Barite: all applications except pharmaceutical; fluorite: fluorine chemicals.

Identification	:	N.S.–20 (Ref. No. 43)
Report – Title	:	A STUDY OF THE PROCESSING OF BARITE SAMPLES FROM SELECTED DEPOSITS IN N.S.
– Authors	:	R.K. Collings, J.M. Lamothe, S.S.B. Wang and P.R.A. Andrews
– No. and Date	:	*Division Report* 86–95 (1986)
Sample Description	:	Lot 1: −150 mm ore from Scotsville; sp gr 4.28. Lot 2: −150 mm ore from Lake Ainslie; sp gr 3.77. Lot 3: −150 mm ore from Pine Brook; sp gr 4.04. Lot 4: −150 mm ore from Brookfield; sp gr 4.27.
Mineralogy	:	Scotsville barite occurs with minor calcite and fluorite. Lake Ainslie barite occurs with green fluorite and minor calcite. Pine Brook barite occurs with significant amounts of calcite and minor sulphides. Brookfield barite occurs with siderite.
Beneficiation	:	Crushing to 12 mm; dry jigging and air tabling; wet jigging and wet tabling with classification before wet tabling. The −150 µm fines from the Scotsville and Pine Brook samples were subjected to flotation. Magnetic separation was used to remove siderite from Brookfield barite.
Results	:	Mud–grade barite (sp gr >4.2) was obtained with each deposit sample.
Potential Use	:	Drill–mud additive.

NEW BRUNSWICK

Identification	: N.B.–1 (Ref. No. 44)
Report – Title	: BENEFICIATION OF BARITE FROM MEMRAMCOOK, N.B., BY ELECTROSTATIC SEPARATION
– Author	: E.G. deWolf
– No. and Date	: *Industrial Minerals Report* 466 (1957)
Sample Description	: Preground to –420 µm; weight and analysis not stated.
Mineralogy	: 50% barite and fluorite, and 40% heavily iron–stained quartz.
Beneficiation	: Screening to remove –150 µm fines; electrostatic separation was conducted on the –420 +150 µm portion; magnetic separation was used to remove iron–stained quartz.
Results	: Electrostatic separation was most successful using positive polarity, barite and fluorite acting as nonconductors. A concentrate analyzing 84.1% $BaSO_4$, 9.05% CaF_2 and 5.80% SiO_2 was obtained, but recovery was only fair since fluorite remained with the barite.
Remarks	: Electrostatic separation as a preconcentration technique for barite requires further investigation.

Identification	: N.B.–2 (Ref. No. 45)
Report – Title	: BENEFICIATION OF A SAMPLE OF BARITE/FLUORITE FROM MEMRAMCOOK, N.B.
– Author	: R.A. Wyman
– No. and Date	: *Division Report* 58–33 (1958)
Sample Description	: –420 µm ore; weight not stated; 42.5% $BaSO_4$, 4.5% CaF_2.
Mineralogy	: Principally barite with minor fluorite; chief gangue mineral is quartz with minor iron oxides and copper sulphide.
Beneficiation	: Ground to –210 µm; barite flotation using sodium alkyl sulphonate as collector and fluorite flotation using oleic acid as collector.

ONTARIO

Identification	:	Ont.–1 (Ref. No. 48)
Report – Title	:	CONCENTRATION OF BARITE FROM LANGMUIR, ONT.
– Author	:	R.K. Carnochan
– No. and Date	:	*Ore Dressing Investigation Report* 547 (1933)
Sample Description	:	190 kg of lump barite ore; 84.72% $BaSO_4$.
Mineralogy	:	White crystalline barite with calcite, quartz, celestite and trace galena.
Beneficiation	:	Screening, classification, tabling and flotation.
Results	:	Screening before tabling gave better results than classification before tabling. Barite was most successfully tabled in the −850 +250 μm fraction; tabling of the −250 μm fraction produced a grade of 98% $BaSO_4$, with a recovery of 70%. Flotation produced a barite concentrate analyzing 93.32% $BaSO_4$; calcite, which could not be depressed, prevented high grades from being obtained.
Potential Use	:	Drill–mud additive.

Identification	:	Ont.–2 (Ref. No. 50)
Report – Title	:	CONCENTRATION TESTS ON A SAMPLE OF BARITE FROM LAVANT, LANARK, ONT.
– Author	:	J.D. Johnson
– No. and Date	:	*Ore Dressing Investigation Report* 863 (1940)
Sample Description	:	200 kg of barite ore; 88.0% $BaSO_4$, 0.4% Cu, 3 g/t Ag.
Mineralogy	:	Principally barite with siliceous carbonate, minor tetrahedrite, pyrite and chalcopyrite.
Beneficiation	:	Tabling with reverse flotation of metallic sulphides from the barite table concentrate.
Results	:	Several size–graded table concentrates (−500 to −150 μm) were bulked; after reverse flotation, a concentrate analyzing 96.88% $BaSO_4$, with a recovery of 70.5%, was obtained.
Remarks	:	The barite had a yellowish tinge, due possibly to oxidized iron minerals, which render the barite unsuitable for the paint industry.
Potential Use	:	Possibly suitable as drill–mud additive.

Identification	:	Ont.–3 (Ref. No. 51)
Report – Title	:	TABLE CONCENTRATION OF BARITE/FLUORITE ORE FROM MOIRA FLUORITE MINE, MADOC, ONT.
– Author	:	A.K. Anderson
– No. and Date	:	*Ore Dressing Investigation Report* 888 (1940)
Sample Description	:	1.36 t of Moira ore and 450 kg of Parry ore.
Mineralogy	:	Principally barite with fluorite and calcite.
Beneficiation	:	Sizing and tabling of –1.7 mm +710 μm and –710 +425 μm fractions.
Results	:	The barite reported in the concentrate; the fluorite, in the middling; and the calcite, in the tailings. No analyses reported for table products.
Potential Use	:	Unknown.

Identification	:	Ont.–4 (Ref. No. 55)
Report – Title	:	BENEFICIATION TESTS ON BARITE ORE FROM PORT ARTHUR, ONT.
– Author	:	V.A. Haw
– No. and Date	:	*Industrial Minerals Report* 192 (1953)
Sample Description	:	10 kg of lump, –50 mm ore; 88.1% $BaSO_4$.
Mineralogy	:	Principally barite with minor iron oxides and carbonates.
Beneficiation	:	Grinding to –420 μm, tabling; regrinding of the combined table middling and tailings to –210 μm followed by flotation.
Results	:	A table concentrate analyzing 97.7% $BaSO_4$, with a 72.5% recovery, was obtained; flotation produced a concentrate analyzing 96.3% $BaSO_4$, with a recovery of 15.5%; combined recovery was 88%.
Potential Use	:	Drill–mud additive.

Identification : Ont.–5 (Ref. No. 56)

Report – Title : SINK–FLOAT CONCENTRATION OF BARITE FROM MCKELLAR ISLAND, LAKE SUPERIOR, ONT.
– Author : H.L. Beer
– No. and Date : *Industrial Minerals Report* 207 (1953)

Sample Description : 25 kg of barite ore; 87.3% $BaSO_4$.

Mineralogy : Principally barite; other contaminants not stated.

Beneficiation : Crushing to –25 mm; sink–float, heavy–media separation using galena media at sp gr 3.00 on sized fractions from 25 mm to 1.7 mm; tabling of –2.4 mm fines.

Results : A sink–float concentrate was produced analyzing 91.1% $BaSO_4$, with a recovery of 64.2%. A table concentrate was produced analyzing 94.2% $BaSO_4$, with a recovery of 16.3%. Combined recovery was 80.5%.

Potential Use : Unknown.

Identification : Ont.–6 (Ref. No. 58)

Report – Title : BARITE FLOTATION TESTS ON LEAD/BARITE ORE FROM RIDEAU BASE METALS LTD., GODFREY, ONT.
– Author : R.A. Wyman
– No. and Date : *Industrial Minerals Report* 385 (1956)

Sample Description : Weight not reported, –4.8 mm size; 12.56% $BaSO_4$, 4.06% Pb.

Mineralogy : Chief gangue minerals were quartz, feldspar, calcite with minor graphite, pyrite, pyrrhotite, titanite, mica and biotite.

Beneficiation : Jigging and tabling of coarse ore; flotation of –300 μm material.

Results : Jigging and tabling were not successful in concentrating barite. Flotation produced a concentrate analyzing 88.9% $BaSO_4$, with a recovery of 63.5%.

Remarks : Free impurities (iron) and impurities in the barite crystal structure indicate that the barite would not be suitable for either barium chemicals or fillers.

Potential Use : Drill–mud additive.

Identification	:	Ont.-7 (Ref. No. 59)
Report - Title	:	EXPERIMENTAL WORK ON BARITE FROM YARROW, ONT.
- Author	:	R.A. Wyman
- No. and Date	:	*Division Report* 70-51 (1970)
Sample Description	:	135 kg of −150 mm split core; 86.12% $BaSO_4$, 0.1% CaF_2; 410 kg of −150 mm bulk ore; 49.56% $BaSO_4$, <1% CaF_2.
Mineralogy	:	Blue-pink barite with minor calcite, silicates and fluorite.
Beneficiation	:	Autogenous grinding to −850 μm, fine grinding by vibration milling to 10 μm; air classification using an Alpine Mikroplex at 10 μm; photometric sorting on coarse ore.
Results	:	Vibration milling was successful in producing −10 μm material. Photometric sorting was successful in concentrating barite in the −10 +6.7 mm fraction. No analyses of concentration were reported.
Potential Use	:	Unknown.

BRITISH COLUMBIA

Identification	: B.C.-1 (Ref. No. 60)
Report – Title	: PRELIMINARY CONCENTRATION TESTS ON A LEAD/BARITE ORE FROM SPILLIMACHEEN, B.C.
– Author	: H.L. Beer
– No. and Date	: *Ore Dressing Investigation Report* 2576 (1949)
Sample Description	: 340 kg of ore; 59.32% $BaSO_4$, 30.35% SiO_2, 4.34% Pb, 1.28% Zn, 1.78% CaO.
Mineralogy	: Principally barite with quartz as the major gangue mineral; minor galena, sphalerite and pyrite.
Beneficiation	: Preliminary bulk sulphide float followed by tabling and flotation of barite.
Results	: Tabling produced a concentrate that analyzed 79.43% $BaSO_4$, with a recovery of 31.5%. Flotation of silica, while depressing barite, was unsuccessful because of fine barite floating with the silica. Flotation of barite, while depressing silica, was more successful, producing a concentrate that analyzed 93.1% $BaSO_4$, with a recovery of 61.3%.
Potential Use	: Drill–mud additive.

Identification	: B.C.-2 (Ref. No. 61)
Report – Title	: CONCENTRATION OF A BARITE TAILING FROM GIANT MASCOT, SPILLIMACHEEN, B.C.
– Author	: H.L. Beer
– No. and Date	: *Industrial Minerals Report* 145 (1952)
Sample Description	: 135 kg of –210 µm Pb–Zn tailings; 61.22% $BaSO_4$, 28.50% SiO_2, 0.42% Fe_2O_3, 0.47% Al_2O_3.
Mineralogy	: Principally barite with quartz as the main gangue mineral, minor iron oxides, alumina and sulphides.
Beneficiation	: Desliming at 150 µm; tabling using both sand and slime decks.
Results	: The slime table produced a concentrate analyzing 95% $BaSO_4$ and 2% SiO_2, with a recovery of 57.2%.
Potential Use	: Drill–mud additive; filler and extender.

Identification	: B.C.–3 (Ref. No. 64)
Report – Title	: CONCENTRATION OF BARITE FROM A SAMPLE OF TAILINGS FROM GIANT MASCOT MINES, B.C.
– Author	: R.A. Wyman
– No. and Date	: *Division Report* 58–16 (1958)
Sample Description	: 45 kg of −150 µm Pb–Zn tailings; ≃ 50% $BaSO_4$.
Mineralogy	: Principally barite and calcite, with quartz and dolomite as the main gangue minerals; minor micaeous aggregates and pyrite.
Beneficiation	: Sizing at 44 µm with tabling of the +44 µm fraction and flotation of the −44 µm fraction.
Results	: Tabling produced a concentrate analyzing 88.2% $BaSO_4$, and flotation, a concentrate analyzing 95.6% $BaSO_4$; combined recovery was 79.2%.
Potential Use	: It is unlikely that barite from this deposit would be suitable for paint pigment although it should be acceptable as a drill–mud additive.

Identification	: B.C.–4 (Ref. No. 65)
Report – Title	: CONCENTRATION OF BARITE FROM THE PARSON AND BRISCO MINES, B.C.
– Author	: R.A. Wyman
– No. and Date	: *Investigation Report* 60–18 (1960)
Sample Description	: 230 kg of Parson ore and 230 kg of Brisco ore, −50 mm in size.
Mineralogy	: Parson ore contains finely disseminated quartz. Brisco ore contains disseminated quartz and dark carbonaceous material.
Beneficiation	: Jigging; sink–float, heavy–media separation on coarse ore; grinding to −1.7 mm; Humphrey spiral and cyclone classification; wet and dry tabling.
Results	: Jigging and heavy–media separation were not suitable since liberation occurred only at −1.7 mm. Spirals, cyclone and dry tabling were also unsuitable as methods of concentration. Wet tabling at −600 µm produced concentrates with sp gr >4.25 and 80% recovery with both ores.
Potential Use	: Drill–mud additive.

Identification	:	B.C.–5 (Ref. No. 66)
Report – Title	:	BENEFICIATION OF BARITE FROM SUMMIT LAKE, B.C.
– Author	:	R.A. Wyman
– No. and Date	:	*Division Report* 60–87 (1960)
Sample Description	:	455 kg of –300 +1.7 mm ore.
Mineralogy	:	Principally barite, chief gangue minerals were limestone, calcite and fluorite.
Beneficiation	:	Sink–float, heavy–media separation.
Results	:	A product of drill–mud grade quality was obtained, with a 75% weight recovery.
Potential Use	:	Drill–mud additive.

Identification	:	B.C.–6 (Ref. No. 67)
Report – Title	:	CONCENTRATION OF BARITE FROM MINERAL KING MINE TAILINGS
– Author	:	R.A. Wyman
– No. and Date	:	*Mineral Processing Test Report* 66–15 (1966)
Sample Description	:	135 kg of –1.2 mm lead tailings; $\simeq$ 35% $BaSO_4$.
Mineralogy	:	Principally barite, which was present in all sizes to 150 µm; chief gangue minerals were dolomite and quartz with minor mica.
Beneficiation	:	Sizing to –300 +75 µm and tabling of the –75 µm fraction.
Results	:	Tabling was successful only on sized feed; a 90% recovery of barite was indicated.
Potential Use	:	The barite was off–white, which would make it unacceptable for paint or filler applications.

Identification	: B.C.–7 (Ref. No. 68)
Report – Title	: BENEFICIATION OF MINERAL KING MINE BARITE TAILINGS
– Author	: J.P. van Cruyringen
– No. and Date	: *Fuels Research Report* 69/1 to 4 (1969)
Sample Description	: 1.82 t of –850 µm base–metal tailings; 32% $BaSO_4$, 30% SiO_2, 30% $MgCO_3$.
Mineralogy	: Principally barite, dolomite and quartz in equal proportions with minor pyrite and sphalerite.
Beneficiation	: Hydraulic classification, sieve bend screening to remove coarse dolomite, tabling and reverse flotation of sulphide minerals from table concentrates.
Results	: Tabling produced a concentrate analyzing 85% $BaSO_4$, with a recovery of 72%. Flotation reduced iron to 0.08% Fe in the barite concentrate; concentrate analysis was 98.3% $BaSO_4$ and recovery was 99.5%.
Potential Use	: The flotation concentrate, at 98.3% $BaSO_4$, is suitable for barium chemicals manufacture. Production of 98% $BaSO_4$ is possible only by removing dolomite before tabling and flotation.

Identification	: B.C.–8 (Ref. No. 69)
Report – Title	: DRY GRAVITY SEPARATION OF BARITE/DOLOMITE ORE FROM INVERMERE, B.C.
– Authors	: R.K. Collings and S.S.B. Wang
– No. and Date	: *Division Report* 84–13 (1984)
Sample Description	: Lump barite and dolomite; 50% $BaSO_4$, 50% $MgCO_3$, as an artifically prepared head sample.
Mineralogy	: Barite and dolomite.
Beneficiation	: Air jigging and air tabling on stage crushed and sized products.
Results	: Air jigging the –13 +2.5 mm fraction produced mud–grade barite, with a recovery of 48%. Air tabling –2.5 +0.15 mm fraction produced mud–grade barite, with a recovery of 44%.
Potential Use	: Drill–mud additive.

Identification	:	B.C.–9 (Ref. No. 70)
Report – Title	:	DRY AND WET GRAVITY SEPARATION OF BARITE/DOLOMITE ORE FROM PARSON, B.C.
– Authors	:	R.K. Collings, S.S.B. Wang and J.M. Lamothe
– No. and Date	:	*Division Report* 84–14 (1985)
Sample Description	:	75 kg of –50 mm ore; ≃ 80% $BaSO_4$.
Mineralogy	:	Principally barite, ≃ 8% quartz, with minor dolomite and trace sulphide minerals.
Beneficiation	:	Wet and dry jigging and tabling; air classification.
Results	:	A combination of air jigging and air tabling produced a concentrate of sp gr >4.2 with a recovery of 80.2% on –9.4 mm feed. A combination of wet jigging and wet tabling produced a concentrate of sp gr >4.2, with a recovery of 77.2% on –4.8 mm feed. Air classification was unsuccessful in separating fine barite from coarse silica.
Potential Use	:	Drill–mud additive.

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