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GYPSUM ASSESSMENT IN THE CARBONIFEROUS BAY ST. GEORGE SUBBASIN

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ABSTRACT

Gypsum is distributed throughout the Carboniferous Bay St. George's Subbasin, where it is found in the basal evaporite zone of the Codroy Group. The most commercially attractive deposits occur in the northern part of the subbasin and one of these, the Flat Bay deposit, has been continuously productive for over thirty years. Relatively unexplored areas having high gypsum potential are found east of Ship Cove and between Boswarlos and Piccadilly, on the Port au Port Peninsula. Attention was focused on these areas and systematic sampling was carried out to determine quality of the gypsum and the type of impurities present.

INTRODUCTION

For more than three decades, Newfoundland has been a producer of gypsum, one of the most versatile industrial minerals. Gypsum is used in construction materials (wallboard, cement, plaster), agriculture (soil conditioner and fertilizer), and medicine (drugs, dental plaster, surgical casts). Newfoundland production has been solely from the Flat Bay deposit located near tidewater at the head of St. George's Bay (Figure 1). This deposit was developed in 1952 to supply a wall-board plant at Humbermouth, and at about the same time, it began supplying the gypsum requirements of a cement plant at Corner Brook. In later years, the Flat Bay operations (Plate 1) expanded into the international market by exporting gypsum through the port of St. George's to the United States. This export trade now accounts for nearly all of the annual gypsum production from Flat Bay (average production approximately 500,000 tons per year).

The purpose of the present investigation is to draw attention to some relatively unassessed gypsum deposits in the northern part of the Carboniferous Bay St. George Subbasin and the Port au Port Peninsula. Major prospects at Ship Cove and Boswarlos were investigated and systematically chip-sampled, to determine the quality of the gypsum and the type of impurities present. The Boswarlos deposit may be of special interest in light of the fact that it occurs near large deposits of limestone and shale. These raw materials, along with gypsum, constitute the essential industrial mineral requirements for a cement industry.

Previous Work

The development of the Flat Bay gypsum deposit in the early 1950's culminated a long history of studies and assessments, many of which were carried out by government. The presence of gypsum in the sea cliffs near Codroy was noted by the pioneer geologist, J.B. Jukes (1843), who suggested it might someday be mined. The region's potential gypsum did not receive serious attention, however, until 1928 when E. Dinan studied the Flat Bay deposit and estimated reserves in excess of 100-million tonnes (Dinan, 1928). Hayes and Johnson (1937) investigated and sampled most of the major gypsum showings in the St. George's Bay area and drew attention to their economic potential. Baird (1951, 1954) described the geological setting and discussed the economic potential of gypsum in the St. George's area. This work led to an extensive mapping and drilling program by the Newfoundland Government in the period 1955 to 1957. This program delineated the quality and reserves of the Flat Bay deposit in addition to a smaller deposit at Romaines Brook (McKillop, 1959).

Geological Setting

Numerous occurrences of gypsum have been documented throughout the Carboniferous Bay St. George Subbasin (Figure 1). They all occur in the Codroy Group and range in significance from the economic deposit at Flat Bay, operated by Domtar, to proven deposits at Fischell's Brook (10-million tonnes), Sheep and Coal brooks (10-million tonnes), Romaines Brook (2.5-million tonnes), and lesser known deposits at Ship Cove, Plaster Cove and on the Port au Port Peninsula. Many isolated showings are found along the margins of the Anguille Mountains in the southern half of the subbasin, where they are exposed along rivers and streams.

The gypsum is found in the Codroy Road and Robinsons River formations of the Codroy Group at four stratigraphic intervals (Bell, 1948; Knight, 1983). The thickest and most important zones (a and b) are found at the base and top of the Codroy Road Formation, respectively. Zones c and d are found in the Robinsons River Formation and are poorly exposed. The Flat Bay deposit occurs in Zone a. At Ship Cove, Zone a has thinned to a few metres of gypsiferous shale; Zone b, however, contains significant widths of good quality

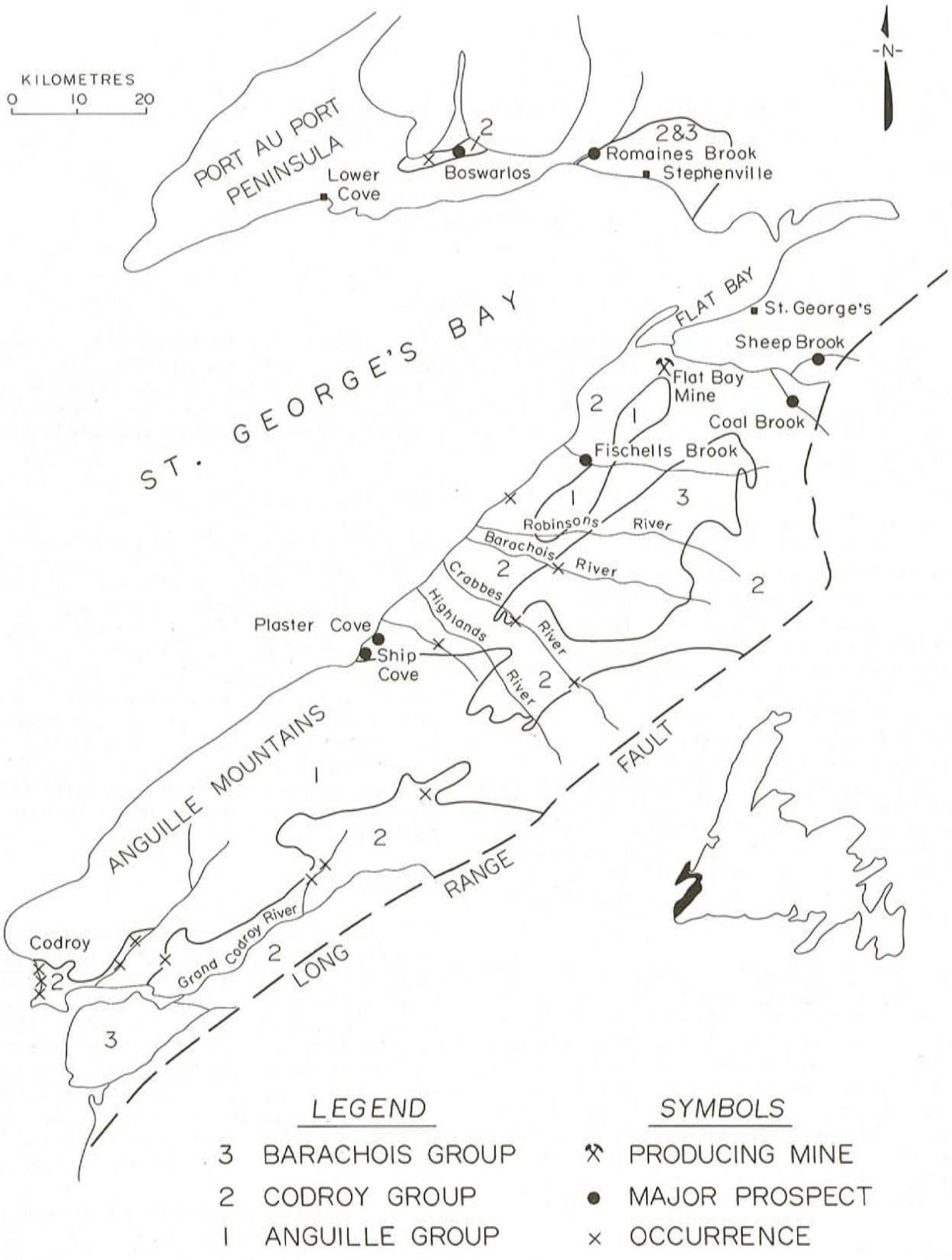

Figure 1. *Gypsum deposits in the Carboniferous Bay St. George Subbasin; (geology after Knight, 1983).*

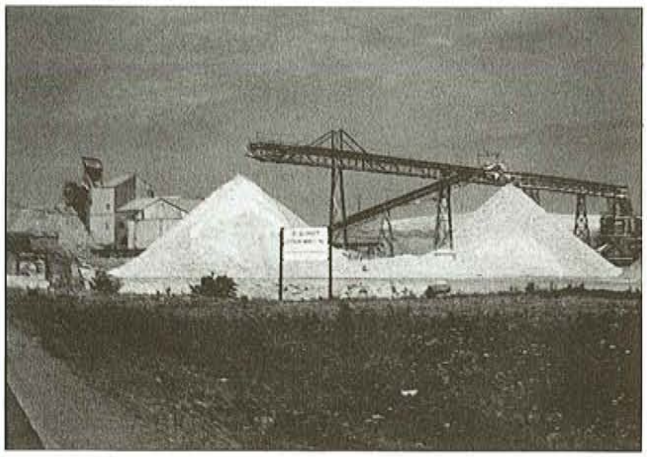

Plate 1. *Piles of crushed gypsum at the Flat Bay quarry.*

gypsum. The following is an account of the gypsum exposed at Ship Cove and Plaster Cove.

Ship Cove Prospect

Five major exposures of gypsum can be seen in the coastal cliffs of Ship Cove (Figure 2). The three southernmost outcrops may be faulted parts of the same zone (Zone a). The stratigraphic position of this gypsum at the base of the Codroy Group is demonstrated by the presence of limestone of the Ship Cove Formation, 60 m beneath the nearest gypsum outcrops. The limestone is exposed in a small brook in the southwest corner of Ship Cove and overlies sandstone of the Anguille Group.

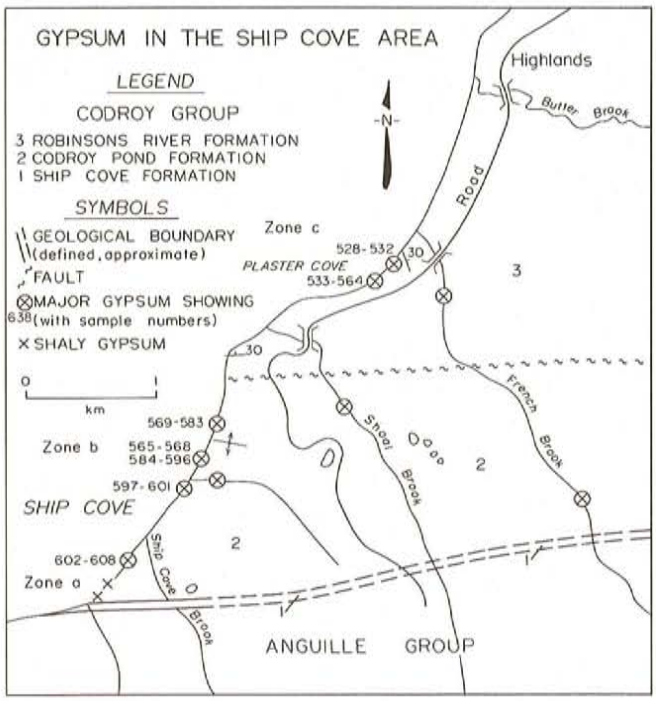

Figure 2. *Gypsum deposits in the Ship Cove–Plaster Cove areas; (geology modified after Knight and Fong, 1975).*

Although gypsum widths of 10 to 15 m were noted and sampled, the gypsum of Zone a is intimately intermixed with shale and siltstone, which greatly detracts from its quality. Anhydrite-rich sections are also present. For these reasons, and also the fact that the gypsum beds are structurally disrupted and steeply dipping, more attention was focused on Zone b, which is located approximately 1 km north of Zone a. There, the gypsum beds, although also relatively steep, appear to be of excellent purity (Plate 2).

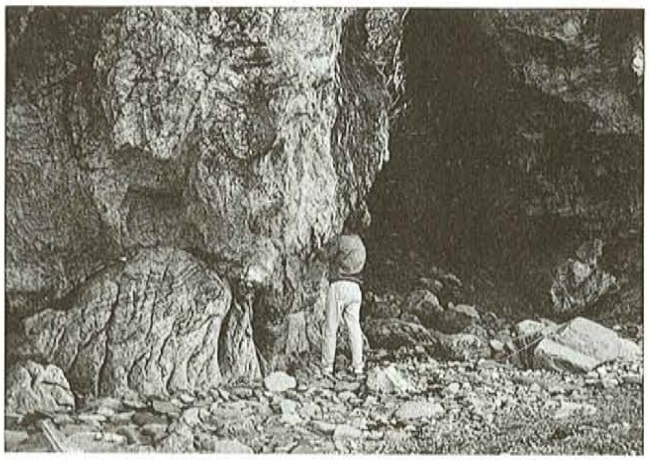

Plate 2. *Cliffs of Zone b gypsum at Ship Cove, St. George's Bay.*

The gypsum beds of Zone b are duplicated on the two flanks of an anticline. Both the north and south flanks of the anticline were sampled and these comprise gypsum widths of 70 and 50 m, respectively. Most of the gypsum is grey having a sugary texture and appears to be of good to excellent quality. An outcrop of white, powdery gypsum 450 m inland, and the presence of sinkholes, are clear evidence that this area is underlain by a significant deposit of gypsum. The documented occurrences of gypsum on French and Butter brooks, are further evidence that both a and b gypsum zones persist inland for several kilometres. However, because of the thick cover of overburden and the faulting and folding of the gypsum, it would be difficult and costly to delineate gypsum reserves inland from Ship Cove.

Plaster Cove

Gypsum is exposed on the south shore of Plaster Cove, approximately 400 m southwest of the mouth of French Brook (Figure 2). There are two showings located about 150 m apart and separated by red and green siltstones. The widest section of gypsum, which forms the basal part of the zone was measured horizontally at 125 m. However, the true thickness is about 50 m. The gypsum is white, massive, finely crystalline and comprises cliffs up to 18-m high. The gypsum is underlain by green and grey siltstone, which dip 30° northeast. The footwall contact is very irregular because of the bulbous squeezing of gypsum into the underlying strata. The overlying red shales that comprise the hanging wall are similarly contorted.

The second gypsum occurrence, which is located 150 m northeast from the gypsum described above, consists of a 4-m band of selenite. The block-shaped outcrop has a 75-cm-wide bed of massive reddish-stained white gypsum capping red-brown gypsum containing coarsely crystalline selenite having cleavage plates up to 4 cm in diameter. The gypsum dips 30° north and is traceable only a few metres inland, where it disappears beneath a thick cover of glacial overburden.

The main gypsum zone in Plaster Cove, outcrops 600 m inland in the bed of French Brook, but otherwise is covered by low swampy ground. This low topography combined with the thick overburden detracts from the economic potential of this deposit.

Boswarlos–Piccadilly Gypsum

A belt of lower Codroy Group rocks, between Boswarlos and Piccadilly on the Port au Port Peninsula, hosts gypsum outcrops (Figure 3). Several of these were investigated during the 1989 field program. Representative samples were collected from good exposures on the Boswarlos side. In one locality, distinctively pink gypsum forms a gently south-dipping block-shaped outcrop 20-m long and 12 m-high. White gypsum containing black bands and fragments (cm scale) was noted in nearby smaller outcrops indicating the gypsum is of variable quality. The gypsum zone is reflected, topographically, as a particularly rugged area characterized by low angular hills adjacent to sinkholes and other abrupt and irregular depressions (Plate 3). This, combined with a lack of good exposure, makes it virtually impossible to estimate the thickness of the gypsum. However, a reconnaissance diamond-drilling program conducted by Flintkote (1970), consisting of an east–west line of widely spaced holes (Figure 3), showed that the gypsum is continuous, where six of the seven holes intersected gypsum. The one exception (Hole 70-7) appears to have been collared too far north, away from the evaporite zone, and encountered only limestone. The purity of the gypsum ranged from 80 to 90 percent $CaSO_4$-$2H_2O$ over widths averaging 17 m. There is no information on the nature of the impurities or the amount of salt present.

Work carried out thus far on the Boswarlos–Piccadilly gypsum deposit indicates the presence of a significant deposit of fair to good quality gypsum, although further testing through drilling is required to confirm this. The combined presence of large reserves of high-purity, cement-grade limestone, and adequate deposits of shale and sandstone on the Port au Port Peninsula, raises the possibility of a potential cement industry for the area. The recent development of modern shipping facilities at Lower Cove further enhances this concept.

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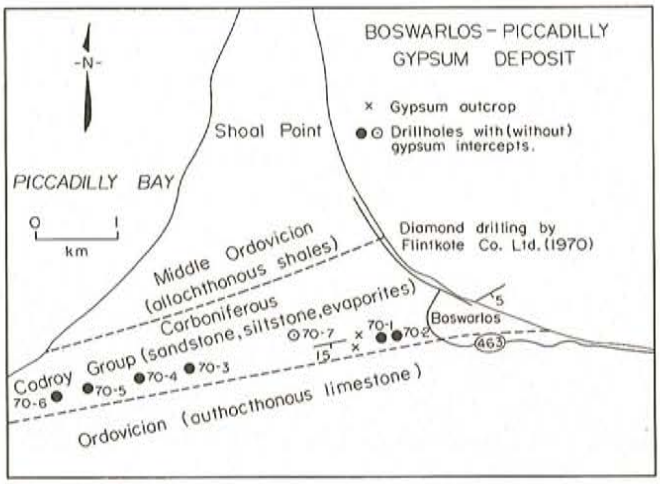

Figure 3. *The Boswarlow–Piccadilly gypsum deposit; geology modified after Besaw (1974).*

Plate 3. *Sinkhole typical of korst topography along gypsum belt between Piccadilly and Boswarlos.*

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