# ECONOMIC GEOLOGY

Exploration for, and exploitation of, mineral deposits in the Antigonish area have been very limited. A tabulation of the major mineral occurrences in the Antigonish area was prepared by Bourque (1979) and a nongenetic classification of the mineral occurrences is tabulated in Figure 47 (p. 79) and Table 1 (p. 80). Historically, copper has been sought along the Antigonish, James River, Ohio outcrop belt, but no significant production has been achieved. Gypsum, which occurs in great abundance in some areas, was quarried on a limited scale in the area of Antigonish Harbour (Adams, 1991). Currently small production occurs in the area of Brierly Brook (Fig. 47, p. 79). Exploration for salt was undertaken in the mid 1800s, but the evaporating operation failed after the loss of the source brine. Potash exploration has been undertaken in recent times, but only minor to trace amounts have been intersected in drilling. Limestone has been produced in small quantities in the past from local pits and was used primarily to serve local agricultural requirements. A small quarry operated near Southside Antigonish Harbour is presently producing high calcium limestone. Petroleum exploration has been carried out by private concerns between 1950 and 1976 (MacNeil, 1946; 1947; 1948; 1952; 1955; 1959). Although a small flow of natural gas was encountered in a salt exploration drillhole, all the wildcat drillholes have been dry and abandoned (McMahon et al., 1986). Coal has been reported in a thin seam in the Pomquet Harbour area, but no indications of any significant deposits have been recognized in the onshore outcrop area.

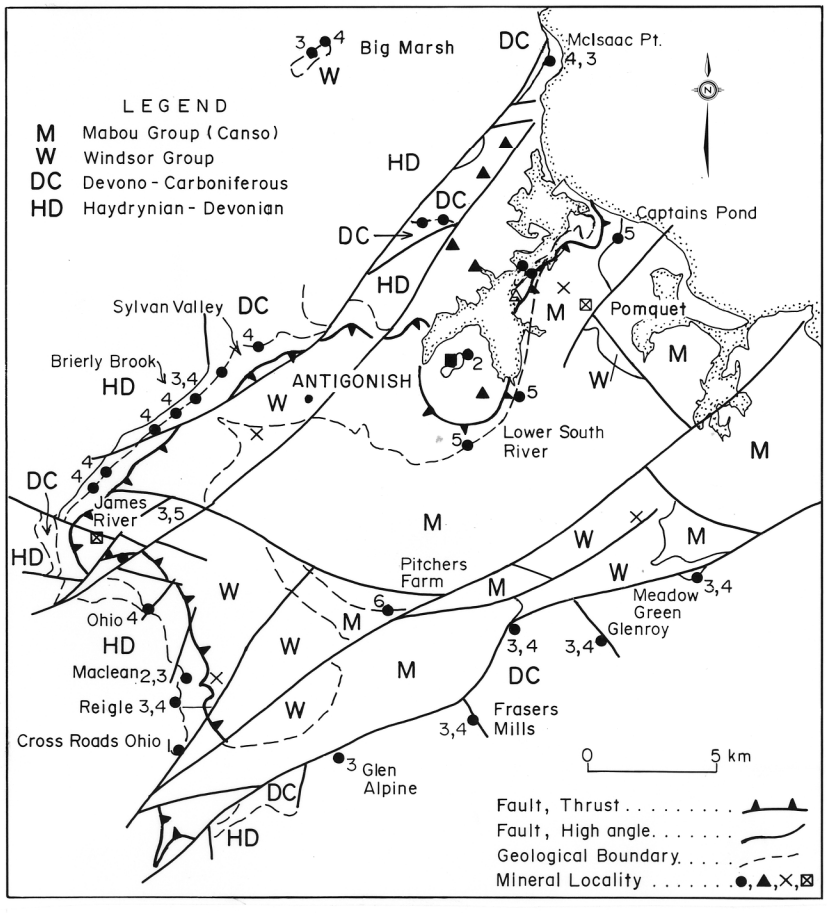


Figure 47. Location map for the major types of mineral occurrences and deposits in the Antigonish Basin. See Table 1 (p. 80) for general classification of mineral occurrences and deposits.

## METALLIC MINERALS

Exploration for base metals has been most intense in the basal part of the Windsor Group where mineral occurrences and prospects are most abundant. This pattern is similar to most other Carboniferous basins in Nova Scotia (Boehner and Ryan, 1990).

Copper minerals, principally malachite, chalcopyrite, azurite and chalcocite are ubiquitous in trace to minor amounts near the base of the Windsor Group between Antigonish, James River and Ohio. The minerals are concentrated in the green, reduced zone in siliciclastic rocks immediately beneath the Macumber Formation. They occur as disseminations, minor aggregations and as clast coatings in conglomerate and also within the lowermost few centimetres of the Macumber Formation. This type of mineralization has been studied and described by Binney and Kirkham (1974; 1975), Kirkham (1974; 1978; 1985), Bourque (1981) and Northcote et al. (1989). The mineralization has been interpreted as representing early diagenetic sedimentary processes localized at an oxidation-reduction interface between marine rocks deposited upon continental clastics.

Chalcopyrite, galena and sphalerite occur as trace accessory minerals in calcite/dolomite/barite/fluorite veins in the Macumber Formation. Chalcopyrite and malachite occur in trace amounts in calcite veinlets and disseminations within the $E_1$ limestone near Monastery (approximately 12 km east of Heatherton, outside the report area). Minor to trace amounts of galena and sphalerite occur as pore and cavity fillings in the outcrops

Table 1. General classification of mineral occurrences and deposits. See Figure 47 (p. 79) for locations.

| MAP SYMBOL (Fig. 47) | STRATIGRAPHIC POSITION | HOST ROCK TYPE | METALLIC AND NONMETALLIC MINERALS | MORPHOLOGY | EXAMPLE LOCALITY |
|---|---|---|---|---|---|
| ●6 | Mabou (Canso) Group Hastings Formation | Grey Mudrock | Cu | Stratabound (Disseminated) | Pitchers Farm |
| ●5 | Addington Formation $E_1$ Limestone | Carbonate | Cu, Pb | Stratabound (Disseminated) Veinlet | Monastery Captains Pond |
| ●4 | Devono-Carboniferous Macumber Formation | Carbonate and Conglomerate | Cu | Stratabound (Contact Oriented) | Brierly Brook Ohio MacLean |
| ●3 | Windsor Group Macumber Formation | Carbonate | Cu, Pb, Zn, Calcite, Barite, Fluorite, Dolomite | Vein | Brierly Brook Cape Jack Lakevale |
| ●2 | Windsor Group Gays River Formation | Carbonate | Cu, Pb, Zn | Stratabound (Contact Oriented) | Williams Point Ohio |
| ●1 | Basement Pre-Carboniferous | Metamorphic | Cu, Calcite, Barite | Vein | Cross Roads Ohio MacIsaacs Point |
| ■ | Windsor Group Gays River Formation | | Limestone | Stratabound | Williams Point |
| ▲ | Windsor Group Bridgeville Formation | | Gypsum | Stratabound | Harbour Centre |
| × | Windsor Group Hartshorn Formation | | Salt | Stratabound | Southside Antigonish Harbour |
| ⊠ | Windsor Group Hartshorn Formation | | Potash and Salt | Stratabound | James River |

and drillhole intersections of the $E_1$ limestone at Lower South River, Captains Pond and Pomquet.

The limestone banks of the Gays River Formation have potential as hosts for base metal deposits of the Gays River type. The banks are well developed on the northeasterly trending basement ridge at Williams Point, Southside Antigonish Harbour and also along the western border of the Antigonish Basin. These banks are very similar to the Gays River Formation banks in the Shubenacadie and Musquodoboit basins (Giles et al., 1979; Boehner et al., 1989), the main difference being that the banks in the Antigonish Basin are not as extensively dolomitized as the ubiquitous dolostone in the Shubenacadie Basin and Musquodoboit Basin. Traces of chalcopyrite, galena and barite are present as disseminations and as euhedra associated with calcite pore filling in the Williams Point, Southside Antigonish Harbour area banks. Trace to minor amounts of copper, lead and zinc are present in outcrop and in drillholes in the Ohio area bank facies (Burton, 1974). The mineralization occurs both within the carbonate and within the basal siliciclastic rocks.

Traces of finely disseminated chalcopyrite occur with carbonaceous material in grey-green, silty interbeds within the Hastings Formation near Pitchers Farm located southeast of Glen Road in the central part of the Antigonish Basin. Chalcopyrite and malachite are locally abundant in association with plant debris within

the Pomquet Formation at several localities in the type section on Pomquet River.

## NONMETALLIC MINERALS

### Barite and Fluorite

Calcite veins and veinlets cutting the Macumber Formation in the Antigonish Basin and outliers at Lakevale and Big Marsh often have trace to minor amounts of barite, fluorite and dolomite. Barite-bearing veins without fluorite prevail in the Ohio, James River, Antigonish contact area and also in the Lakevale and Big Marsh areas. Calcite veinlets along the southeastern border of the Basin are characterized by the presence of fluorite and dolomite with no significant barite. Fluorite is locally present in dolomite and anhydrite veins cutting the Bridgeville Formation near Addington Forks. The increased abundance of veins in the southeastern border area is believed to reflect greater intensity of deformation and fracturing related to the major faults in the area. Calcite veins with minor barite, chalcopyrite and malachite are present in the Hadrynian-Devonian basement volcanic rocks at Cross Roads Ohio and MacIsaacs Point. Evidence of stratiform barite-fluorite deposits has not been recognized in the Antigonish Basin (also see Felderhof, 1978).

### Limestone and Dolostone

The limestone and dolomite deposits and occurrences in the Antigonish Basin were described by Murray (1975). The most important deposits are located within the Windsor Group and at present one quarry is operated by Ridge Brokers Ltd. in the Gays River Formation bank at Southside Antigonish Harbour (Fig. 28, p. 38; Fig. 29, p. 39). The high calcium limestone from this quarry is used primarily in paper production and agriculture. Historically, the Macumber Formation has been used as a local source of structural stone, but this has ceased.

### Gypsum

Gypsum occurs in large outcrop areas in the vicinity of Antigonish Harbour and near Brierly Brook (Adams, 1991). The land in the vicinity of the gypsum is characterized by the development of karst topography related to the dissolution and weathering of soluble gypsum. This land is generally unsuitable for agriculture or forestry. The gypsum deposits near Harbour Centre, Lanark, Lower South River and Southside Antigonish Harbour are attractively close to potential tide water shipping. The gypsum near Brierly Brook is favourably situated within a few hundred metres of the Canadian National Railway mainline and is intermittently quarried by Nova Construction Company Ltd. (Adams, 1991).

### Salt and Potash

One of the earliest attempts to establish a salt production industry in Nova Scotia occurred in the Antigonish area around 1866. Fletcher (1887) reported that a company called Nova Scotia Salt Works and Exploration Company drilled a hole in search of salt near Town Point in Antigonish Harbour. The hole was abandoned without encountering salt or brine. The next hole was drilled near the railway station in Antigonish and encountered salt brine. An evaporating salt works was established, but the salt brine decreased in strength and the venture failed following unsuccessful attempts to locate a sufficient salt brine source.

The presence of significant salt deposits indicated by the abundance of salt springs and seeps described by Dawson (1868) and Hayes (1931) was established in exploration drilling between 1950 and 1980. Boehner (1985; 1986a) identified and classified the salt resources in the Antigonish Basin. Three deposits, Southside Antigonish Harbour, Antigonish and James River and two occurrences, Ohio and Pomquet River, were described. Deposit designation was given to significant intersections of salt strata (typically 100+ m) and occurrence status was given to thin intersections (typically 10 m or less).

The first major salt deposit to be discovered was near Southside Antigonish Harbour. This discovery was the result of an attempt by the Nova Scotia Department of Trade and Industry to determine the feasibility of establishing a soda ash industry. The Southside Antigonish Harbour deposit is defined by five drillholes and a significant Bouguer gravity low (Boehner, 1985; 1986a; Farries Engineering, 1976). The intersected thickness of the salt-bearing seetion (Hartshorn Formation) ranges from 152-213 m (500-700 ft) with the top at a depth of approximately 229 m (750 ft). Chemical analyses indicate an average analysis of 85.8% over 38 m in NSDM 1708 and an average grade of 88.2% over 24 m in Novasel-1 (NSDM 4862) (Boehner, 1986a).

The Antigonish salt deposit (Boehner, 1986a) is situated approximately 3.5 km west of Antigonish and is defined by two drillholes and a significant Bouguer gravity low. The salt-bearing section (Hartshorn Formation) has an intersected thickness of approximately 46 m (150 ft) and was not completely penetrated. The James River salt deposit is situated approximately 2 km south of James River in the western part of the Antigonish Basin. The deposit is defined in three drillholes JR-3, redrilled as JR3-80 (BM-1) and AP-1-74 and by a significant Bouguer gravity anomaly. The salt has an intersected thickness of 76 m (250 ft) as

opposed to the true stratigraphic thickness (Boehner, 1986a).

Two salt occurrences are known in the Antigonish Basin (Boehner, 1986a). The Ohio salt occurrence is located near the western border of the Antigonish Basin and is defined by a single drillhole. A bed of halite (<1 m) was intersected at a depth of 298.7 m. The salt was not completely penetrated and the extent is unknown. The Pomquet River salt occurrence is located near the Pomquet River, 3 km southwest of Pomquet Forks and 4 km northeast of St. Andrews. Salt was intersected in a petroleum exploration drillhole K-1 (NSDM 2554) (Boehner, 1986a). Salt with red shale were intersected in a 16 m thick section with its top at a depth of 363 m. A large Bouguer gravity low coincident with the Pomquet River occurrence area indicates a major salt deposit may be present at a greater depth (Boehner, 1986a).

Potash salts including sylvite and carnallite are known in low grade zones and disseminations in the salt deposits (Hartshorn Formation) at James River and Southside Antigonish Harbour (Boehner, 1986a). At James River traces of potash salts were first reported near the top of the Hartshorn Formation by Millmor-Rogers Syndicate et al. (1974). A potash mineralized interval was described in drillhole AP-1-74 by Stewart (1976). This hole was drilled by Amax Exploration Ltd. near JR-3 and intersected potash at a depth of 590-591 m (1935.8-1939.1 ft). A maximum analysis of up to 6.25% $K_2O$ was reported by Stewart (1976) for a 10 cm interval at the centre of the zone. Minor disseminated crystals of sylvite were noted in drillhole Novasel-1 in the Southside Antigonish Harbour deposit at a depth of approximately 286 m (939 ft). Chemical analyses of the salt in this interval have up to 0.27% K confirming the presence of potash traces (Boehner, 1986a).