SUMMARY

OIL SHALE RESOURCES

Oil shale, a term applied to rocks that yield 25 litres or more of hydrocarbons per tonne of rock upon retorting, is known to occur in nine areas in Nova Scotia (Figs. 1, 18). All these rocks are of Upper Paleozoic age (Fig. 2) and occur within the late Devonian-Tournaisian and Westphalian B-D strata of the northern mainland and Cape Breton Island and within the Westphalian A-B strata of northwestern Nova Scotia. Oil shale development has been attempted at two of these areas, Stellarton and Antigonish (Big Marsh), but they were only short-lived events. Oil shale was mined at Stellarton from 1852-1859 and 1929-1930 and at Antigonish circa 1865.

Stellarton Basin

The largest oil shale resource known in Nova Scotia is from the 2600 m thick Westphalian B-D coal-bearing Stellarton Formation. The formation is situated within the 6 km x 18 km Stellarton Basin and contains 60 silicate-rich oil shale beds, all of lacustrine origin. The oil shale beds vary in thickness (average of 5 m and maximum of 35 m) and are interbedded with sandstone, siltstone, claystone, coal and/or minor conglomerate. Most (90%) of the oil shale beds are fissile shale (avg. yields of 25 l/t or less) with thin sections of cannel shale (avg. yields of 40 l/t). The remaining beds are rich in boghead shale (avg. yields of 110 l/t). A total *in situ* resource of 825 x 10^6 tonnes of oil shale giving 168 x 10^6 bbls of shale oil is estimated from oil shale beds 1-45 (Table 5). Resource estimates for oil shale beds 46-60 are currently unobtainable due to lack of oil yield information.

Antigonish Basin

The second largest resource occurs within the 500-1230 m thick South Lake Creek Formation, late Devonian-Tournaisian Horton Group, in the Antigonish Basin. Oil shale occurs at two localities, Big Marsh and Beaver Settlement, that are 10 km apart. The oil shale bed averages 117.5 m thick along strike for 4.8 km at Big Marsh and 61.6 m along strike for 1.6 km at Beaver Settlement. The oil shale is dominated by low yielding fissile oil shale (avg. yield of 14.6 l/t) with thin sections of higher yielding massive (cannel) oil shale (with maximum yields of 58.9 l/t). A total *in situ* resource of 738 x 10^6 tonnes of oil shale giving 75.6 x 10^6 bbls of shale oil is estimated from the two areas (Table 4).

Other Localities

Westphalian B-D (Pictou Group) oil shale also occurs within the Mabou-Inverness coalfield (cannel shale), Sydney Basin (calcareous shale and petroliferous limestone) and Trenton Syncline (boghead shale); all are associated with coal. Late Devonian-Tournaisian (Horton Group) oil shale also occurs in the areas of Cape St. Lawrence (silicate-rich shale) and Minas Basin (carbonaceous and coaly shale). Oil shale of late Westphalian A - Westphalian B age is known in the Cumberland Basin (Cumberland Group: laterally extensive calcareous shale and petroliferous limestone) and in the Debert-Kemptown Basin (Delaney formation: cannel shale); both occurrences are associated with coal. The oil shale beds at these areas are generally less than 1.5 m thick, only a few attain a thickness of up to 3.0 m, with the higher yielding portions of the beds confined to sections only 30 cm thick. Thus, they represent only limited resources.

OIL SHALE DEPOSITION

Oil shale deposition during late Devonian-Tournaisian time occurred within fault-bounded extensional basins that formed following the Acadian Orogeny in northern and western Cape Breton Island and on mainland Nova Scotia (Murray, 1960; Hamblin, 1988; Martel and Gibling, 1989) (Figs. 1, 2). The basins probably included components of deep, annually stratified lakes in Cape Breton (Murray, 1960), small, shallow algal lakes bordered by swamps at Antigonish (Murray, 1960), and a hydrologically open lacustrine system with a gently sloping shoreline transitional to a swamp environment within the Minas Basin (Martel and Gibling, 1989).

During Westphalian A-B time, the Cumberland and Debert-Kemptown Basins were the main depocenters of continental deposition. Deposition of petroliferous, pelecypod-bearing limestone and shale associated with the coal-bearing Cumberland Group in the Cumberland Basin is attributed to brackish, standing water conditions (Duff and Walton, 1973). The lateral continuity of the

pelecypod-bearing limestone suggests that brackish conditions were regionally extensive. Deposition of cannel shale within the Debert-Kemptown Basin probably represents ephemeral lacustrine conditions that drowned the coal-forming swamps and resulted in their termination.

During Westphalian B-D time regionally extensive coal formation and fluvial sedimentation occurred within the Sydney Basin and Gulf of St. Lawrence region of the Maritimes Basin. Oil shale beds in these areas are associated with coal seams, where they occur within the roof and/or floor strata. The oil shale probably represents widespread flood events that drowned the swamps and, in some cases, terminated peat accumulation. Within the Stellarton Basin, however, restricted sediment supply to a relatively small and rapidly subsiding basin allowed lacustrine conditions, in which algae flourished, to develop. Lacustrine conditions, similar to those of Stellarton, probably also existed from time to time northward within the Trenton Syncline. Oil shale beds contained within Pictou Group strata of the Trenton Syncline, although thinner and less abundant, are lithologically and chemically similar to those of Stellarton.