NICKELIFEROUS AND URANIFEROUS ANTHRAXOLITE FROM PORT ARTHUR, ONTARIO

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Several years ago specimens of anthraxolite collected near Port Arthur by T. L. Tanton of the Canadian Geological Survey were found by the writer to be slightly radioactive. As Dr. Tanton considers this anthraxolite to be definitely of post-Animikie (late pre-Cambrian) age, and as he states further that by blasting it would be easily possible to obtain the mineral in quantities of 100 pounds or more, it appeared to be worth while to ascertain whether the radioactive element content is sufficient to justify an attempt to determine the age of the mineral by the lead-ratio method.

The anthraxolite is a brilliant black carbon that has evidently been much sheared and is now plastered around rock fragments and quartz. It is penetrated by numerous veinlets consisting chiefly of quartz with lesser amounts of calcite and soft secondary minerals in the smaller fractures. Some metallic sulphides are present in the rocky portions. By crushing, small pieces of the anthraxolite can be picked out that appear to be perfectly pure, but even if the greatest care be exercised it is almost impossible to be certain that the fragments do not contain some very thin included veinlets of quartz or other minerals. For this reason it was impracticable to attempt to isolate a sufficient quantity of the absolutely pure material for analysis.

A 50 gram sample for analysis was obtained by crushing the best specimens on hand to about eighth-inch fragments and picking out visible quartz and other impurities without attempting any microscopic examination of individual fragments. The sample was burned in a muffle at low red heat and yielded a residue weighing 3.35 grams consisting chiefly of quartz and rock fragments along with a minor amount of fine brownish powder evidently representing the true ash of the mineral. The residue was sifted through several bolting cloths of increasing fineness of mesh so long as there appeared to be no danger of losing the fine powder. The powder that passed through the last cloth having apertures of about 0.25 mm. weighed 1.1893 grams and was used for analysis, though it still consisted chiefly of lime, quartz and other impurities. Due to an

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oversight this sample was not ignited to constant weight at a higher temperature and probably contained water and possibly CO_2. The analysis was made primarily to get an idea of the U, Th, R. E., and V content of the mineral, but as many of the major constituents were also roughly determined as was conveniently possible.

PORT ARTHUR ANTHRAXOLITE RESIDUE
(Per cent of Original Sample)

SiO_2	0.3696
Fe_2O_3	0.1150
Al_2O_3	0.0168
MnO	0.0166
CaO	1.3366
MgO	0.0128
NiO	0.0626
CoO	Traces
U_3O_8	0.0034
V_2O_5	0.0008
Th, R. E.	Not detected

In order to obtain an idea of the amount of true ash present in the analyzed residue, a sample of small fragments individually selected for apparent purity under the binocular microscope, was burned in a platinum crucible. Combustible gases came off and burned for several minutes but no tarry matter was deposited on the sides or lid of the crucible. The residue from 3.7678 g. taken, weighed 0.0182 g. but on examination under the binocular was found to contain grains of quartz and white partly sintered silicates. After carefully picking these out the residue weighed 0.0063 g. which may be considered as being still somewhat in excess of the true weight of the essential ash.

Thus it appears that the anthraxolite contains only about 0.16 per cent or less of essential ash. Relating this value to the ash analysis above, the essential ash should contain about 39 per cent NiO, 2 per cent U_3O_8 and 0.5 per cent V_2O_3. This nickel content seems high and in fact some may have come from sulphides, but a qualitative test on the 0.0063 g. residue showed that a large percentage of Ni is certainly present in the essential ash. Although no Th nor R. E. were found, it is possible that very small percentages might escape detection owing to the small amount of true ash present and the fact that a separate sample which would have been most favorable for their exact determination was not available.

From these results the mineral does not appear to be particularly favorable for an exact age determination by the lead-ratio method, because of the small percentage of true ash, the small percentage of U in the ash, and the difficulty of obtaining the true ash free from impurities. Nevertheless, it might be possible to produce a reasonably clean anthraxolite concentrate by tabling or flotation, in which case further investigation would be justified.

Carbon minerals containing nickel and uranium were recognized long ago in Sweden.[2]

The geological occurrence of the Port Arthur anthraxolite has been described[3] and mapped[4] by T. L. Tanton, who says

"anthraxolite occurs in narrow veins at a few places in Port Arthur and environs. The largest known deposit is half a mile east of the Golf Club, southwest of Port Arthur, where in the central part of a banded vein of the silver-bearing type, anthraxolite occurs through an exposed length of 30 feet with an average width of 6 inches. Beyond the limits of Fort William and Port Arthur map-area many occurrences of anthraxolite are known in veins cutting the Gunflint formation. None of the occurrences is of sufficient size to be of commercial value as fuel." (*loc. cit.* p. 201.)

The anthraxolite-bearing veins belong to a rather widespread system of fault-veins cutting both Animikie sediments and intrusive diabase. The veins carry in various instances, one or more of the following minerals: native silver, argentite, galena, chalcopyrite, sphalerite and pyrite, besides gangue minerals such as quartz, calcite, fluorite and barite. In many instances more or less anthraxolite also is present and in a few veins, it, along with quartz and calcite, constitutes the main vein filling.

In view of the presence of uranium in the anthraxolite of these veins, it would appear that the native silver and argentite which occur in the same vein system might carry sufficient uranium to permit determination of the age by the helium-ratio method.

Dr. Tanton has also found small quantities of anthraxolite in the banded ferruginous chert of the Gunflint (iron) formation in the same map-area.

[2] Nordenskiöld, M., *Comptes Rendus*, vol. **CXVI**, pp. 677–678, 1893.
[3] *Geol. Surv. Can., Memoir* **167.**
[4] *Geol. Surv. Can., Map* **2141,** No. 198A.