Geoscience Canada

Metallic Mineral Occurrences in or under the Phanerozoic Rocks of Saskatchewan

D. F. Paterson

Volume 15, Number 2, June 1988

URI: https://id.erudit.org/iderudit/geocan15_2art07

See table of contents

Publisher(s)

The Geological Association of Canada

ISSN

0315-0941 (print)
1911-4850 (digital)

Explore this journal

Cite this article

Paterson, D. F. (1988). Metallic Mineral Occurrences in or under the Phanerozoic Rocks of Saskatchewan. *Geoscience Canada*, *15*(2), 103–105.

Metallic Mineral Occurrences in or under the Phanerozoic Rocks of Saskatchewan

D.F. Paterson
Saskatchewan Energy and Mines
201 Dewdney Avenue East
Regina, Saskatchewan S4N 4G3

Introduction

In Saskatchewan, the Precambrian basement is exposed in the north and slopes to the south where it is covered by a progressively thicker sedimentary succession of Phanerozoic age. This succession reaches over 3000 metres in thickness in the southeast, reflecting the Williston Basin structure that extends northward from North Dakota.

The mineral wealth of southern Saskatchewan includes oil, gas, coal, potash, sodium sulphate and bentonite. These are well known, but there are occurrences of metallic minerals which also warrant consideration. This paper summarizes those occurrences known in the sedimentary rocks or the igneous/metamorphic basement at shallow depths below them. Though not economically important today, some of these have been exploited in the past and others have potential for future development. Published references have been given where available; otherwise the original document on which this paper is based can be consulted in the Mineral Assessment Section, Saskatchewan Energy and Mines, Regina.

Gold

Gold occurs on the Precambrian Shield in situations which suggest strong possibilities of it also being present under the contiguous Phanerozoic rocks. Around the Amisk Lake – Flin Flon area for example there are many showings, and in general the rocks strike north-south under the sedimentary cover. Showings at Brownell Lakes and Wapawekka Lake are along an east-west strike, which likewise carries the host rocks under the sedimentary cover. In addition, the important finds in the La Ronge Belt – Waddy Lake, Star Lake, Sulphide Lake (Coombe, 1984) are located along a northeast-southwest trend, which disappears under the Phanerozoic cover rocks south of La Ronge. In order to assess the likelihood of gold mineralization occuring beneath Phanerozoic cover rocks, it would be necessary to carry out a systematic study such as that underway within Project Cormorant of southern Manitoba (Blair *et al.*, 1988, this volume).

Placer gold has been reported from four areas in southern Saskatchewan (Coombe, 1984). The principal area is the North Saskatchewan River between the Alberta border and Prince Albert (1a on Figure 1). Gravels have been worked intermittently since 1859 by dredging and sluicing at many places along this stretch and, although the amount of gold recovered has been poorly documented, some 275 oz. are known to have been taken in the four years from 1938 to 1942. There are still some active claims along this part of the river. Why, also, should there not be gold to the east of Prince Albert?

Gold of placer origin was also found in the Waterhen River area (1b) and some surrounding creeks in 1926 (Coombe, 1984). The area is about 185 km north of North Battleford. The gold recovered was reported to be exceedingly fine. There appears to have been little, if any, production.

On the east side of the province, gold has been panned in small quantities from the sands and gravels around Leaf Lake (1c) in the Pasquia Hills (Beck, 1967).

The other occurrence reported is on a tributary draining Fife Lake (1d) in the extreme south (Coombe, 1984). A large number of claims were staked there in 1931, but investigations by the then Department of Natural Resources failed to find any gold. Thus, this showing should perhaps be classed as "not proven".

In summary, placer gold has been found at widely separated localities in the province and these areas might well be worth a second look. Other similar areas no doubt exist. It would be interesting to know more about the gravels which occur in buried river valleys, as shown on the Geological Map of Saskatchewan by Whitaker and Pearson (1972). Possibly the Battleford Valley, and the northwestern portion of the Hatfield Valley, have the same potential for gold production as the North Saskatchewan valley, which area they previously drained.

The possibility exists, therefore, not only for Precambrian occurrences under the Phanerozoic, but also for post-Precambrian placer deposits in ancient channels in the sedimentary cover, and within modern river gravels.

Uranium

Anomalous concentrations of uranium have been detected at widespread localities in southern Saskatchewan. Of particular interest are the uppermost Cretaceous and Tertiary rocks of the extreme southwest (2a), because of the lithological and stratigraphic similarities to the host rocks of uranium mines in Wyoming. Several exploration surveys have been conducted in this area, including radiometric surveys, geochemical analysis of well waters, biogeochemical sampling, drilling and surface prospecting. Concentrations up to 400 times background were found locally. It appears that organic materials, in particular lignite and fossil bone, have locally concentrated the uranium, presumably from metal-rich waters. Concentration gradients were found in some sandstones, possibly paleochannel fills, but concentrations found were not high enough to be economic. It remains possible that somewhere in this southwest region, which covers about 500 km^2, concentrations high enough to warrant mining may be present.

Substantially further north (2b), a track-etch survey showed several anomalies south of the Duddridge Lake deposits. The anomalies appear to be located along the edge of a paleo-valley cut into Precambrian rocks.

In the eastern part of the province, uranium anomalies associated with helium gas were explored in the region of the Red Earth Indian Reserve (2c). No high concentrations were found and no plausible mechanism for their occurrence was formulated. Possibly locally occurring shales of the Boyne and Favel Formations (Cretaceous) have led to concentrations of uranium. The shales are very rich in organic matter, to the extent of being informally called "Oil Shales", and show elevated radioactive readings on geophysical logs.

Manganese

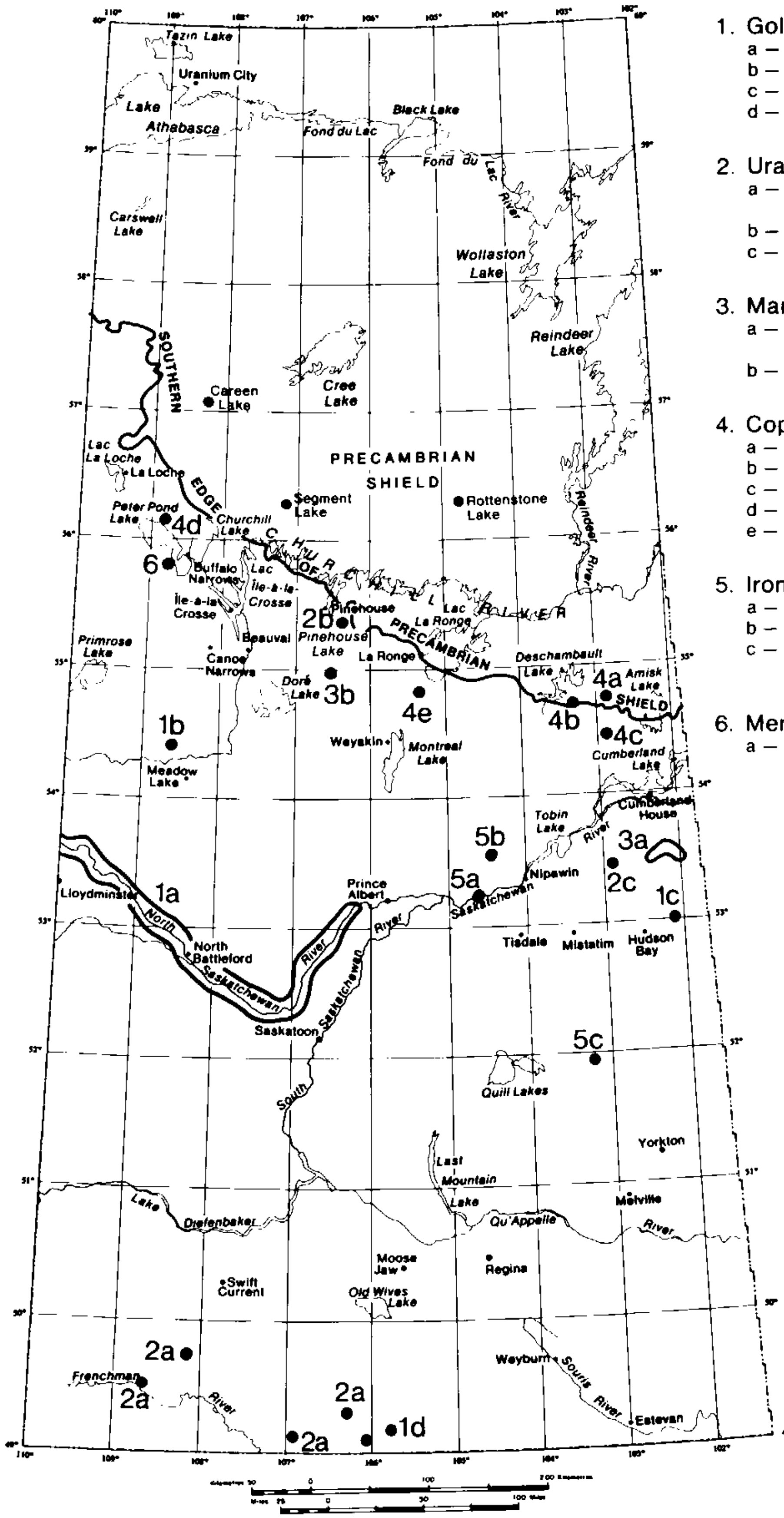
Beck (1974) reported that the basal 100 m or so of the Upper Cretaceous Riding Mountain Formation in the Pasquia Hills area of east-central Saskatchewan contains nodular concretions rich in iron and manganese. Analyses showed these nodules to contain an average 20% iron and 17% manganese along with minor or trace amounts of barium, chromium, cobalt, copper, gold, lead, molybdenum, nickel, silver, titanium, vanadium, zinc and zirconium.

The geology of the area suggests that the nodules are present over an area of some 400 km^2. However, the potentially mineable area consists of a 60 km strip around the northern tip of the Pasquia Hills (3a) where a stripping ratio of 0.5 (waste) to 1.0 (ore) or better exists. This gives a potential of 5 to 6 million tonnes of nodules.

Manganese-rich sands have been reported from Little Emmeline Lake (3b), 70 km west of La Ronge (Simpson, pers. comm.). They appear to be of recent origin but their thickness and lateral extent are unknown.

Copper, Zinc and Lead

Base metal deposits on the Precambrian Shield have been mined in Saskatchewan for



1. Gold
   - a — North Saskatchewan River
   - b — Waterhen River
   - c — Leaf Lake
   - d — Fife Lake
2. Uranium
   - a — Southwest Saskatchewan (several locations)
   - b — South of Duddridge Lake
   - c — Red Earth Indian Reserve
3. Manganese
   - a — Northern edge of Pasquia Hills
   - b — Little Emmeline Lake
4. Copper, Zinc, and Lead
   - a — Hanson Lake
   - b — Bigstone Lake
   - c — Miskas Lake
   - d — Peter Pond Lake
   - e — South of La Ronge
5. Iron
   - a — Choiceland anomaly
   - b — Kelsey Lake anomaly
   - c — Miami Hudson Bay No. 1 Nut Mountain well
6. Mercury
   - a — Fleury Pt. Peter Pond Lake

Figure 1.
Location of mineral deposits referred to in text

many years. The Flin Flon Mine (chalcopyrite and sphalerite) and the Anglo-Rouyn Mine (chalcopyrite) provide examples. Galena and sphalerite were mined at the Western Nuclear Mine, Hanson Lake (4a) and there is a showing of the same minerals at Segment Lake (Figure 1).

The Hanson Lake deposit is located at the edge of the Precambrian Shield and, in fact, the mine buildings were built on the adjacent Ordovician dolomites. Two bodies of chalcopyrite and sphalerite occur in the Precambrian basement beneath about 50 m of sedimentary cover at Bigstone Lake (4b) and Miskas Lake (4c). The Bigstone Lake deposit is estimated at 3.5 million tonnes grading 3.5% copper and 600,000 tonnes grading 7% zinc. The scatter of showings all along the Shield edge suggests that most of the shallowly buried Precambrian may be prospective.

Base metals have also been encountered hosted within sedimentary carbonate rocks. Chalcopyrite has been reported in fractures within Devonian rocks (Fuzesy, 1980) near Peter Pond Lake (4d) and south of La Ronge (4c). Also south of La Ronge, visible galena and anomalous zinc values have been reported from Devonian rocks. The Meadow Lake Escarpment is a subsurface structure that runs WSW-ENE through that area and could bear some relationship to the mineralization.

Iron

Substantial reserves of iron have been established in the Precambrian basement rocks of southern Saskatchewan, particularly in an area some 100 km east of Prince Albert near the town of Choiceland. Claims were staked in 1955 and 1956 on the basis of magnetic deviations, observed in the past by pilots flying over the area. Ground geophysics, and later airborne geophysics, showed a complex of magnetic anomalies and two in particular have been drilled. These are the Choiceland anomaly (5a) and the Kelsey Lake anomaly (5b).

The Choiceland anomaly was drilled between 1957 and 1959, and shown to consist of two bodies. A shaft pilot hole was cored in 1965 though a shaft was never begun. Iron formation of highly inclined bedded magnetite-quartz was encountered at about 600 m and continued to more than 900 m depth. Based on this 300 m figure, on a strike length of 900 m and on an average width of 120 m, the main body would contain some 150 million tonnes of ore grading approximately 28% iron. A further 50 million tonnes is indicated for the second body, some 5 km to the northeast.

The Kelsey Lake anomaly is 30 km northeast of the Choiceland occurrence. It was examined and drilled in 1975. Indicated reserves are in the order of 300 million tonnes, in a body 150 m wide, with a strike length of 3 km, starting at 550 m depth, and continuing for at least 300 m. The ore grade averages 30% iron reaching up to 85% in places.

The aeromagnetic map of the area shows numerous other anomalies. Interestingly, the Kelsey Lake anomaly extends to the east for about 8 km, then turns south near the town of Love and the Love anomaly runs south for 35 km. It would seem reasonable to assume that other bodies of iron mineralization must exist in the area.

There is another interesting occurrence 160 km southeast of Choiceland (5c). An exploratory well for petroleum, the Miami Hudson Bay No. 1 Nut Mountain well, drilled into magnetite at 1191.8 m and continued in it for 32 m before stopping. No other details of the deposit are known.

Mercury

Rumours of native mercury occuring in the Buffalo Narrows area were investigated by a party from the University of Regina in 1972 (Parslow, pers. comm). A small quantity of native mercury was indeed found in muddy sediment in the bottom of a trench at Fleury Point (6), which abuts the narrows near the south end of Peter Pond Lake. This area has been investigated previously as the site where bituminous sands occur in the till. Kupsch (1954) reported various trenches in the area and did some trenching himself, but neither he nor previous authors reported the occurrence of mercury.

There are several obvious questions. Is this a spill, and if so, under what circumstances did it originate? Suggestions of a gold prospector or a photographer carrying mercury would seem to place the time of the spill many years ago — and as mercury evaporates in the atmosphere it would have to have been below the water table all that time. With its high specific gravity, why would it not sink out of reach? If the occurrence is natural, how has it accumulated? Are exhalations of mercuric compounds rising into a reducing environment and being converted to the metal?

Further speculation, though interesting, is futile without more thorough investigation. It would be interesting to know the size of the occurrence (or occurrences) and the nature of the substrate.

Other Considerations

Metallic mineral occurrences close to, but outside Saskatchewan, might well extend into the province. Such a case is exemplified by the deposit of nickel-copper ore presently being defined in Manitoba at Namew Lake (Pickell, 1987). This deposit occurs in the Precambrian beneath Ordovician carbonates and very close to Saskatchewan's eastern border.

There is no reason why metallic ores present on the Shield should be absent under the Phanerozoic sedimentary cover. So, unless it is considered unique, an orebody like that at Rottenstone Lake (Figure 1) should have a counterpart somewhere. The Rottenstone ore is nickel and copper-rich with small amounts of platinum, palladium, gold, silver, lead and zinc. Exploration for platinum and its associates is also being conducted around an anorthosite body west of Careen Lake (Figure 1) in the Clearwater River Valley. Similar prospective situations might well exist south of the shield edge.

Conclusion

In conclusion, metallic mineral occurrences in or under the Phanerozoic rocks of Saskatchewan range from large deposits, through visible mineralization, to geochemical anomalies. Some of these, given the right circumstances, could become economic. Other occurrences no doubt remain to be found, some of which, in their turn, may prove to be economically viable.

References

Beck, L.S., 1967, Report on industrial minerals investigations in the Pasquia Hills area, *in* Summary Report of Geological Surveys Conducted in Saskatchewan, 1967: Saskatchewan Department of Mineral Resources, p. 17-20.

Beck, L.S., 1974, Geological investigations in the Pasquia Hills area: Saskatchewan Department of Mineral Resources, Report 158, 16 p.

Blair, B., Weber, W., Kornik, L.J. and Gordon, T.M., 1988, Project Cormorant: Interpretations of Sub-Paleozoic geology of the Cormorant Lake map area from geophysical and drill core data: Geoscience Canada, v. 15, p. 98-100.

Coombe, W., 1984, Gold in Saskatchewan: Saskatchewan Energy and Mines, Open File Report 84-1, 134 p.

Fusezy, L.M., 1980, Geology of the Deadwood (Cambrian), Meadow Lake and Winnipegosis (Devonian) Formations in west-central Saskatchewan: Saskatchewan Energy and Mines, Report 210, 63 p.

Kupsch, W.O., 1954, Bituminous sands in till of the Peter Pond Lake Area, Saskatchewan: Saskatchewan Department of Mineral Resources, Report 12, 32 p.

Pickell, J., 1987, The Namew Lake Nickel-Copper Discovery, Flin Flon, Manitoba: Geological Association of Canada – Mineralogical Association of Canada, Program with Abstracts, v. 12, p. 80 [also reprinted this issue, p. 120].

Whitaker, S.H. and Pearson, D.E., 1972, Geological map of Saskatchewan: Saskatchewan Research Council and Saskatchewan Department of Mineral Resources, scale 1:1,267,000.