Miniota-Armitage Gravel Pit
A New Rockhound Collecting Site in Manitoba

by
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Introduction

The gravel and sand found in the Miniota-Armitage gravel pit is probably equivalent to the gravel and sand, noted by Elson (1955), in a gravel pit located 1.2 km east of Souris, Manitoba (Figure 1).

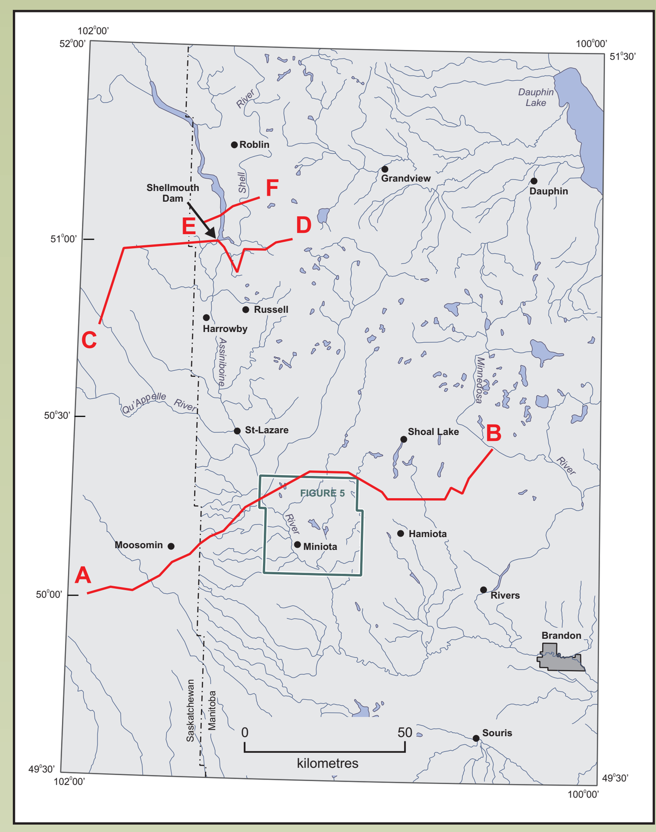

Figure 1: Upper Assiniboine area, with locations of cross-sections A-B, C-D and E-F, and showing location of Fig. 5 (after Klassen, 1979).

Souris gravel and sand

Klassen (1969) informally gave the name "Souris gravel and sand" to the Pleistocene interglacial stream sediment containing a mixture of Tertiary gravel and sand and glacially-derived gravel and sand found in the Souris pit. The reference section for the unit is situated in SW L.S. 9, Sec. 34, Twp. 7, Rge. 21, W 1st Mer. (abbreviated SW9-34-7-21W1).

According to Klassen (1969), Souris gravel and sand is comprised of 20 to >75% of rock types from western or Rocky Mountain provenance, whereas typical glacial gravels contain <10%. These rock types include sub- to well-rounded quartzite, epidote, argillite, chert, jasper, agate and porphyritic volcanic rock. Klassen interpreted Souris gravel and sand to have been deposited by interglacial streams that occupied preglacial valleys, after the first Pleistocene glaciation.

The cobbles and boulders found at Souris are prized by rockhounds who collect specimens from the pit, after purchasing a permit from the Souris River Gem Ltd. at their store (The Rock Shop) in Souris. Many of the specimens are cut and polished to make ornaments and jewellery.

Upper Assiniboine valley

During the excavation for the construction of the Shellmouth dam (***Figure 1***) in the Upper Assiniboine valley, north of Russell in SW14-1-23-29W1, Klassen (1969) recognized Souris gravel and sand, in four boreholes in the general vicinity, and within the excavation itself (which was subsequently flooded). The boreholes were drilled in 1963 and from 1966 to 1969 as part of a larger stratigraphic study. On the basis of this study, Klassen (1979) also interpreted that Tertiary gravel and sand is present, at depth, in the Upper Assiniboine area. He named these beds the "Wynyard Formation", as shown in ***Figures 2*** and ***3***. The Wynyard Formation probably correlates with the Miocene Wood Mountain Formation, which extends across southern Saskatchewan for 160 km east-west and 30 km north-south (Leckie et al., 2004).

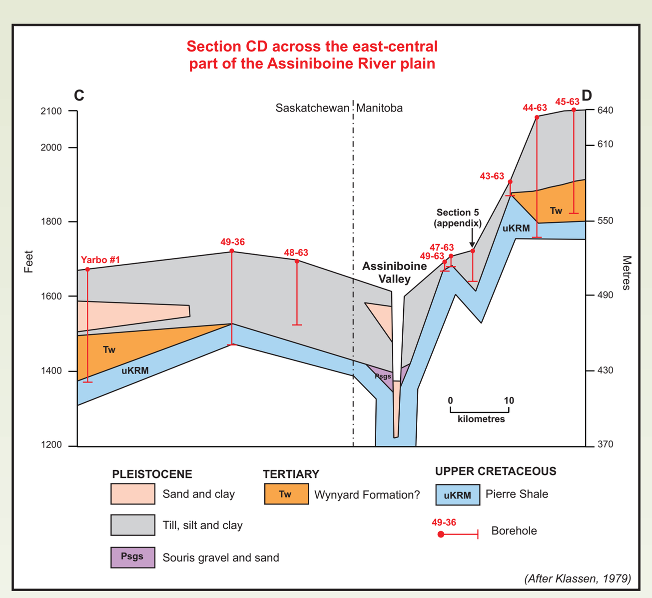

Figure 2: Section C-D across the middle portion of the Upper Assiniboine area, in the vicinity of the Shellmouth Dam, depicting Upper Cretaceous and Tertiary bedrock and overlying Pleistocene Souris-type gravel and glacial drift (after Klassen, 1979). See Figure 1 for location of Section C-D.

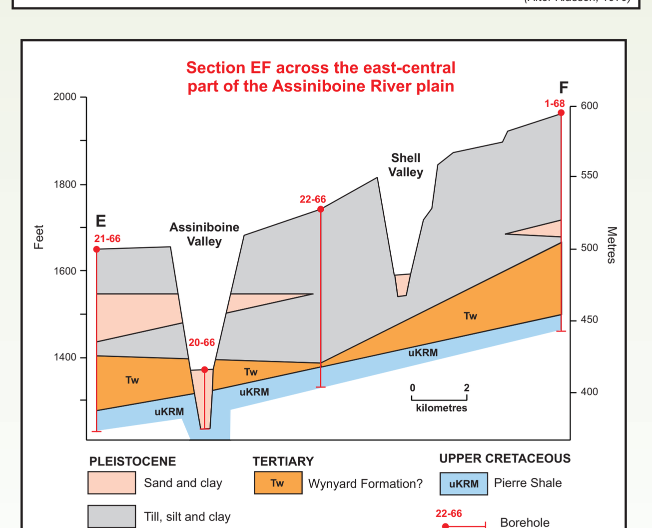

Figure 3: Section E-F across the middle portion of the Upper Assiniboine area, approximately 6 km north of Section C-D, depicting Upper Cretaceous and Tertiary bedrock and overlying Pleistocene glacial drift, including sand and gravel (after Klassen, 1979). See Figure 1 for location of Section C-D.

Examination of ***Figure 3*** shows obvious thinning of the Wynyard Formation between the Assiniboine valley and the Shell valley, which suggests removal of previously deposited Wynyard beds occurred in the Tertiary or in early Pleistocene time. Further, ***Figure 2*** illustrates that the Wynyard is completely absent in the immediate vicinity of the Assiniboine valley, which may indicate that the present-day Assiniboine River, in the vicinity of the Shellmouth dam, occupies the valley of the ancestral Assiniboine. It should also be noted that this is the site where Klassen (1979) showed that Souris gravel and sand rims the paleo-Assiniboine valley walls within a channel in the Cretaceous bedrock, as depicted in ***Figure 2***.

Figure 4 shows that the Wynyard Formation is not present in the northwest portion of the Rural Municipality (R.M.) of Miniota in the vicinity of the mouth of Birdtail Creek (***Figures 1*** and ***5***). This suggests that the Wynyard Formation was completely removed by Tertiary or early Pleistocene erosion along the Upper Assiniboine valley, south of St-Lazare (***Figure1***). Groom (1986) concluded from a bedrock topography map of the R.M. of Miniota, from Klassen et al., (1970), that the present-day Assiniboine River occupies the valley of the ancestral Assiniboine from the village of Miniota southwards.

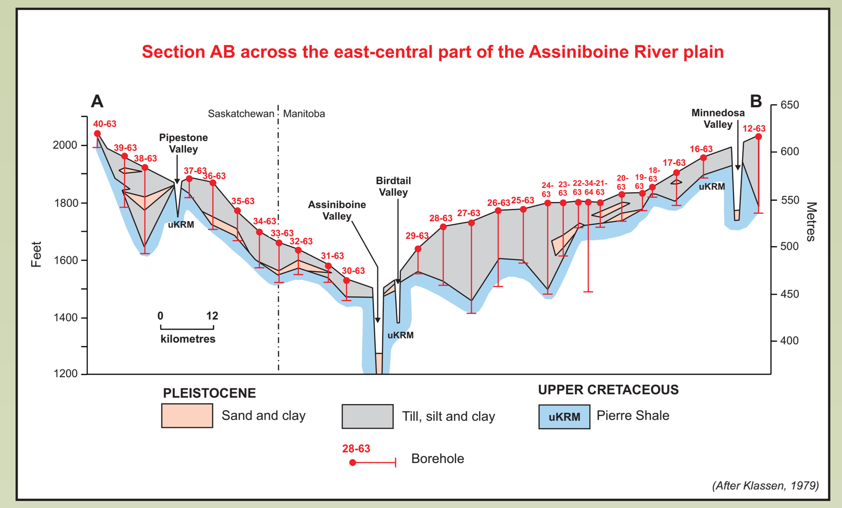

Figure 4: Section A-B across the southern part of the Upper Assiniboine area depicting Upper Cretaceous bedrock and overlying Pleistocene glacial drift, including sand and gravel (after Klassen, 1979).

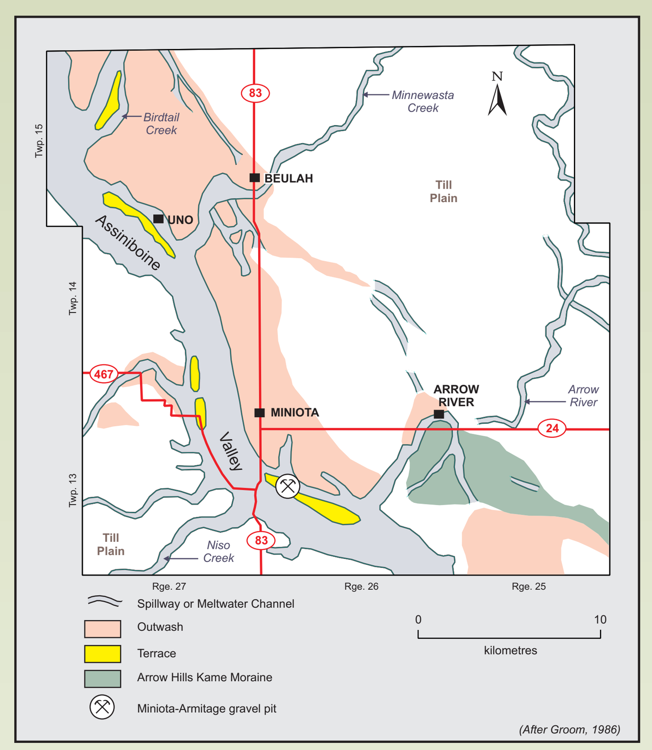

Figure 5: Generalized Surficial geology of the R.M. of Miniota (after Groom, 1986).

The Miniota-Armitage gravel pit is located in the Upper Assiniboine valley (Figures 6 to 9), 3 km southeast of the village of Miniota (Figure 5), in NE18 & SE19-13-26W1. The gravel pit, situated within a spillway terrace, shown in Figure 5, comprises about 25% exotic sub to well-rounded cobbles and boulders (including septarian and other concretions, quartzite, petrified wood, porphyritic volcanic rock, chert and jasper) mixed with about 75% of typical glacial gravel. For the most part, these cobbles and boulders appear to have the same western provenance as those found at Souris; and therefore, the gravel deposit can be considered to be Souris-type. However compared with the Souris pit, the Miniota-Armitage pit contains numerous and large rigid, and sometimes fossiliferous, septarium and other types of concretions, which appear to have a local provenance within the Cretaceous Pierre Shale.

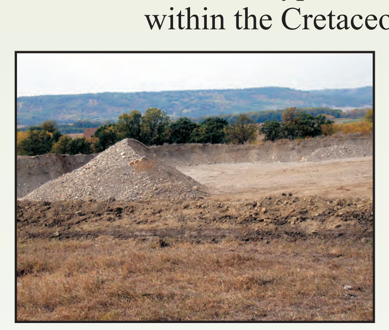

Figure 6: Miniota-Armitage gravel pit within the Upper Assiniboine valley. View is to south, showing south wall of valley, in background; south wall of gravel pit, next to the trees; and a stockpile of boulders and cobbles, in foreground.

Figure 8: Miniota-Armitage gravel pit. View is to west, showing stockpile of boulders and cobbles overlying disturbed and unsorted gravel and sand.

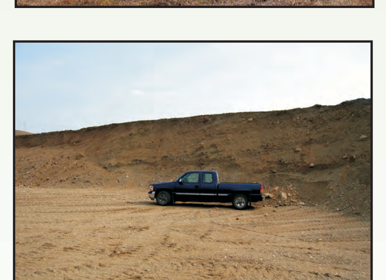

Figure 7: Miniota-Armitage gravel pit. View is to east, showing stratified bedding planes of sand, gravel, cobbles and boulders.

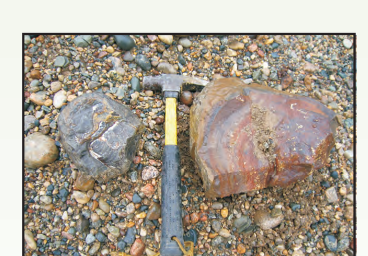

Figure 9: Manganese-coated fossilized carbonate concretion on left and concentrically banded ironstone concretion on right from the Miniota-Armitage gravel pit. The specimens are found within a matrix of sand and gravel shown (after a rain and with natural lighting) in the background.

The cobbles and boulders found in the Miniota-Armitage pit can be separated into three major groups based upon their possible provenance: western, northern and local. The northern group can be further subdivided into Precambrian Shield and Paleozoic subgroups.

Western (Rocky Mountain) provenance

Typical cobbles and boulders of a western (Rocky Mountain) provenance include subrounded to well-rounded: quartzite (***Figure 10 a*** and ***b***), argillite, chert, agate and petrified wood.

Figure 10: Reddish-buff ripple-marked quartzite (wet), (a) top and (b) bottom

Northern (Precambrian Shield) provenance

Typical cobbles and boulders of a northern (Precambrian Shield) provenance include subangular to rounded: granitic rock (***Figure 11***) and foliated metamorphic rock. However, occasionally a distinctive porphyritic volcanic rock, shown in ***Figure 12***, can be found, which is identified as originating from outcrops of the Proterozoic Dubawnt Group in Nunavut. Ice transport of these distinctive erratics into Manitoba was documented, in detail, by Shilts (1980); and Nielsen (1982) identified the erratics in northern, southwestern and western Manitoba.

Figure 11: Rounded coarse pink feldspar with green epidote veinlets (wet).

Figure 12: Oval-shaped purple and maroon alkaline volcanic porphyry with off-white rounded feldspar phenocrysts (wet) of the Pitz Formation of the Proterozoic Dubawnt Group (Nunavut).

Northern (Paleozoic) provenance

Typical cobbles and boulders of the northern (Paleozoic) provenance include subangular to rounded (sometimes fossiliferous) Ordovician to Devonian limestone and dolomite. In addition, a distinctive chemical sedimentary rock can also occasionally be found, which is a siliceous sinter (***Figure 13***). It is believed that these sinters possibly formed within a paleo-brine spring vent setting, similar to that described in the Mafeking Quarry, by Fedikow et al., 2004). It is also interesting to note that siliceous sinter erratics, found in glacial till and other Pleistocene deposits (west of lakes Winnipegosis and Manitoba), were used by first nations people, on the southern part of the Canadian prairie provinces, to produce spearpoints and arrowheads by knapping (Grasby et al., 2002). This would suggest that these erratics, known by the name Swan River chert, were among the first industrial minerals to be utilized in Manitoba.

Figure 13: Grey rounded siliceous sinter (wet) with devitrified (white) and glassy (clear) textures.

Local provenance

Typical cobbles and boulders of local provenance include subangular to rounded (sometimes fossiliferous) Cretaceous shale, concretions and nodules (***Figures 14*** to ***20***). Smith (2006) noted that fossiliferous concretions and well preserved fossils (Pelecypoda, Gastropoda, Cephalopoda, Scaphoda, Crinoid and petrified wood) have been found within the Pierre Shale in the Upper Assiniboine valley, upstream of the Miniota-Armitage gravel pit near Harrowby (***Figure 1***).

Figure 14: Ovoid turtle-back concretion or septarium with orange to yellow calcite-filled septum (wet), possibly from the local Millwood Member of the Cretaceous Pierre Shale. It should also be noted that similar concretions have been found lower in the Cretaceous stratigraphy, within the Morden Member of the Carlile Formation.

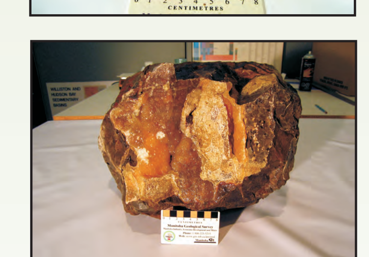

Figure 15: Broken turtle-back concretion or septarium (wet) with orange to yellow calcite-filled septum, possibly from the Millwood Member of Cretaceous Pierre Shale.

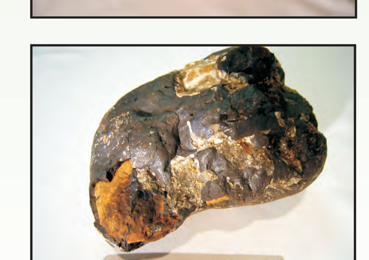

Figure 16: Oval black manganese-coated carbonate nodule (wet), possible from the Odanah Member of the Cretaceous Pierre Shale.

Figure 17: Baculites, ammonoid with nacre (mother-of-pearl luster) forming core of ironstone concretion (wet).

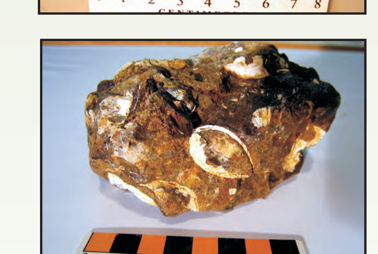

Figure 18: Pelecypod bound in ironstone concretion (wet).

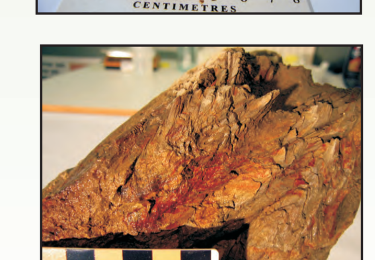

Figure 19: Cone-in-cone structure in soft shale (wet).

Figure 20: Broken banded ironstone concretion (wet), with possible Baculites core.

Rock Hounding

With the identification of Souris-type gravel in the Miniota area, there is an opportunity to develop a similar local rockhound collecting site. The sand and gravel rights for aggregate in the Miniota-Armitage pit are partially held privately by the Armitage family and under quarry lease by the R.M. of Miniota from the Crown. Please contact the office of the R.M. in the village of Miniota, to determine accessibility, before attempting to visit the Miniota-Armitage gravel pit.

The spillway terraces, shown in Figure 5, have good potential for discovery of additional Souris-type gravel, but similar exotic clasts have also been reported in several other gravel pits in the R.M. of Miniota (R. Rowan, pers. comm., 2007). Please contact the surface holder before venturing on any land in the Miniota area.

Acknowledgements:

I would like to thank Thomasina Charney (Economic Development officer for the Rural Municipalities of Miniota, Archie and Rossburn for inviting the MGS to Miniota and Rossburn to present talks on the industrial minerals potential of the municipalities. Details of the material prepared for the talks, including much of the above, is presented in Bamburak (2007).

Ross Rowan, a resident of the R.M. of Miniota, is gratefully acknowledged for recognizing the unusual nature of the cobbles and boulders in the Miniota-Armitage gravel pit, and other pits in the rural municipality; and facilitating visits to these sites on several occasions in 2006 and 2007.

Bonnie Lenton is gratefully acknowledged for preparing the figures for this poster.

Definitions from the AGI Glossary of Geology:

Cephalopod - Any marine mollusc belonging to the class Cephalopoda, characterized by a definite head, with the mouth surrounded by part of the foot that is modified into lobe-lobe processes with tentacles or arm-like processes with hooklets or suckers or both. The external shell, if present, as in nautiloids, is univalve and resembles a hollow cone, which may be straight, curved, or coiled and divided into chambers connected by a siphuncle; the shell is internal in present-day cephalopods and their fossil ancestors, such as the belemnites.

Cone-in-cone structure - a minor sedimentary structure in thin, generally calcareous layers of some shales and in the outer parts of some large concretions (esp. septaria), resembling a set of concentric, right circular cones fitting one into another in inverted positions (base upward, apex downward) and commonly separated by clay films, consisting usually of fibrous calcite and rarely siderite or gypsum. The apical angles are commonly between 30 and 60 degrees and the cone axes are normal to the bedding; the height of the cones usually vary between 10 mm and 10 cm, and their sides are often ribbed, fluted or grooved and marked by annular depressions and ridges that are more pronounced near the bases and finer and more obscure near the apices. The structure appears to be due to pressure aided by crystallization and weathering (solution) along conical shear zones that intersect one another.

Ironstone - Customarily applied to a hard, coarsely banded or nonbanded, and non-cherty sedimentary rock of post-Precambrian age. The iron minerals may be oxides (limonite, hematite, magnetite), carbonate (siderite), or silicate (chamosite).

Manganese nodule - A small, irregular, black to brown, friable, laminated concretionary mass consisting primarily of manganese salts and manganese-oxide minerals (Mn content is 15-30%) alternating with iron oxides, abundant on the floors of the world's oceans …… as a result of slow deposition, and occurring suspended in sediments …… or as a rounded ball with a small nucleus (such as a shark's tooth), ……

Manganese nodules vary in size from a few microns to 25 cm in diameter (generally 3-5 cm) and have an average weight of 115 grams.

Metaquartzite - A granoblastic metamorphic rock consisting mainly of quartz and formed by recrystallization of sandstone or chert by either regional or thermal metamorphism.

Nacre - The hard, iridescent internal layer of various mollusc shells, having unusual luster and consisting chiefly of calcium carbonate in the form of aragonite deposited organically in a succession of thin overlapping laminae parallel to the growth lines of the shell and interleaved with thin sheets of organic lines of organic matrix. Syn. mother-of-pearl.

Pelecypod - Any benthic aquatic mollusc belonging to the class Pelecypoda, characterized by bilateral symmetrical bivalve shell, a hatchet-shaped foot, and sheet-like gills.

Porphyry - An igneous rock of any composition that contains conspicuous phenocrysts in a fine-grained groundmass; a porphyritic igneous rock. The term was first applied to a purple-red rock quarried in Egypt and characterized by alkali feldspar phenocrysts.

Septarium - a large (8-90 cm in diameter), roughly spherical concretion, usually of an impure argillaceous carbonate (such as clayey ironstone), characterized internally by irregular polyhedral blocks formed by a series of radiating cracks that extend from within outward and widen toward the centre and that intersect a series of cracks concentric with the margins, the cracks invariably filled or partly filled by crystalline minerals (most commonly calcite) that cement the blocks together. Its formation involves the formation of an aluminous gel, case hardening of the exterior, shrinkage cracking due to dehydration of the colloidal mass in the interior, and vein filling. When worn on the surface, the veins sometimes weather in relief, thus producing a septate pattern.

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