Silica Sand Exploration, Dunvegan Formation, Etsho Plateau, Northeast British Columbia

Etsho Property

By

Jeffrey Bond
117 War Eagle Way
Whitehorse, Yukon
Y1A 0C2

Location, Access and Background

The Etsho property is located in northeast British Columbia, approximately 75 km from the community of Fort Nelson. The claim block encompasses the central portion of the Etsho Plateau and is on the eastern margin of the Horn River basin (Fig. 1 and 2). Currently, frac sand is shipped into the region from sources as distant as Illinois in the central United States. The purpose of this project is to find a strategically located supply of frac sand that would greatly reduce transportation costs. Access into the project area is by the all-weather SYD and Komie roads.

Bedrock Geology

The Etsho Plateau is immediately underlain by Upper Cretaceous age Dunvegan and Shaftsbury formation (Thompson, 1977). The primary unit of interest is the Dunvegan formation. Little is known about the Dunvegan formation in the study area, however outcrops further west in the foothills describe the formation as a conglomerate (Thompson, 1977). Further south the Dunvegan has been described in great detail in subsurface well logs and drill core (Bhattacharya, 1989a, 1991). In northwest Alberta the Dunvegan Formation is a northwest to southeast trending clastic wedge that can be viewed overall as a regressive-transgressive cycle (Stott, 1984). Towards the northwest, fluvial facies that originated from the Early to mid-Cretaceous Columbian Orogeny are common. Further east the Dunvegan Formation largely consists of deltaic facies where it entered the Western Interior Seaway (Stott, 1982).

In northeastern British Columbia very little is known about the Dunvegan Formation east of the fold and thrust belt. The Etsho Plateau and Escarpment are believed to be capped by the Dunvegan Formation, however it is not known whether the Dunvegan is a fluvial or deltaic deposit.

Etsho Project - Canadian Silica Industries

Markup

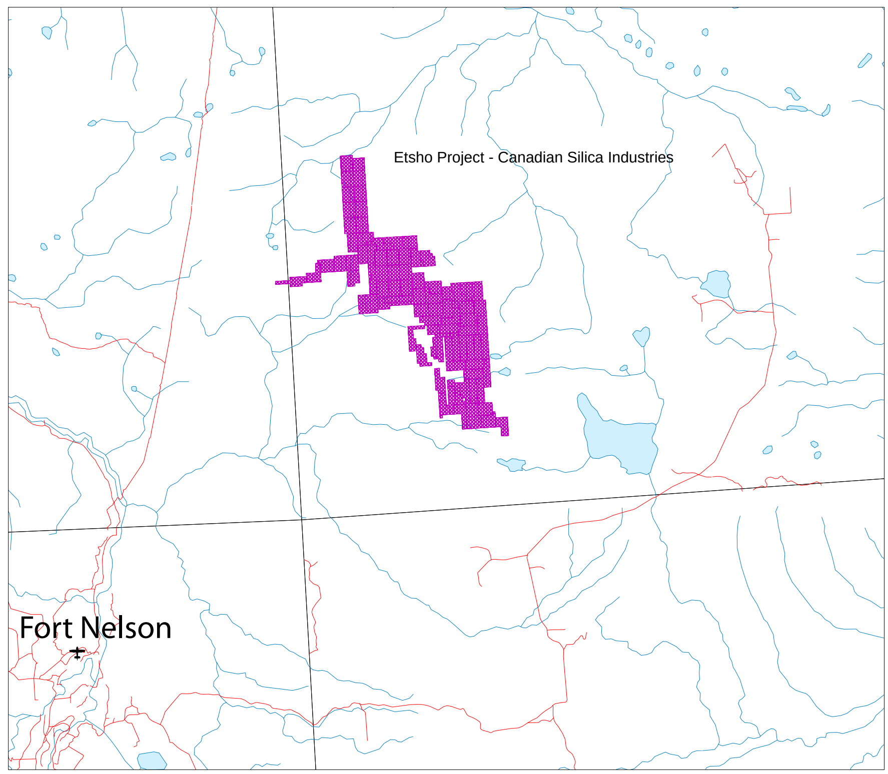
MTO Mineral Titles Layers

MTO Mineral Titles Online solid
- Coal
- Placer
- Mineral
- Other

MTO Mineral Claim Outlines
- Mineral

Topographic Layers
- **Airports Main**
- **Roads 1:250K (<2M)**
- **Lakes 1:2M (<4M)**
- **Rivers 1:2M (<4M)**
- **Sea**

Grid Layers
- **Grid 1:250K maps - outline**

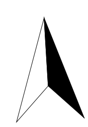


SCALE 1 : 1,000,000

20 0 20 40 60

KILOMETERS

N



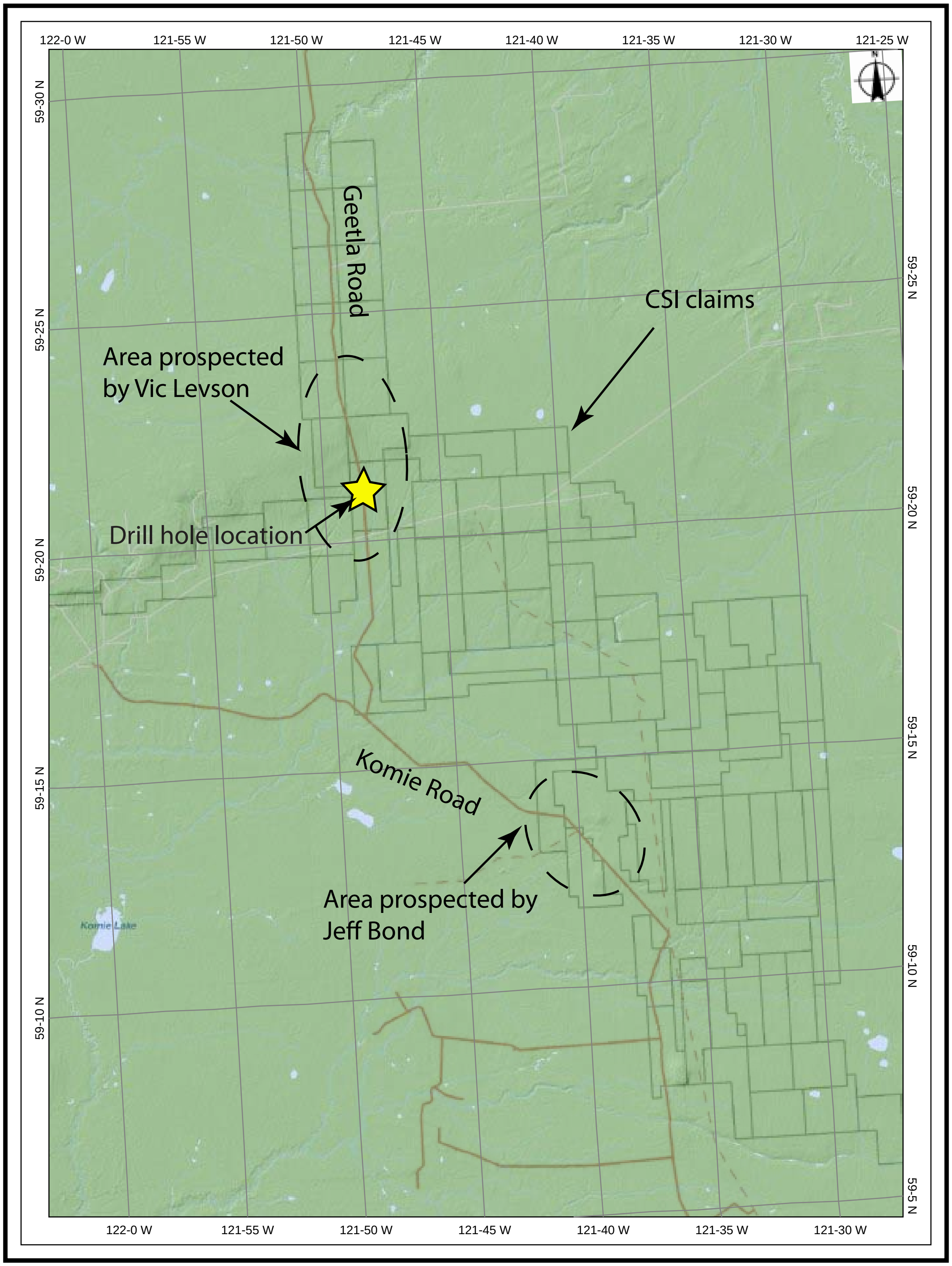


Figure 2. Location of Canadian Silica Industries mineral claims and prospected areas that are discussed in this report.

Surficial Geology

The Etsho Plateau was glaciated by the west to southwest-flowing Late Wisconsinan Laurentide ice sheet approximately 18,000 years ago (Bednarski and Smith, 2007; Bednarski, 2008). Much of the region is overlain by clay-rich lodgement and meltout till associated with the full glacial conditions (Demchuk, 2010). During deglaciation the Laurentide ice sheet down-wasted and separated into two lobes, one that occupied the Fort Nelson Lowland adjacent to the Etsho Escarpment and one that covered the Etsho Plateau (Demchuck, 2010). As these ice lobes melted water drained across the Etsho Escarpment to the west and south and entered into a proglacial lake that was bound between the Escarpment and the lowland ice lobe. Meltwater channels cut into the Etsho Plateau eroded the underlying plateau surface and deposited the sediment in the Komie glaciofluvial delta (Demchuk, 2010).

Exploration Methodology

Outcrops of the Dunvegan sandstone are very sparse in the study area. In order to evaluate the Dunvegan Formation as a potential silica sand source the author and Vic Levson prospected borrow pits and road cuts. These were focused on the Geetla and Komie roads where they bisect the Etsho escarpment. In addition, one sonic drill hole was drilled into the Dunvegan formation to test the quality of the sandstone in a covered area on the Etsho escarpment. The prospecting sites and drill hole locations are shown in figures 2, 3 and 4.

Prospecting Results

Geetla Road outcrop prospecting

VLE-11-10 567108E 6583765N

Water-filled borrow pit; ~2 m of till exposed, clay-rich, clast-poor till; Shield clasts common; Dunvegan clasts rare.

VLE-11-11 567235E 6583373N

Till ridge ~3 m high at ~km 13.5, clay-rich, clast-poor till; Shield clasts common; no Dunvegan clasts seen.

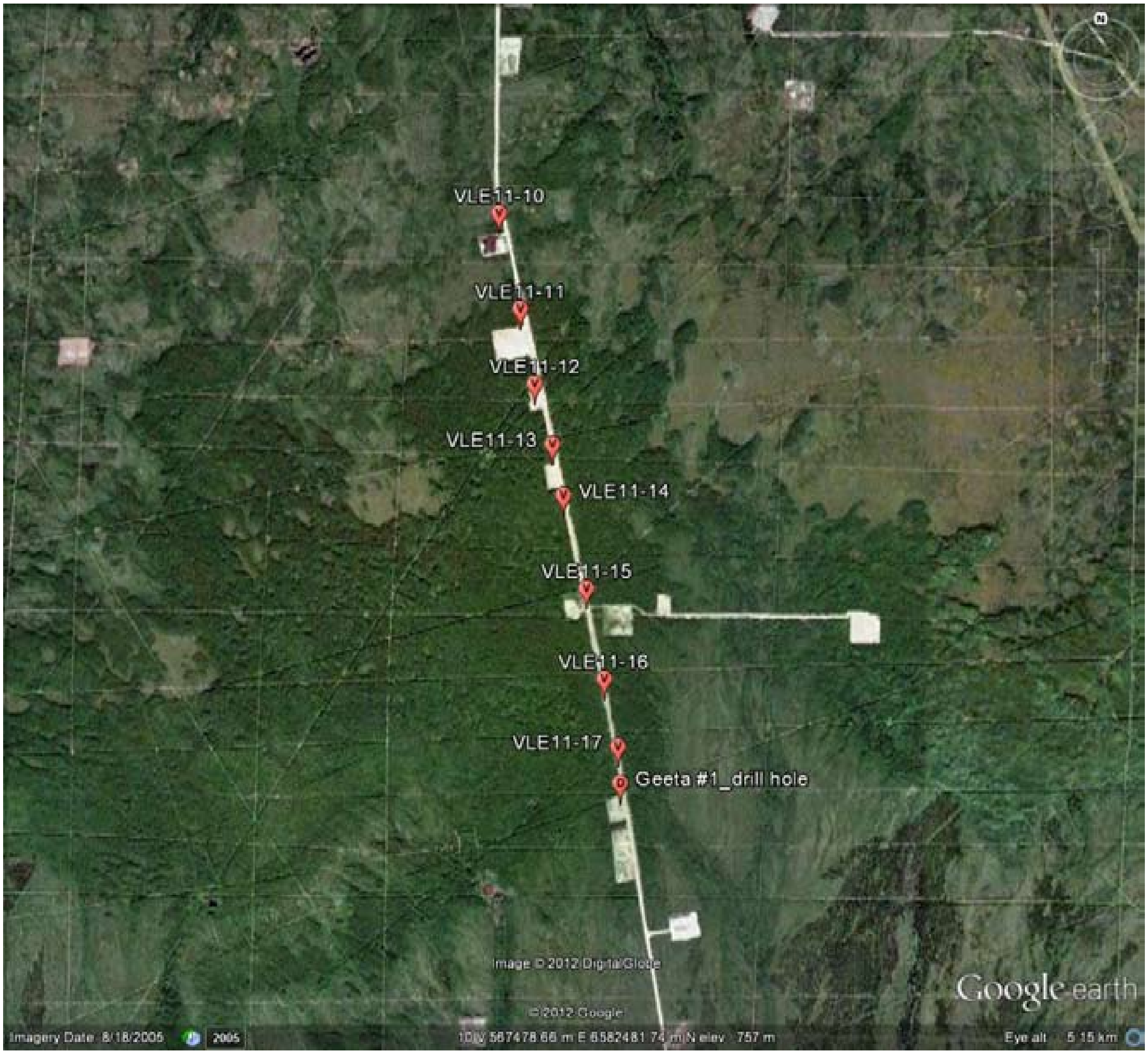


Figure 3. Detailed location map of areas prospected by Vic Levson along the Geetla Road, including the drill hole location.

Figure 4. Location map showing the sites prospected by Vic Levson and Jeff Bond.

VLE-11-12 567287E 6583026N

Borrow pit with sandstone underlying 2-5 m of till; sandstone is poorly exposed along the bottom of the pit for ~50 m; it is thickest and best exposed at the south end of the pit; in the centre of the pit the sands are covered but can be exposed by digging; site is at ~km 12.9 on the west side of the road, ~200-300 m north of the Dunvegan "scarp" crest. Dunvegan sandstone under till; contact is very sharp; locally thin (<5 cm thick) injection wedges of till occur in the upper part of the sandstone; till clay-rich, clast-poor; Shield clasts common; Dunvegan clasts rare; little evidence in the till of the underlying sandstone; sandstone samples described below:

- sampled ~ 1 m below base of till (~3-4 below original surface) fine to very fine sand; tan to grey; well to moderately well sorted; very weakly cemented; ~80% quartz (Fig. 5)
- sampled ~ 2 m below base of till (~4-5 m below original surface) medium to fine sand (coarser than above); moderately well sorted; weakly cemented (excavated blocks fall apart quickly); ~80% quartz, ~10% mafics; minor mica (may give coarser appearance to sand)

VLE-11-13 567380E 6582803N

Near crest of Dunvegan "scarp"; 2-3 m of till at surface; no bedrock exposed clay-rich, clast-poor till; Shield clasts common; Dunvegan clasts rare.

VLE-11-14 567431E 6582533N

Remote drilling waste disposal site (Encana a-A56-F / 94-P-5); clay-rich till exposed throughout site; several Dunvegan cobbles were seen weathering out at surface in one area but all exposures are till (to depths of 2-3 m); Dunvegan clasts may have been excavated by heavy equipment from unknown depth.

VLE-11-15 567530E 6582123N

Old water well (?) site with capped drill casing at surface; adjacent water-filled borrow pit; ~ 3 m of till exposed above water level Clay-rich, clast-poor till; Shield clasts common; Dunvegan clasts rare.

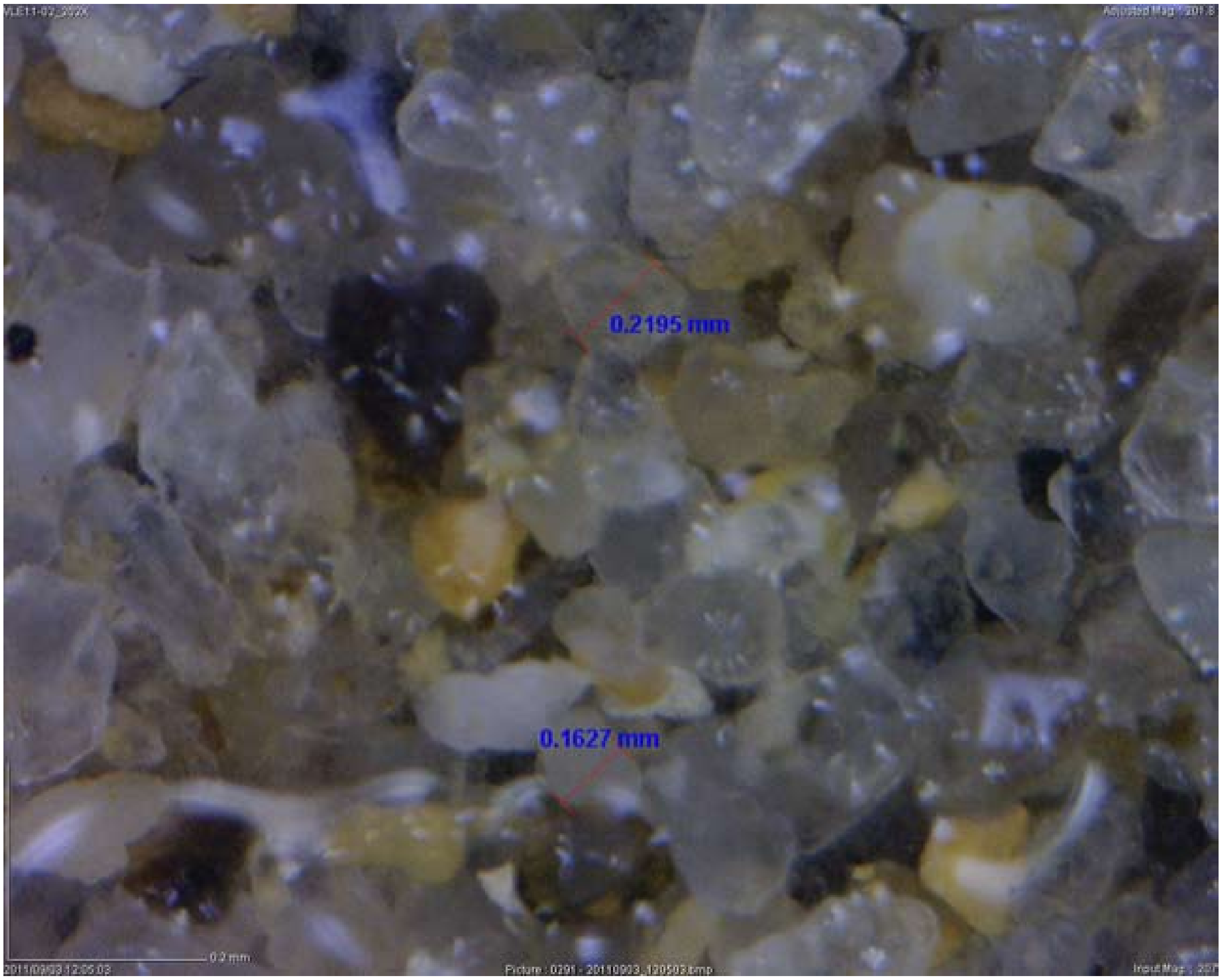


Figure 5. Digital microscope photograph (200X zoom) of the Dunvegan sandstone exposed on the Etsho escarpment at VLE-11-12. The sandstone is fine grained in this location and contains approximately 70-80% quartz.

VLE-11-16 567613E 6581715N

Road-cut about half way down the Dunvegan "scarp"; a Dunvegan (?) sandstone unit occurs within clay-rich till (glaciotectonically interbedded?); poor exposure in road cut ~30 cm of sandstone (Sample VLE-11-03, P188) occurs under ~2 m of clay-rich till and over ~2 m of till with sand lenses; the sand unit may be a Dunvegan intraclast (rip-up clast) or till may be injected into the sandstone; the sandstone has sharp upper and lower contacts with the till; the till in the lower 2 m has gravelly and sandy lenses (~5 cm thick); sandy lenses may be sheared Dunvegan clasts.

- sampled ~about 2-2.3 m below surface under 2 m of till fine sand; tan to grey; well to moderately well sorted; very weakly cemented

VLE-11-17 567675E 6581411N

Several road-cuts in the lower half of the Dunvegan "scarp"; only till observed clay-rich, clast-poor till; Shield clasts common; Dunvegan clasts rare.

11-JB-001 576958E 6566268N 693m asl

Bedrock ridge near Cabin gas plant on the Thetlandoa Road. Road cut exposes 10m of fine to medium fluvial sand. Sand generally has a subangular shape and looks too immature to be suitable as a frac sand.

11-JB-008 577663E 6563726N 548m asl

Borrow pit at km 40 of Komie Road. Exposes Dunvegan sandstone which is overlain by 2-3 m of till. Bedrock is similar to Geetla #1 drill hole described below and consists of a shaley sandstone that is very fine grained and dark grey colour. Not prospective as a frac sand source. Large sandstone erratics (1-2m) are present on edge of borrow pit and were likely extracted from the till during excavation. They are coarser grained (med to find sand) and have some rounded grains present. Indicates a more resistant quartz-rich sandstone is present in the area.

Geetla Road Drilling

Figure 6

Geetla #1 567711E 6581249N 698m a.s.l.

KM 11.1 of Geetla Road

0-10ft: Clay-rich till

90% clay/silt matrix, olive brown colour, very dense

10% polished pebbles 1-2 cm size

10-12ft: clay-rich till, same as 0-10ft

12-20ft: compact grey till with fewer pebbles

Very fine sand matrix

98% clay and silt

2% granules and pebbles

22-22.5ft: muddy fine sand lense, less compact

22.5-30ft: compact grey till; blebs of oxidized fine sand showing up at 24ft (Fig. 7)

98% clay/silt matrix

2% granules and pebbles

30-40ft: Dunvegan bedrock

Laminated fine sand and clay/silt, beds are 1mm thick, possible lacustrine environment?

65% clay/silt

35% fine white sand

40-60ft: Dunvegan bedrock

Laminated clay and very fine sand; very dense, grey, laminations are 1-2mm thick; black organic-like material at 60ft mixed in with clastic sediment.

Drilling is getting slower do to density of material

60-70ft: Dunvegan bedrock; black clay, sandy shale? (Fig. 8)

70-80ft: Dunvegan bedrock; finely bedded to laminated silt/clay and very fine quartz sand; extremely dense

70% silt and clay

30% very fine sand

Figure 6. View northeast of the sonic rig and support vehicle at the Geetla #1 drill hole.

Figure 7. Photograph of the Laurentide till at a depth of 24 feet. This is near the bottom of the till unit and the fine white sand component is probably locally incorporated Dunvegan bedrock.

Figure 8. View of the Dunvegan bedrock core from a depth of 55 feet - 70 feet. Note the bedrock has predominant silty texture with thin beds of very fine grained sand.

80-90ft: same as 70-80ft

End of hole

Disscussion

Prospecting near the Etsho escarpment has identified some potential for finding quartz-rich sandstone that may be suitable as frac sand. Generally, the sandstone identified was too fine and the grain shape was too angular, indicating immature sandstone. On the Geetla road the drill hole encountered a shaley to very fine sandstone with minor organics. Just north of the escarpment summit (approximately 500m to the north of the drill location), a fine-medium grained sandstone was located in a borrow pit next to the road (VLE11-12). This suggests that the Dunvegan sandstone is coarsening upward in this region, and/or there are coarser-grained fluvial channels within the Dunvegan stratigraphy. The underlying shale to very fine sandstone was likely deposited in a near shore backwater environment that was not influenced by wave action and was conducive for vegetation growth. These coarser-grained sandstone facies could be fluvial deltaic-like channels or perhaps were deposited in a beach setting. Regardless, this section of the Dunvegan stratigraphy appears to support a regressing shoreline at this time in the Cretaceous. Future work should focus on drilling or trenching along the Etsho escarpment to prospect for suitable sandstone coarser-grained facies within the the Dunvegan stratigraphy.

Recommendations

The glaciofluvial and well cutting samples contain significant amounts of non-quartz minerals. It is recommended that the attrition washed product fractions be analyzed by whole rock analyses in order to determine the silica content. This will also identify the percentage of feldspars within the samples. A program of shallow sonic drilling on the Etsho Plateau is also recommended to obtain intact samples of the Dunvegan Formation in order to confirm the texture, the silica content and perhaps locate areas with higher silica content.

References

Bednarski, J.M. and Smith, I.R., 2007. Laurentide and montane glaciations along the Rocky Mountain foothills of northeastern British Columbia; Canadian Journal of Earth Sciences, Volume 44, pages 445-457.

Bednarski, J.M., 2008. Landform assemblages produced by the Laurentide Ice Sheet in northeastern British Columbia and adjacent Northwest Territories – constraints on glacial lakes and patterns of ice retreat; Canadian Journal of Earth Sciences, Volume 45, pages 593-610.

Bhattacharya, J., 1989a. Allostratigraphy and river- and wave-dominated depositional systems of the Upper Cretaceous (Cenomanian) Dunvegan Formation, Alberta. Unpublished Ph.D. thesis, McMaster University, Hamilton, Ontario, 588 p.

Bhattacharya, J., 1991. Regional to sub-regional facies architecture of river-dominated deltas, Upper Cretaceous Dunvegan Formation, Alberta sub-surface. In: The Three-dimensional Facies Architecture of Terrigenous Clastic Sediments and its Implications for Hydrocarbon Discovery and Recovery. A.D. Miall and N. Tyler (eds.). SEPM (Society for Sedimentary Geology), "Concepts and Models in Sedimentology and Paleontology", v. 3, p. 189-206.

Demchuk, T.E., 2010. Surficial geology of the Komie Creek map area and an investigation of an ice-contact glaciofluvial delta, northeast British Columbia (NTS 94P/05). Master of Science thesis, University of Victoria, 266 p.

Stott, D.F., 1982. Lower Cretaceous Fort St. John Group and Upper Cretaceous Dunvegan Formation of the foothills and plains of Alberta, British Columbia, District of Mackenzie and Yukon Territory. Geological Survey of Canada, Bulletin 328, 124 p.

Stott, D.F., 1984. Cretaceous sequences of the foothills of the Canadian Rocky Mountains. In: The Mesozoic of middle North America. D.F. Stott and D.J. Glass (eds.). Calgary, Canadian Society of Petroleum Geologists, Memoir 9, p. 85-107.

Thompson, R.I., 1977. Geology of Beatton River, Fontas River and Petitot River Map-Areas, Northeastern British Columbia; *Geological Survey of Canada*, Paper 75-11, 8 pages.

Statement of Qualifications:

I, Jeffrey D. Bond, of Whitehorse, Yukon do hereby certify that:

- I am a geomorphologist with the Yukon Geological Survey.
- I am a graduate of the University of Alberta, Edmonton, Alberta, with an M.Sc. degree in Geomorphology (1997).
- I have practiced research geomophology for 17 years in Yukon Territory
- At the time of writing this report, I am the registered owner (100%) of the Etsho property tenures.
- I completed the geological investigations in partnership with Canadian Silica Industries as summarized in this report.

Respectfully submitted,

Jeffrey D. Bond

STATEMENT OF EXPENSES

Expense	Comment	Days	Rate	Total Cost
Personnel				
Field work wages	Jeff Bond wages	5	$ 600.00	$ 3,000.00
Field work wages	Vic Levson wages (incl HST)	2.5	$ 896.00	$ 2,240.00
Assistants (2)	Fort Nelson First Nation local hires	2	$ 200.00	$ 800.00
Transportation				
Truck	Fort Nelson to Geetla (Jeff Bond)			$ 801.92
Airfare	Whitehorse to Fort Nelson (Jeff Bond)			$ 1,081.92
Truck fuel				$ 170.56
Truck for assistants		2		$ 400.00
Ferry – Victoria to Van	Vic Levson			$ 77.60
Airfare Vic to Fort Nelson	Vic Levson			$ 853.44
Airfare Vancouver to Vic	Vic Levson			$ 244.29
Truck rental	Vic Levson			$ 959.32
Fuel	Vic Levson			$ 98.45
Radio Rental	Vic Levson			$ 110.88
Airline change fee	Jeff Bond			$ 157.46
Accomodations				
Fort Nelson	Jeff Bond	2		$ 371.37
Vancouver	Jeff Bond	1		$ 204.49
Food and camp				
Geetla lodge	9 total man days	9	$ 200.00	$ 1800.00
Meal	Jeff- Northern Rockies Cafe			$ 21.54
Sonic Drilling				
Mob/Demob				$24,135.46
Drilling – 1 hole				$ 7,187.65
			Total	**$44,716.35**

Tenure Number	Claim Name	Owner	Tenure Type	Map Number	Issue Date	Good To Date	Status
761702	KOMIE3	217993 (100%)	Mineral	094P	2010/apr/29	2013/apr/29	GOOD
761722	KOMIE4	217993 (100%)	Mineral	094P	2010/apr/29	2013/apr/29	GOOD
761742	KOMIE5	217993 (100%)	Mineral	094P	2010/apr/29	2013/apr/29	GOOD
761762	KOMIE6	217993 (100%)	Mineral	094P	2010/apr/29	2013/apr/29	GOOD
761782	KOMIE7	217993 (100%)	Mineral	094P	2010/apr/29	2013/apr/29	GOOD
761802	KOMIE8	217993 (100%)	Mineral	094P	2010/apr/29	2013/apr/29	GOOD
808162	SOGGY1	217993 (100%)	Mineral	094P	2010/jul/03	2012/dec/19	GOOD
808182	SOGGY2	217993 (100%)	Mineral	094P	2010/jul/03	2012/dec/19	GOOD
808202	SOGGY3	217993 (100%)	Mineral	094P	2010/jul/03	2012/dec/19	GOOD
808222	SOGGY4	217993 (100%)	Mineral	094P	2010/jul/03	2012/dec/19	GOOD
808242	SOGGY5	217993 (100%)	Mineral	094P	2010/jul/03	2012/dec/19	GOOD
808262	SOGGY6	217993 (100%)	Mineral	094P	2010/jul/03	2012/dec/19	GOOD
808282	SOGGY7	217993 (100%)	Mineral	094P	2010/jul/03	2012/dec/19	GOOD
808302	SOGGY8	217993 (100%)	Mineral	094P	2010/jul/03	2012/dec/19	GOOD
808362	SOGGY9	217993 (100%)	Mineral	094P	2010/jul/04	2012/dec/19	GOOD
808382	SOGGY10	217993 (100%)	Mineral	094P	2010/jul/04	2012/dec/19	GOOD
808402	WB1	217993 (100%)	Mineral	094P	2010/jul/04	2012/dec/19	GOOD
808422	WB2	217993 (100%)	Mineral	094P	2010/jul/04	2012/dec/19	GOOD
808442	WB3	217993 (100%)	Mineral	094P	2010/jul/04	2012/dec/19	GOOD
808462	WB4	217993 (100%)	Mineral	094P	2010/jul/04	2012/dec/19	GOOD
808522	SOGGY11	217993 (100%)	Mineral	094P	2010/jul/04	2012/dec/19	GOOD
808542	SOGGY12	217993 (100%)	Mineral	094P	2010/jul/04	2012/dec/19	GOOD
808562	SOGGY13	217993 (100%)	Mineral	094P	2010/jul/04	2012/dec/19	GOOD
808582	SOGGY14	217993 (100%)	Mineral	094P	2010/jul/04	2012/dec/19	GOOD
808602	SOGGY15	217993 (100%)	Mineral	094P	2010/jul/04	2012/dec/19	GOOD
808642	SOGGY17	217993 (100%)	Mineral	094P	2010/jul/04	2012/dec/19	GOOD

Assessment work to be filed to the above claims