MINISTÈRE
DE L'ÉNERGIE
ET DES RESSOURCES

DIRECTION GÉNÉRALE DE
L'EXPLORATION GÉOLOGIQUE
ET MINÉRALE

SURFICIAL GEOLOGY OF THE ST-JEAN-VIANNEY AREA

P. LaSalle

1973

DP-136
GM-28451

II

OPEN - FILE MANUSCRIT

Government of Québec

DEPARTMENT OF NATURAL RESOURCES

Mines Branch

Geological Exploration Service

SURFICIAL GEOLOGY OF THE ST-JEAN-VIANNEY AREA

Dubuc County

Preliminary Report

by

Pierre LaSalle

Québec

1973

Surficial Geology of the St-Jean-Vianney area Dubuc County

INTRODUCTION

The detailed mapping of the St-Jean-Vianney landslide area was undertaken after the May 4th, 1971 landslide. The area had already been mapped during the summer of 1965, but not in great detail.

The new mapping was done during the summer of 1971 and was executed by conventional means of borings along field traverses and examination of sections that were available.

Location

The St-Jean-Vianney area is located in Dubuc County along the north side of the Saguenay River and lies entirely within the limit of the post-glacial marine invasion. The surficial sediments of the area were hence all deposited during the last marine invasion.

Topography

The general relief in the St-Jean-Vianney valley is re-larively high if one speaks of the relief of a land surface

of the unconsolidated sediments which formed the bottom of the post-glacial sea. Following the longitude axis of the valley, from the northwest to the southeast, are: the high terrace at 400 feet (120 m.) (all elevations are above the mean sea level); the crater of the old landslide ranging from 360 (108 m.) to 240 feet (72 m.) near the new crater; 160 feet (48 m.) in the latter, and 25 feet (7.5 m.) on the shore of the Saguenay river in the Terres Rompues area. Crossing the valley, perpendicular to the main axis, the maximum relief is 350 feet (105 m.) in the Terres Rompues area. In the larger, ancient landslide, there is a typical washboard topography, while the topography related to the undisturbed sediments is relatively flat. Indeed, the latter is related to the bottom of the former sea-arm that occupied the area some 10,000 to 8,000 years ago. Incising this flat land-surface, there are escarpements that are related to deep ravining of the area because of lowering of the base level (following post-glacial uplift) or landsliding. Some escarpements are also related in part to bedrock topography.

The drainage developed on this surface is effected through the Shipshaw River, the Rivière des Vases, and the Rivière Petit-Bras, which is adjacent to the 4th of May landslide.

GENERAL GEOLOGY

Geology of the bedrock

The greater of the bedrock in the area is of Precambrian age and belongs to the Grenville tectonic Province. One of the most common rocks is anorthosite (labradorite). Associated with anorthosite are gabbros, diorites, monzonites and syenites.

Table I

TABLE OF FORMATIONS

CENEZOIC	QUATERNARY	RECENT		Low terrace sediments including peat, colluvium, and eolian deposits	
				High terrace sands	
		PLEISTOCENE	WISCONSIN	Shallow water sand and gravel, fossiliferous in places	
				Deeper water sediments including clays and silts, fossiliferous in places	
				Glacio-marine sand and gravel (fossiliferous in places)	Circa 10,000 years Before present
				Kame-terrace, eskers, and other ablation deposits on the highlands	
				Lodgment till, grey on fresh cut, calcareous in places, sandy matrix on the highlands; more silty in the lowlands.	
				Unconformity	
PALEO-ZOIC	Upper Ordovi-cian			Shales and limestones	
				Unconformity	
PRECAMBRIAN				Anrthosite, gabbro, diorite, monsonite, syenite, Sillimanite gneiss, amphibolite, quartzite, pyroxenite calcsilicate, rocks, migmatite	

There are also several varieties of metasedimentary rocks: sillimatite gneiss, amphibolite, quartzite, pyroxenite, calcsilicate rocks and migmatites. They combine the characters both of the amphibolite and the granulite facies.

Outliers of Upper Ordovician shales and limestones outcrop in a few places.

Fault lines, of which the St-Jean-Vianney Valley may be one (Kumarapeli and Saul, 1966), are marked in places by scarps that separate the Lac St-Jean Lowlands from the Precambrian Uplands to the north and south. These faults may be part of a larger rift system related to the St-Lawrence Valley, as carbonatites (St-Honoré, north of Chicoutimi) are apparently associated with the fault zones (Kumarapeli and Saul, 1966).

Glaciation

The Wisconsin glaciers covered the whole area. Because of the ice-loading, the ground surface was depressed about 550 feet (165 m.) with respect to the present sea-level, i.-e. the present 550 foot (165 m.) contour line was about at sea level 1o,000 years ago (LaSalle, 1968,1969). When the glaciers melted, the marine waters invaded the lowermost part of the areas bordering the sea and relatively deep water sediments (silts and clays) were deposited (figure 1).

As the ground slowly rose with removal of the ice-load, the surface of the water and the surface of deposition came closer to each other and the energy in the deposition cycle increased: hence, coarser sediments were also gradually deeply trenched by ravines and gullies. Landsliding became part of the mass-wasting processes in the area as soon as gullying and cutting of scarps in the saturated marine clays became effective.

However, at St-Jean-Vianney, from the radiocarbon age dates obtained (cf. Table 2), it seems probable that there was a long period of stability as the sea receded from its maximum high limit, and that landsliding has only been more active in the last 2 to 3 thousand years of the geological history: the frequency of landsliding and mass movement (as one might expect) should increase with the deepening of gullies and the heightening of scarps. As one can observe now, along the northern side of the Saguenay River, between Terres Rompues and Chicoutimi-Nord, the lowermost terrace is built in part with landslide material. Exposures along the river bank show contorted beds of marine fossils incorporated in landslide material. It can also be suggested that this type of landslide may have occurred under water in the sea, as turbidites, because the saturated sediments were deposited on an unstable slope.

Marine Clays

The marine clays are fine-grained sediments deposited in relatively deep water with respect to high terrace sands that were deposited in shallow water. The quick clays (les argiles sensibles) are simply rock flour picked up by the glacier from Precambrian terranes. They reflect the mineralogy of the Precambrian rocks and contain a proportion of clay minerals. Those clay minerals were either picked up from existing soils or from the Ordovician rocks.

The clays in which the landslides generally occur in the area, are laminated clays. Such lamination is also common in the marine clays of the St-Lawrence Lowlands; the laminae are due to the alternance of more silty or more clayey layers. Futhermore, at St-Jean-Vianney, the apparently undisturbed clays shows "dykelets" of intruded material even at the scale of a thin section.

CONCLUSION

To sum up, the study of the mechanical properties of the clays and their distribution has important economical and environmental value, particularly in directing the development and expansion of towns and cities so that the problems that may be caused by unconsolidated sediments are avoided.

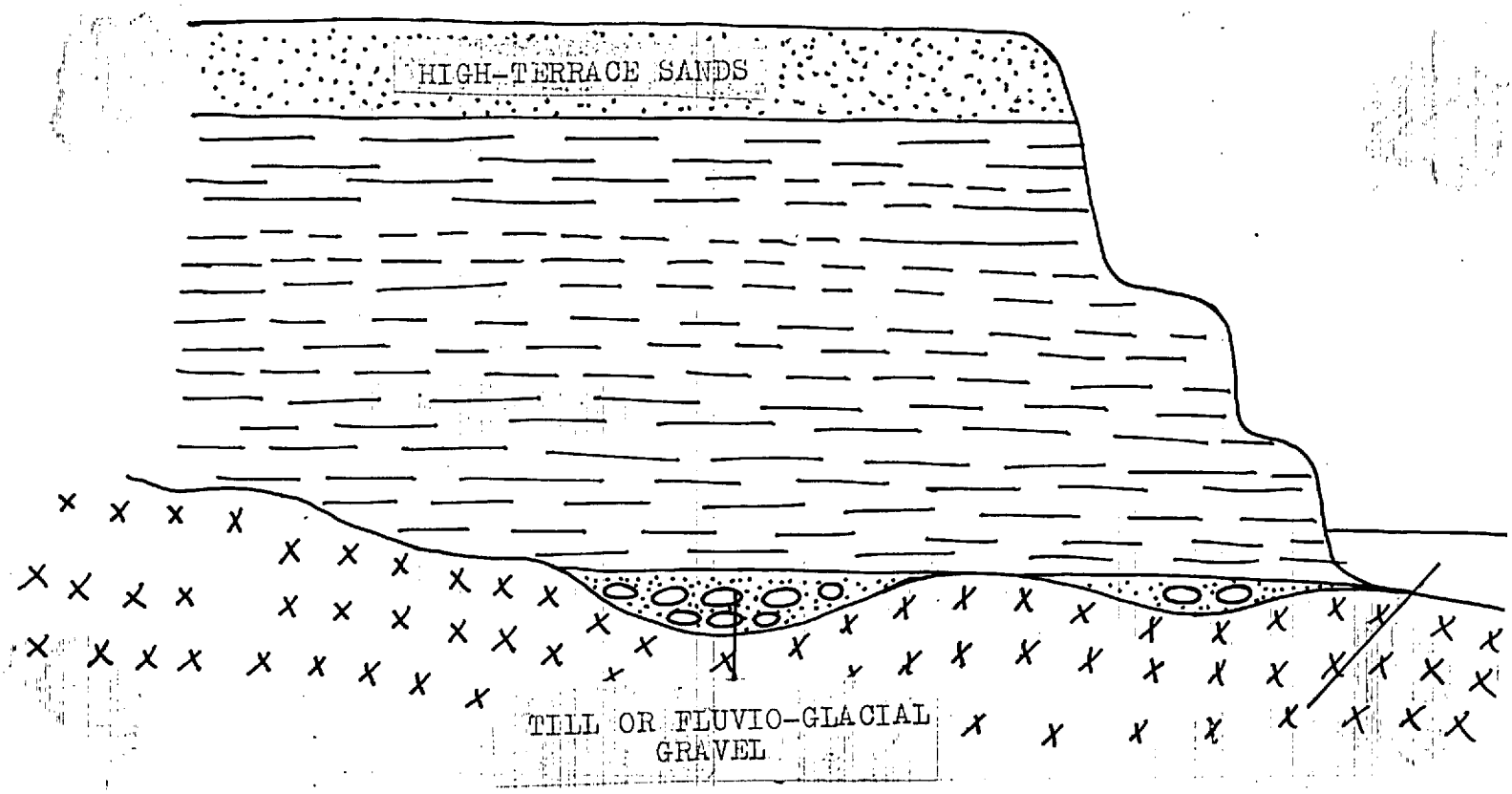

FIGURE I

Sketch of the undisturbed stratigraphy in the St-Jean-Vianney area.

TABLE 2

RADIOCARBON AGE DETERMINATIONS

Sample Number	^{14}C Age Years Before present		Location Long. (W)	Lat. (N)	Elevation	Type of Matérial dated and Reference
I-3141	560	90	71°11'40"	48°27'15"	60 m. 200'	Wood LaSalle and Chagnon, 1968
I-3142	420	90	71°12'55"	48°28'58"	67.5 m. 225'	Wood LaSalle and Chagnon, 1968
G.S.C.-1480	330	90	71°13'18"	48°27'06"	52.5 m. Circa 175'	Wood unpublished
I-6002	400	90	71°12'45"	48°29'30"	79 m. 264'	Wood unpublished
I-6003	4420	115	71°13'45"	48°29'45"	99 m. Circa 330'	Wood unpublished
I-6004	260	90	71°10'40"	48°30'00"	97 m. Circa 325'	Wood unpublished
I-6005	260	90	71°13'20"	48°28'40"	60 m. Circa 200'	Wood

REFERENCES

CHAGNON, J.Y., and LaSALLE, P.; - 1968 - An ancient landslide along the Saguenay River, Québec. Can. Jour. Earth Sci., V. 5, pp. 578-579.

HOUSTON, N.W., and MITCHELL, J.K., - 1969 - Causes of clay sensitivity: Journal of the Soil Mechanics and Foundation Division. ASCE No SM3 Proceedings Paper 6568, May 1969.

KUMARAPELI, P.S., and SAUL, V.A., - 1966 - The St-Lawrence valley system. A North American equivalent of the East African rift valley-system: Can. Jour. Earth Sci., V. 3, pp. 639-658.

LaSALLE, P., - 1965- Radiocarbon date from the area of Lake St-John, Québec, Canada: Science, V, 149, No 3689, pp. 860-862.

LaSALLE, P.; - 1969 - Field trip of Quaternary geology Saguenay River - Lac St-Jean: G.A.C. Guide to Excursions, Montreal Meeting.

LAWSON, D.W., - 1968 - Groundwater flow systems in the crystalline rocks of the Okanagan Highland, British Columbia: Can. Jour. Earth Sci., V. 5, p. 813.

REFERENCES

LEGGET, R.F., - 1945 - Pleistocene Deposits of the Shipshaw Area, Québec: Roy. Soc. Canada Trans., Sect. 4, ser. 3, V. 39, pp. 27-39.

NORVATOV, A.M. and POPOV, - 1961 - Laws of the formation of minimum stream flow: Bull. Intern. Assoc. Sci. Hydrol. Vol. VI, No 1, Louvain.

RADFORTH, N.W., - 1945 - Report on the spore and pollen constituents of a peat bed in the Shipshaw Area, Québec: Roy. Soc. Canada Trans., Sect. 5, Ser. 3, v. 39, pp. 131-142.