[redacted] CREEK

GEOLOGY OF WRECK BAY - VANCOUVER ISLAND (FLORENCE) BY J.M. BREMNER

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ABSTRACT

Wreck Bay is located on the west coast of Vancouver Island at 49°00'N, 125°38'W. It is roughly crescent shaped with a small cuspate foreland named Sand Point in the middle, and measures 2½ miles (2.17 kilometers) between the enclosing headlands of Quisitis and Wya Points.

Rocks exposed along the coast are indurated, unmetamorphosed, impure sandstones and mudstones of late Jurassic to early Cretaceous age. They were derived from the hinterland northeast of Wreck Bay, and were rapidly deposited into a trough which extended parallel to the present-day coastline. The contact between these sediments and the source rocks is thought to lie beneath a thick cover of Pleistocene material which now overlies the Estevan Coastal Plain; the southwestern edge of the paleotrough, from seismic evidence, appears to lie 5 - 6 miles (4.35 - 5.22 kilometers) seaward from the present-day coastline. Infilling of both sides of this paleotrough with Pleistocene and Recent sediments has resulted in a narrow, arcuate, present-day trough on the continental shelf adjacent to Wreck Bay. The Pleistocene sediments, consisting of cohesive grey clay and glaciofluvial outwash, were also derived from the mountainous hinterland to the northeast, and Recent sediments derived therefrom are dispersed across the bay and inner shelf. Boulders and gravel freed from the retrograding sea cliff behind the beach have settled to the base of wave erosion in the bay, and this coarse "mat" is covered by a thin veneer of very well sorted fine sand which becomes progressively finer further away

(I)

from shore. A nearshore surface current transports clay, silt and some of the sand southeastwards to Wya Point and the offshore trough.

During the summer, breaker heights in the bay vary from 0.75 - 4.00 feet (0.23 - 1.27 meters), and it is calculated that during winter storms, wave heights exceed 19 feet (5.75 meters). The foreshore in summer consists of fine, light-coloured sand, and slopes gently seaward at less than 2.6°. Profile changes on the foreshore result from three controlling factors: the breaker height, the breaker incident angle, and the position of the water table on the beach. The direction of littoral drift near the middle of the beach changes with tide level, but generally it is towards Sand Point and very strong; near Quisitis and Wya Points it is weak, and consistently away from them; elsewhere, it is weak and variable in direction. Transverse profiles were found to be most sensitive to tidal range where the breaker incident angle was small and consistent; they were virtually insensitive where the breaker incident angle was small and variable. In winter, the foreshore is generally less steep than in summer, and near Sand Point the surface material of the beach is reduced to coarse gravel as sand is carried out to the middle of the bay; northwest and southeast from here, the beach surface consists of dark-coloured medium sand; adjacent to the two headlands, the light-coloured fine sand of summer remains. Profile changes in winter are determined by breaker heights only, the other two controlling factors becoming insignificant.

Runnels, or incipient beach cusps, tend to form wherever littoral drift is not too strong, and their spacing is apparently related to the thickness of the swash wedge. The cliffbase along the northwest half of Wreck Bay very closely approximates a log-spiral curve in plan due to the angular relationship between prevailing wave fronts and the coastline; the southeast half, however, does not, because a complex wave pattern is created in the lee of islands located in the middle of the bay.

92F 04 The value of gold contained in the backshore near Lost Shoe Creek is calculated to be $10,650. An offshore placer deposit at 20 fathoms (36.6 meters) depth is indicated by a great increase in the amount of magnetite and other heavy minerals there, together with the fact that a small mode of very fine sand, which contains most of the heavy minerals onshore, reappears in samples collected from this bathymetric level.

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XII. ECONOMIC GEOLOGY

A. REGIONAL ASPECTS

Economic interest in the region around Wreck Bay began in 1898, at a time when lode and placer production of gold was at high level in British Columbia. Prospectors were successful in locating fine placer gold on the beach at Wreck Bay, and along Kennedy River, a number of small gold-bearing quartz veins were worked. V. Dolmage of the Geological Survey of Canada briefly described the area in 1919 and 1920, and mentioned that: "This part of the island is thinly populated, chiefly by Indians of a most primitive type." Since this time, a number of small companies and promotion groups have shown interest in the beach placers, and even today a few individuals derive some income from working beach concentrate during the winter (Plate 23a).

In the late 1950's attention was briefly directed towards the "black sands" magnetite content at Wreck Bay (Holland and Nasmith, 1958), and in 1961, Brynnor Mines commenced development of a magnetite ore-body on Draw Creek, which flows east into Barkley Sound. Since production began in April 1962 until the end of 1966, the mine produced 4,400,000 tons of ore (Eastwood, 1968). Several other small iron and copper showings in the area have been known for a long time, and occur where granodiorite or diorite of the Kennedy Batholith have intruded Quatsino Limestones.

B. SUMMARY OF GOLD PRODUCTION AND SAMPLING AT WRECK BAY

The total amount of gold extracted from the black sands is unknown, but from records that were kept in the past, it is apparent that rich pay streaks were located and mined.

From 1896 until 1901, $20,589 worth of gold was recovered ($15.20/oz.), and in 1919, when Dolmage visited the area, two samples collected at the cliffbase produced phenomenal assays: (i) concentrates from 3 pans - $416.70/cu.yd., (ii) unpanned average black sand - $115.20/cu.yd. ($20.67/oz). In 1920, the Ucluelet Placer Mining Company was formed, and during that summer, $9,400 worth of gold was recovered from 600 yards of gravel ($15.75/oz). From 1931 to 1935, a total of $1,997 was taken ($21.60/oz). In 1936, Stevenson conducted a semiquantitative investigation on the recoverability of gold from a number of different environments, the results of which are summarised in Table XVIII.

Sample locations	Number of samples	Oz's/cu.yd.		Average value/cu.yd.*
		Range	Average	
Beach black sands	5	0.048-3.488	1.086	$38.01
Gravel from cliff face	7	Tr-0.096	0.030	$1.05
Gravel from behind cliff	4	Tr-0.009	0.002	$0.08
Gravel in Lost Shoe Creek	1	0.024	0.024	$0.84

* ($35.00/oz)

Table XVIII. Summary of semi-quantitative Investigation of Gold Recoverability by Stevenson (1936).

All mining and sampling was conducted in the vicinity of Lost Shoe Creek. On the strength of this, the present investigation was designed to emphasise examination of this particular beach section.

C. PRESENT INVESTIGATION AND RESULTS

In conjunction with general field sampling of the area (see APPENDIX), a number of additional samples were panned to concentrate gold and magnetite for later evaluation in the laboratory. Approximately 10 lbs. of material was used in each case, and this was panned down to about 1 lb.

In the laboratory, magnetite was first extracted with a hand-magnet, and its proportion by weight roughly estimated. The balance of the heavy mineral concentrate was then processed on a Super Panner, and the number of "colours" counted and isolated. The results of this work are listed in Table XIX.

It should be mentioned here that during the summer of 1968, five prospect-holes were dug at various places on the beach by an unnamed exploration company. A mechanical shovel was used, and the holes measured about 6 feet across, and 6 feet deep. An attempt by the writer to sample the beach in depth with hand-auger and casing met with little success; consequently, one of the prospect holes was channel sampled in four 1.3 foot lengths. This particular hole was located 850 feet northwest of Profile D, and 90 feet from the cliffbase,

just behind the winter berm crest (Plate 23b).

D. ESTIMATED VALUE OF GOLD NEAR LOST SHOE CREEK

The diameter of gold colours was arbitrarily broken down into three catagories, as shown in Table XIX, to simplify determination of a mean particle size. Colours were examined under a petrographic microscope with a micrometer eye-piece (Plate 22).

Results in Table XIX confirm that the backshore near Lost Shoe Creek contains the highest gold values. We will therefore consider samples from NWR-5a (1,375 feet northwest of Lost Shoe Creek) to SER-5a (1,250 feet southeast of Lost Shoe Creek), for a total beach section of 2,625 feet (Map 1). These 9 samples together contained a total of 72 gold colours. Assuming the category midpoints to be: large = 300μ, medium = 150μ, and small = 50μ, multiplying these values by the number of particles in each category, and dividing the summed total by 72, we obtain the mean diameter of the colours, viz. 111.1μ.

Hite (quoted in Bateman, 1965) has estimated that 17×10^6 gold discs having an area of 0.1 sq.mm., averaged about 1 oz. troy for the Snake River, U.S.A. No specification on disc thickness was made, so this value is assumed to be constant regardless of source. These discs have a diameter of 11.28μ (from $\pi r^2 = 100\mu$). Therefore $(17 \times 10^6 \times 11.28)/111.1$ = 1,700,000 colours (approximately), with diameter 111.1μ, would average 1 oz. troy.

Now each of the 9 samples originally consisted of about 10 lbs. of material. We can therefore say that 72/1,700,000 oz's of gold were recovered from 9/200 tons of material from the backshore. The amount of gold contained in 1 ton of backshore material is given by:

$$\frac{72}{1,700,000} \times \frac{200}{9} = 0.0009412 \text{ oz's.}$$

The value of this at $35.00/oz = 3.289¢/ton or 5.271¢/cu.yd. (using the equivalent: 1¢/ton = 1.6¢/cu.yd., Bateman, 1965).

This figure represents the tenor of surface material derived from 2,625 feet of backshore. The average width of backshore in this region is 100 feet, and using the reported depth of 20 feet (or more) to the surface of the grey clay (Stevenson, 1936), gives dimensions for the zone in yards as follows: length 875, breadth 33, and depth 7. Therefore volume of the zone = 202,100 cu.yds. Assuming extension of the surface tenor with depth, we obtain the approximate value of gold contained in this zone:

Value = 0.05271 x 202,100

= $10,650.00.

E. DISCUSSION AND ECONOMIC SIGNIFICANCE

The figure derived at above should be regarded as a minimal value for the following reasons: Results from the prospect hole (Table XIX) indicate an increasing number of gold colours with depth - a situation probably valid for the rest of the beach as well. Furthermore, it is likely that a

number of very fine gold particles were lost through aeration during field-panning, or did not separate cleanly from the he heavy mineral concentrates on the Super Panner. This fact is borne out by the lack of results from either the cliff-face or Lost Shoe Creek, since Stevenson (1936) and others report that "colours can be obtained almost anywhere in the gravels" of the cliff-face.

Due to the exploratory nature of this study, the expense of fire-assaying large bulk samples was not deemed neccessary. The tenor derived at for the surface material (5.271¢/cu.yd.) is sub-marginal, however, in considering accessibility to the area, and the immediate abundance of water, re-evaluation in light of similar low-grade placer deposits elsewhere is required. Bateman (1965) reports that part of the Klamath Mountain Placers, consisting of cemented Miocene gravels, were economically hydraulicked with a tenor of $2\frac{1}{2}$ - 3¢/cu.yd. Similarly, some Tertiary Sierra Nevada Placers averaging 10¢/cu.yd., were also economically mined. It therefore appears likely, that by employing a cheap method of concentration such as the hydraulic method, the entire calculated zone could be mined at a profit during one summer season. Confirmation of this view should, however, first be sought through a detailed sampling program conducted in three dimensions. A point in favour of this type of mining, is that with the passing of winter, the beach would be naturally

restored to the satisfaction of conservationists.

The high surficial values obtained by Dolmage (1919), and in depth by early prospectors and Stevenson (1936), was a result of concentration over hundreds of years due to the continual "jigging" action of the surf. Low surficial values obtained in the present study suggest that most of the gold has already been taken, and therefore the deposit would appear to be capable of supporting only a single season's work.

Concerning magnetite estimates shown in the right-hand column of Table XIX, a positive correlation is indicated with gold in samples from Beach (berm) and the prospect hole. Furthermore, Holland and Nasmith (1958) report that the beach is most concentrated with magnetite along the backshore, between berm crest and cliffbase (approximately 100 feet). Depending on a detailed quantitative examination of the magnetite content in the calculated zone,a profitable by-product to gold mining such as this, could elevate the status of the mining proposition as a whole.

The only other mineral of possible economic significance found to be concentrated on the backshore, was zircon (Table VI). Finally, a small quantity of platinum has been reported to occur with the gold by a local mining company who recently examined the property.

F. SOURCE OF GOLD AND POSSIBLE OFFSHORE PLACER DEPOSITS

Several gold-bearing quartz veins were mined along

the gold is derived from concentration of material in the glaciofluvial outwash through selective erosion of the sea cliff.

the Kennedy River at the turn of the century. These occurrences are unique to this part of the west coast (Dolmage, 1920), and as postulated by him, almost certainly gave rise to the beach placers at Wreck Bay. Stevenson (1936) noticed the shallow depression in clifftop elevation 1000 feet northwest of the mouth of Lost Shoe Creek (Map 1). He suggested that the continuence of this depression inland possibly represents the original stream bed of Lost Shoe Creek, prior to coastal uplift. The likelihood of this channel being the course of gold transportation from the hinterland is, however, most improbable, since the fine gold is dispersed throughout the glaciofluvial gravels. Pay-streaks may well exist in the gravels, but their search would be extremely difficult and costly.

I doubt it very much

Evidence for the existence of an offshore placer was derived at from two independent studies: (i) A minor mode in the very fine sand fraction (0.0625 mm to 0.105 mm), which contained most of the heavy minerals, was found to characterize samples collected along the 20 fathom line (see chapter on SEDIMENT SIZE ANALYSES, Table VI). (ii) Petrologic examination of this size fraction in samples B-19 (middle of Wreck Bay - Map 1), OS-4 (20 fathom line - Map 2), and OS-16 (60 fathoms - Map 2), revealed that OS-4 contained five times as much magnetite as the other two samples (Table VI). It also possessed a higher proportion of other heavy mineeals, namely non-magnetic opaques, garnet epidote, pyroxene and hornblende,

but somewhat less zircon (see heading on POINT-COUNT ANALYSIS).

Gold bearing beach placers produced during still-stands of sealevel in Holocene times, are known off the coast of Nome, Alaska, and in southern Oregon. In the latter area, three zones of black sand have been located on the continental shelf by positive magnetic response of the deposits (Chambers, 1968). They contain magnetite, ilmenite, chromite and gold, and occur at 40, 23, and 10 fathoms. The fact that the indicated Wreck Bay offshore placer corresponds closely in depth to the Oregon 23 fathom placer is probably fortuitous, since post-Pleistocene isostatic adjustments of the crust in the two regions have not been the same.

Environment	Sample Number	Gold "colours			Total	Magnetite ×
		Large 400-200μ	Medium 200-100μ	Small <100μ		
BEACH (berm) (Map 1)						
(northwest of river)	NWR-6a	-	1	1	2	**
	NWR-5a	1	2	3	6	**
	NWR-4a	-	6	12	18	***
	NWR-3a	-	6	7	13	***
	NWR-2a	1	-	3	4	***
(Lost Shoe Creek)	NWR-1a	1	1	1	3	***
	SER-1a	-	5	3	8	***
	SER-2a	3	-	-	3	***
(southeast of river)	SER-3a	-	4	4	8	***
	SER-4a	-	5	4	9	***
	SER-5a	-	1	3	4	*
(Sand Point)	SER-6a	1	-	-	1	*
	SER-7a	-	1	-	1	*
	SER-8a	-	-	-	-	*
CLIFF FACE GLACIOFLUVIAL OUTWASH (Map 1)						
	C-2	-	-	-	-	*
	C2 grey clay	-	-	-	-	*
	C-3	-	-	-	-	**
	C-4	-	-	-	-	**
(Sand Point)	C-5	-	-	-	-	***
	C-6	-	-	-	-	***
	C-7	-	-	-	-	***
LOST SHOE CREEK (Fig. 5)						
	LSC-3	-	-	-	-	***
	LSC-6	-	-	-	-	**
	LSC-9	-	-	-	-	*
	LSC-12	-	-	-	-	*
LONG BEACH (Map 2)						
	LB-1	-	-	-	-	*
	LB-3	-	-	-	-	*
	LB-4	-	-	-	-	*
	LB-5	--	-	-	-	*
PROSPECT HOLE						
	P-1	-	-	-	-	-
	P-2	-	-	-	-	-
	P-3	-	-	2	2	*
	P-4	1	1	1	3	**

× Magnetite content estimated visually from panned concentrate

* = little (<10%)
** = fair (10 - 30%)
*** = abundant (30%)

Table XIX.
Gold and Magnetie from Five Environments at Wreck Bay.