51/123/5

PETROLEUM RESOURCES BRANCH
ASSESSMENT REPORT
NO. 935 ENCLOSURES

A Report of

1. Photogeological Survey
2. Surface Geological Reconnaissance
3. Well: Honolulu Nazko #a-4-L 93-B-11
4. Geophysical Survey

on

The Nazko River and Puntzi Permit

Areas - Interior Plateau

Central British Columbia

Permits 1117 to 1130 inclusive and

1248 to 1252 inclusive

National Topographic Grids

92-O-14; 93-B-3; 93-B-5; 93-B-6;
93-B-11; 93-B-12; 93-B-13; 93-B-14;
93-C-1; 93-C-8; 93-C-9; 93-C-10.

March 11, 1960 to March 11, 1961.

by

N. W. Taylor
Division Geologist

Honolulu Oil Corporation

March, 1961

8 Maps and Well Log in Accompanying Envelopes

Submitted in support of application for credit;
see affidavit made by J.W. Moore on April 26, 1961.

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The Nazko River and Puntzi Permit Areas
Interior Plateau - Central British Columbia

INTRODUCTION

This report is a summary of all oil and gas exploration work conducted by the Honolulu Oil Corporation, during the year 1960, on the Nazko River and Puntzi Permits and adjacent areas. The Permit Area consists of some 1,521,793 acres and is located approximately 55 miles west of Quesnel.

The Nazko River area is accessible by road both from Quesnel and Williams Lake. The Puntzi area is accessible only from Williams Lake.

PREVIOUS REPORTS

To the best of our knowledge only one previous report has been submitted on the Nazko River permit and is entitled:

Report of Photogeological Survey and Surface Geological Study

The Nazko River Permit Area

Interior Plateau Central British Columbia.

by N. W. Taylor, March 18, 1960.

Reports on this general area are as follows:

Armstrong, J.E.	1949 - Fort St. James Map Area, Cassiar and Coast District British Columbia. Geol. Survey Can. Mem. 252
Buckhorn, A.F. & Latour, B.A.	1950 - The Ground Hog Coal Field British Columbia Geol. Survey Can., Bull. 16
Cairnes, C.E.	1943 - The Geology and Mineral Deposits of Tyaughton Lake Map Area British Columbia Geol. Survey Can. Paper 43-15.
Duffel, S.	1959 - Whitesail Lake Map Area British Columbia Geol. Survey Can. Mem. 299
McTaggart, K.C.	1952 - Ashcroft Map Area British Columbia Geol. Survey Can. Mem. 262
Frebold, H.	1959 - Marine Jurassic Rocks in Nelson and Salmo Areas Southern British Columbia Geol. Survey Can. Bull. 49

Lord, C. S. 1948 - McConnel Creek Map Area Cassiar District British Columbia Geol. Survey Can. Mem. 251

Tipper, H. W. 1954 - Anahim Lake Map Area British Columbia Geol. Survey Can. Map 10-57
- Nechako River Map Area British Columbia Geol. Survey Can. Map 54-11
- Revision of the Hazelton & Takla of Central British Columbia Geol. Survey Can. Bull 47
- Quesnel Map Area British Columbia Geol. Survey Can. Map 12-1959

White, H. W. 1959 - Cordilleron Tectonics in British Columbia Bull. Amer. Assoc. Petrol. Geol. Vol. 43 No. 1 (Jan.) pp 60-100

WORK DONE ON PERMITS

Work on the permits consisted of four separate projects. They are listed below and will be discussed in separate sections:

I. Photogeological Survey of the Puntzi Permits

II. Surface Geological Reconnaissance of the Puntzi Permits and Surrounding Area.

III. Well: Honolulu Nazko #a-4-L 93-B-11

IV. Geophysical Survey on the Nazko River Permits

I. Photogeological Survey of the Puntzi Permits

V. Zay Smith and Associates Ltd. were contracted by Honolulu Oil Corporation to prepare a photogeologic evaluation of the Puntzi Permits. The preparation of this report took $4\frac{1}{2}$ months over a period dating from July 15 to November 1960. The report was titled:

Areal Geology and Structural Interpretation of the Puntzi Area

Central British Columbia

by

G.M. Collins, B.F. Brock and R.L. Hughes

Approximately a week was spent in the office by two Honolulu employees checking the photogeologic interpretation.

Techniques Employed

The area was evaluated by detail photogeologic mapping. Contact prints of vertical air photographs were acquired from the British Columbia government and are at an average scale of 1 inch to 2,640 feet. Base maps and controlled air photo-mosaics were prepared to cover the entire area at a scale of 1 inch to 1 mile.

The mapping of stratigraphic units and the interpretation of structure was made difficult by the following factors:

1. Poor expression of bed rock and relative similarity of gross lithology.
2. Dense forest cover.
3. Extensive glacial deposits and the effect of glacial scouring and grooving.

Stratigraphy

No Permian Cache Creek or Triassic rocks were discernable on the project. However, two major divisions were readily recognizable on the air photographs. The first group consisted of volcanics and sediments, the second group was composed of relatively flat lying basalts and associated rocks. Field work would classify the first group as Middle Jurassic to Oligocene, the second Miocene to Pliocene.

This first group was labelled "Jhz" (Jurassic-Hazelton) and "Top" (Tertiary - Oligocene and/or Paleocene). The differentiation of the two map units within this first group was adapted from the Geological Survey of Canada Map 10-1957.

Rocks of the "Jhz" unit outcrop at three localities. One is at the northeast corner of the project; another at the confluence of Punkut-laenkut Creek and the Chilcotin River; the third is in the Itcha Range.

The relationship of the "Jhz" unit with the underlying rocks has not been demonstrated within the project. Its upper contact is presumed to be unconformable. No thickness of the unit is available.

Rocks of the "Top" unit outcrop in the hilly terrain in the northern and eastern part of the project. There are also local outcrops in the southern part of the project just north of Tatla Lake and along the Chilanko River. Again no thickness is available for the unit. However, field work would indicate an estimated 3000 feet.

Miocene and/or Pliocene

Basalts and associated rocks of this age form bed rock throughout most of the area. This unit is labelled "Tm" (Tertiary - Miocene) on the evaluation map, and overlies the older rocks with marked angular unconformity. These relatively undisturbed rocks apparently were deposited following the deformation and erosion of the Pre-Miocene rocks. Throughout most of the area these lavas have filled valleys so that only the peaks of the previous mountainous landscape project through the volcanic veneer. Many cinder cones are associated with the "Tm" unit especially near the Itcha Range which is considered to have been the major source of these volcanics.

Quaternary

Quaternary deposits are comprised of Pleistocene glacial drift, recent alluvium, and terrace deposits. Their thickness is variable and probably reaches several hundred feet. Quaternary deposits are labelled "Q" on the evaluation maps.

Structure

Stereoscopic examination of the air photographs provided most of the dip control for the structural interpretation. In some areas strike and dip was interpreted and based on geomorphic evidence, mainly topographic expression. Two sets of structural axis are shown on the evaluation maps. The red and green axis indicate folds present in the Pre-Miocene strata whereas the orange and blue axis designates folds mapped in Post-Miocene and/or Pliocene volcanics.

Pre-Miocene Structure

Folds in the Pre-Miocene rocks are moderately to tightly folded with dips ranging from nearly horizontal to vertical. Few faults are mapped due to the relatively poor surface expression of bedding and the difficulty in obtaining conclusive fault evidence. However, many distinctive alignments mapped probably indicate faults.

Post-Miocene and/or Pliocene Structure

Folds in this group are broad, open and gentle, and are defined by dips ranging from nearly horizontal to 5°. Many folds mapped in the younger volcanics probably do not extend to depth. They are related to draping over Pre-Miocene topography.

Many of the dips surrounding the Itcha Mountains appear to be primary dips of lavas, indicating this as being the source area for the lavas.

The Prominant Structures Mapped are:

1. The Thunder Mountain Anticline, the axial trace of which is north-south and mapped from Lat. 52°33' N Long. 124°15' W to Lat. 52°38' N Long. 124°15'W.

2. The Mount Dent Anticline, the axial trace of which is northerly and mapped from Lat. 52°43' N Long. 124°14' W to Lat. 52°51' N Long. 124°15' W.

3. The Arc Mountain Anticline, the axial trace of which is northerly and mapped from Lat. 52°30' N Long. 124°22' W to Lat. 52°35' N Long. 124°23' W.

4. The Toil Mountain Anticline, the axial trace of which is northerly and mapped from Lat. 52°47' N Long. 124°12' N to Lat. 52°53' N Long. 124°12' W.

II. SURFACE GEOLOGICAL RECONNAISSANCE OF THE PUNTZI PERMITS AND THE SURROUNDING AREA

During the month of October, 1960, a geological field party consisting of two Honolulu geologists K. A. Lowell and N. A. Meyers under the supervision of the author conducted a geological reconnaissance of the Puntzi Permits. The purpose of the field trip was to check out photogeologic mapping done by V. Zay Smith, and to check on sedimentary outcrops reported by Dr. H. W. Tipper with the Geological Survey of Canada.

The area under study is located 85 miles southwest of Quesnel and is contained within the Longitudes of 122°15' and 125° west and Latitudes 52° and 53° N.

The south boundary of the area is accessible by car. A two-way radio was used for communication.

Areas covered and sections measured are shown on enclosed Map #1 (1 in. = 4 miles) entitled "Reconnaissance Surface Geology, Puntzi Area.

Techniques Employed

V. Zay Smith and Associates had previously prepared geologic maps from vertical air photographs. The photogeologic maps, the air photographs and Geological Survey of Canada Map 10-1957, were used as a guide in the field. Reported sedimentary outcrops were checked using a helicopter piloted by Dennis Pagon. Outcrops were plotted on air photographs measured and sampled for the purpose of identification and dating palynological methods.

Work Record	Month of October
Days in the field	26 days
Total days worked	13 days
Travel time	7½ days
Inclement weather	4½ days
Sickness, delays, time off	1 day

Geology

Regional Geological Setting

The area under study is part of a late paleozoic, mesozoic and cenozoic depositional basin. It is flanked on the west by the Coast Range mountains, which consist primarily of igneous intrusives, and flanked on the east by the Caribou Mountains, which are made up of early Paleozoic and late Proterozoic rocks.

Considerable vulcanism is associated with the basinal deposition throughout the Mesozoic and Cenozoic periods. The area has been subjected to at least four periods of deformation.

Stratigraphy

Rocks of Proterozoic through to Carboniferous age have never been found in outcrop in this area. This has led many writers such as Wm. H. White to conclude that the area was strongly positive throughout the Paleozoic, with no deposition having taken place. However, this author would conclude from evidence to date that the sediments of these ages were deposited but have since been destroyed by later orogenies in some areas and in others a mesozoic intrusive now forms the basement.

Permian

Rocks of permian age were not observed on or near the Puntzi Permits. The nearest known Permian rocks are those of the Cache Creek sequence which are exposed to the south and east of the Nazko River. The only Cache Creek rocks examined on the field trip were those in the Quesnel area. They consisted of argillites and chert.

Triassic

Tipper of the G.S.C. has mapped Triassic rocks in the Coast Ranges west of the permits. This assemblage is characterized by andesites, basalts, related tuff and breccias, argillites, greywackes and argillaceous limestones. These rocks are probably the equivalent of the Tatla sequence.

Rocks of this sequence were not observed in the area of study, however, schists which were examined in the Itcha Mountains and on the shores of Tatla Lake may very well have been their metamorphosed equivalent.

Jurassic

Rocks of this age have been mapped by Tipper both in the mountains to the west and on the Puntzi Permits. They are characterized by andesite, dacite, rhyolite, related tuffs and breccias, chert pebble conglomerate, shale and sandstone. This sequence is probably the equivalent of the Hazelton.

Exposures thought to be of this sequence were examined in the field, but samples taken for dating proved to be barren of microflora. Therefore, no definite age could be fixed to the sequence. Outcrops were very discontinuous and poorly exposed making them difficult to measure.

The thickest section observed was on Punkutlaenkut Creek where it is believed to be 2900 ft. The greater portion of this was covered however. Rock types consisted of volcanic breccia greywacke, shale, sandstone, rhyolite or dacite and related tuffs.

In the Baezaeko River area a 75' section of volcanic breccia was examined. It is probably the equivalent of the basal unit at Punkutlaenkut Creek. At Puntzi Ridge, Mt. Palmer, and on the shores of Puntzi Lake sections similar in lithology to those found at Punkutlaenkut Creek and Baezaeko River were examined. However, metamorphism has destroyed much of the character.

Cretaceous

A good sedimentary exposure totaling 743 feet was measured in the Itcha Mountains. It consisted of dark grey, grey, grey-green, red and mottled shales and grey-green and grey sandstones. Tipper has placed these in the Jurassic. Samples taken for dating proved to be barren, however, lithologically these rocks are similar to Lower Cretaceous rocks found in the Honolulu Nazko #a-4-L well. It is on this basis that the section has been placed in the Cretaceous.

One other Cretaceous outcrop was examined in the Three Sister Hills area. It consisted of friable sandstone.

Tertiary

There are two periods of volcanic deposition in the Tertiary; the older of these Tipper dates as Upper Cretaceous, Paleocene or later. One outcrop of this sequence was examined on the Chilcotin River. It consisted of pitchstone, rhyolite, dacite, and related tuffs and breccias. Lying on top of these, with marked angular unconformity, are the flat lying plateau basalts. Tipper dates these basalts as Oligocene, Miocene or later.

Two sedimentary sections of Tertiary age were examined. At McClinchy Creek 80 feet of siltstone and volcanic ash were measured. Microflora indicated an age of Tertiary or younger. A second sedimentary outcrop examined on the Chilcotin River consisted of 100' of conglomerate, sandstone, and siltstone with thin lenses of lignite. Samples collected were barren of microflora, however, lithologic character and stratigraphic position indicate an age of Eocene or younger.

Frazer River sediments examined near Quesnel have been dated as Tertiary. They consist of sandstone, conglomerate, shale and lignite.

All of the Tertiary sediments examined were very poorly stratified.

Structure

Other than the taking of a few strikes and dips, very little was done in the way of a structure check on the permits. However, it is known that the area has been subjected to at least four periods of deformation. The Cassiar orogeny faulted and folded the Permian Cache Creek rocks. The Coast Range orogeny which started in the early Jurassic and continued into the Cretaceous, deformed the Triassic, Jurassic and probably some cretaceous rocks. The Rocky Mountain orogeny faulted and folded Cretaceous and some Tertiary rocks and finally the later Tertiary beds are faulted and folded.

Gas and Oil Seeps

One day was spent searching for a reported oil seep on Baker Creek with no success. A gas seep on the Chilcotin River was found but a gas analysis showed that the gas was composed of 95% carbon dioxide. This combined with the amount of $FeCO_3$ present indicates the seep has nothing to do with hydrocarbons. The aforementioned sections are described in more detail as follows:

Baezaeko River Section #1

Lat. 52°56' Long. 124°01'42"

25' Basalt - dark grey, fine crystalline, vesicular, contains feldspar, quartz, hornblende.

25' Volcanic Breccia - grey, angular, pebbles and fragments of andesite, basalt and red volcanic ash in a tuffaceous or argillaceous matrix phenocrysts of feldspar, hornblende, and augite, trace of vein of calcite and secondary calcite.

50' Volcanic Breccia - red, fragments of basalt and andesite in a red argillaceous or tuffaceous matrix, fragments larger in basal 10', phenocrysts of hornblende and feldspar.

Baezaeko River Section #2

Lat. 52°56' Long. 124°01' (Single small rubbly outcrop.)

Volcanic Breccia - grey green, fragments of basalt and andesite in a volcanic glass matrix which shows flow structure, phenocrysts of feldspar, hornblende and augite, some calcite infill.

Punkutlaenkut Creek Section #1

Lat. 52°30'06" Long. 124°24'03" (Most of section covered only scattered small rubbly outcrops.)

100' Volcanic Breccia - dark grey, green and red, fragments of basalt, andesite, and volcanic ash in a red to grey argillaceous or tuffaceous matrix, phenocrysts of plagioclase, hornblende and augite, some secondary silification and copper mineralization.

690' Covered.

520' Mostly covered with scattered small rubbly outcrop of Sandstone or greywacke - grey green, angular, coarse to medium grained poorly sorted, feldspathic, abundant mafic minerals, siliceous cement.

10' Shale - dark grey, blocky, traces of red volcanic ash (required digging through shale talus to get to outcrop.)

260' Covered.

4' Sandstone - dark grey, angular, fine grained, well sorted, feldspathic, abundant mafic mineral, siliceous cement.

1056' Covered.

14' Rhyolite or Dacite - white to yellow, very fine crystalline matrix with yellow weathering phenocrysts of feldspar, muscovite, a few small vesicules, earthy odor on fresh fracture. One small outcrop of lithic tuff, containing fragments of rhyolite and basalt.

250' Covered.

One small outcrop of quartz, diorite, grey, medium crystalline phenocrysts of feldspar, quartz, hornblende, and mica - it is questionable if in place.

2904'

Note: Section was overlain by Plateau Basalts.

Punkutlaenkut Creek Section #2

The south side of the creek was examined. However, because no attitude was obtainable the section could not be measured. Scattered outcrop consisted of rhyolite or dacite, and volcanic breccia, similar in lithology to those found in Punkutlaenkut Creek Section #1.

Chilcotin River Sections #1 and #2

Lat. 52°30'25" Long. 124°24' (The attitude of the beds was not discernable, therefore, the section could not be measured. The rock types are described below.)

Volcanic Breccia - varicolor, red and grey fragments of rhyolite or dacite in an aphanitic siliceous matrix, some chalcedony, and copper mineralization probably cresocola.

Pitchstone - black, almost obsidious, shows pellitic structure.

Rhyolite - red aphanitic, shows flow structure.

Volcanic Glass - grey, aphanitic shows flow structure.

Volcanic Breccia - red and grey, boulders and fragments of pitchstone in a red and grey argillaceous, tuffaceous matrix, also fragments of flow banded rhyolite.

Rhyolite - grey, aphanitic, vesicular, trace of copper mineralization probably bornite.

Chilcotin Section #3

Lat. 52°30'21.5" Long. 124°24'03"

20' Conglomerate - brown, boulders and pebbles in a coarse sandstone matrix, some volcanic fragments, poorly stratified.

50' Sandstone and Siltstone - light brown, poorly sorted, very friable, trace of volcanic ash and tuff. Thin lenses of black coal, abundant plant remains.

30' Conglomerate - grey, pebbles and fragments of pitchstone and volcanic breccia in an argillaceous, tuffaceous matrix. Volcanic breccia consists of pebbles of pitchstone in a grey tuffaceous matrix.

Itcha Mountain Section #1

Lat. 52°41'32" Long. 124°54'41"

5'	Sandstone - grey green, subangular, fine to coarse grained, poorly sorted, feldspathic, mafic, and quartzitic, slightly calcareous, tight.
82'	Shale - dark grey, blocky, hard, micromicaceous.
45'	Covered.
2'	Shale - dark grey, blocky, hard, scattered grains of quartz and feldspar.
3'	Covered.
2'	Shale as above.
30'	Covered.
11'	Shale - dark grey, blocky, hard, interbedded with sandstone, grey subangular, very fine to medium grained, in part a siltstone, fair sorting, micaceous, feldspathic and argillaceous.
30'	Sandstone - green, subangular, medium to coarse grained, poor sorting very feldspathic, siliceous cement, tight.
35'	Covered.
41'	Shale - grey and grey green, blocky, hard.
10'	Covered.
38'	Shale - grey green, blocky, hard, silty, grades into sandstone towards base.
8'	Sandstone - light grey to grey, subangular, fine grained, well sorted very micaceous, feldspathic, siliceous cement, tight.
10'	Covered.
3'	Sandstone, as above.
45'	Covered.
3'	Shale - grey green, blocky, hard, silty.
10'	Covered.
22'	Sandstone - grey, angular, medium to coarse grained, poorly sorted, feldspathic, siliceous cement, slightly calcareous, tight.
4'	Covered.

13' Shale - red, blocky, micromicaceous.

55' Covered.

17' Sandstone - grey green, subangular, medium grained, well sorted, feldspathic, siliceous cement, tight.

9' Covered.

2' Shale - red and green mottled, fissile to blocky.

5' Covered.

25' Shale - grey, blocky, silty, interbedded with siltstone, grey and grey green, grading in part to a very fine grained sandstone, slightly calcareous, argillaceous.

25' Covered.

5' Shale as above.

5' Covered.

3' Sandstone - grey green, fine grained, tight.

5' Covered.

135' Shale - red green and mottled, blocky, in part arenaceous.

Note: Overlying this section are basalts and schists, probably in fault contact. The igneous and metamorphic rocks were not measured.

Puntzi Ridge Section #1

Lat. 52°09' Long. 124°17'

The southeast end of the ridge consisted primarily of metamorphosed sandstone and basalt, however, the northwest end of the ridge appeared to be igneous intrusive. No samples taken for further examination.

Tatla Lake Section #1

Lat. 51°57' Long. 124°27'

Only one outcrop was observed on the shores of Tatla Lake and it consisted of a mica-schist with a micro-granodiorite or latite dyke cutting through the middle.

Puntzi Lake Sections #1, 2 and 3

Lat. 52°13'2" Long. 123°56'58"

Outcrops around Puntzi Lake were scattered and small. No sections were measured, however, rock types consisted of:

Lithic Tuff - red and green.

Sandstone - green, coarse grained, calcareous.

Siltstone - green, argillaceous.

Basalt

and metamorphosed equivalents of the above-mentioned rocks.

Three Sister Hills Section #1

Lat. 52°12' Long. 123°42'1.5"

One outcrop was examined, it consisted of:

6' Sandstone - green, angular, coarse grained, fair to poor sorting in part friable, siliceous cement, occasional large pebbles of basalt.

McClinchy Creek Section #1

50' Siltstone - light brown, volcanic ash, thin stringers of plant remains, and fossil leaves.

III. WILDCAT WELL - HONOLULU NAZKO #a-4-L

During the year 1960 Honolulu Oil Corporation drilled a well on the Nazko permits. Two copies of the final well report complete with logs and other pertinent data were sent to the Department of Mines and Petroleum Resources, Petroleum and Natural Gas Branch, Victoria, B.C., on February 20, 1961. These reports cover the drilling operation in detail so this report will only summarize this operation. Included in the pocket of this report is a litholog of the well and recorded below is a summary of the well.

Well Name	Honolulu Nazko #a-4-L
Well Location	Quarter Unit a, Unit 4, Block L of NTS 93-B-11
Final Status	Dry and abandoned
Area and Type of Well	Nazko Central B.C. Wildcat
Co-ordinates	North 466.5' and West 1331.2' from SE corner of Unit 4 Lat. 52°40'04.60" Long. 123°25'06.59"
Elevation	Ground 3035 K.B. 3049
Land	B.C. Permit No. 1125 Honolulu 100% Working Interest
Dates	Rigged Up July 11, 1960 Spudded 2:00 A.M. July 16, 1960 Completed Drilling December 16, 1960 Rig Released 4:00 P.M. December 21, 1960 Total Days Drilling 153
Contractor and Rig No.	Arrow Drilling Co. Ltd. Rig #7 (Emsco 500)
Hole Sizes	0- 884 17-1/2") 884- 3,691 12-1/4") 3,691- 5,054 11") Drilled with mud 5,054- 7,808 7-7/8") 7,808-10,864 6-1/8" Drilled with air
Total Depth	10,864 (Driller)
No. of Tests	5 Bottom Hole Tests
Tested Intervals	DST #1 2391-2406 Recovered 10' mud DST #2 3590-3610 Recovered 40' mud DST #3 4184-4219 Recovered 180' mud DST #4 5984-6037 Misrun DST #5 6214-6264 400' slightly gas cut mud.

No. of Cores 28 Total footage cored 202

Cored Interval		Cut/Recovered
Core #1	741 - 748	7/4.8
Core #2	994 - 1,006	12/3.85
Core #3	1,311 - 1,321	10/9.3
Core #4	1,768 - 1,774	6/5.0
Core #5	2,300 - 2,305	5/4.5
Core #6	2,305 - 2,308	3/3.0
Core #7	2,406 - 2,411	5/4.9
Core #8	2,900 - 2,905	5/1.4
Core #9	3,372 - 3,373	1/0
Core #10	3,795 - 3,804	9/8.1
Core #11	4,219 - 4,249	30/30
Core #12	4,735 - 4,745	10/2.8
Core #13	5,138 - 5,148	10/8.4
Core #14	5,304 - 5,312	8/7.8
Core #15	5,801 - 5,810.5	9.5/9.5
Core #16	6,264 - 6,276	12/10
Core #17	6,714 - 6,718	4/2
Core #18	7,178 - 7,186	8/5.4
Core #19	7,354 - 7,364	10/10
Core #20	7,506 - 7,516	10/10
Core #21	7,983 - 7,983	0/0
Core #22	8,125 - 8,135	10/2
Core #23	8,914 - 8,915	1/0.9
Core #24	9,480 - 9,486	6/5.7
Core #25	10,077 -10,081	4/0.07
Core #26	10,683 -10,684	1/0
Core #27	10,849 -10,851	2/0.5
Core #28	10,860 -10,864	4/2.5

Casing and Cementing

Surface Casing
28 jt. 13-3/8" 61# J55 casing at 879'
Cemented with 750 sax cement + 1% $CaCl_2$
Intermediate Casing
21 jt. 7" 26# N80 57 jt. 7" 23# N80
158 jt. 7" 23# J55 at 7804' cemented with 800 sax cement.

Plugs

Plug #1 8367-8267 40 sax cement

Plug #2 7850-7750 40 sax cement, felt top of plug at 7720.

Welded plate over casing.

Logs

Run #1		
Schlumberger ES log	80-888'	2"=100'
	80-888'	5"=100'
Schlumberger MLC log	100-888'	5"=100'
Run #2		
Schlumberger ES log	880-4282'	2"=100'
	880-4282'	5"=100'
Schlumberger MLC log	880-4282'	5"=100'
Schlumberger Sonic GR log	880-4276'	5"=100'
Schlumberger Cont. Dipmeter	880-4277'	5"=100'
Schlumberger Dipmeter(Computed)	880-4277'	2"=100'
Run #3		
Schlumberger ES log	4282-7807'	2"=100'
	4282-7807'	5"=100'
Schlumberger MLC log	4282-7806'	5"=100'
Schlumberger Sonic GR log	880-7807'	2"=100'
	4100-7807'	5"=100'
Schlumberger Cont. Dipmeter	4277-7803'	5"=100'
Schlumberger Dipmeter(Computed)	4277-7803'	2"=100'
Baroid Mud-Gas log	890-7800'	2"=100'
Continuous Velocity log (SSC)	880-7808'	
Conventional Velocity log (United Geophysical)	880-7808'	
Run #4		
Schlumberger Induction log	7808-10,850'	2"=100'
	7808-10,850'	5"=100'
Schlumberger GRN log	700-10,854'	2"=100'
	7600-10,854'	5"=100'

Employees at Wellsite

Engineers: J. Bodor
R.W.M. Reeve
P.D. O'Connell

Geologists: M. Pyecroft
N.A. Meyers
K.A. Lowell

GEOLOGICAL MARKERS

Age	Marker	Depth K.B.	Depth Subsea
Quaternary	Glacial drift & river deposits	Surface	
Upper Lower Cretaceous	Dark grey shales, and siltstones	68'	+2981'
Upper Lower Cretaceous	Conglomerate (Oil stained 735-740)	732'	+2317'
Upper Lower Cretaceous	Siltstone and sandstone	980'	+2069'
	Fault?	1,275'	
Lower Cretaceous	Dark grey shale and siltstone	1,275'	+1774'
	Fault?	2,275'	
Upper Cretaceous	Dark grey & grey shale & siltstone	2,275'	+ 774'
Lower Cretaceous	Sandstone and conglomerate (Oil stained 2390-2425)	2,385'	+ 654'
Lower Lower Cretaceous	Red & varicolored shales, siltstone and sandstone (Oil stained 3585-3645)	2,740'	+ 309'
	Fault?	3,800'	
Age Unknown	Grey shales,siltstone & sandstone (Oil stained 4185-4255)	3,800'	- 751'
Lower Lower Cretaceous to Jurassic	Conglomerate and red shale	4,348'	-1299'
Jurassic	Red shale	5,290'	-2241'
	Fault?	5,560'	
Age Unknown	Grey shale and siltstone (Oil stained 5815-5820)	5,560'	-2511'
Age Unknown	Sandstone, conglomerate & shale (Oil stained 5985-6035) 6235-6260	5,988'	-2939'
	Fault?	6,270'	
Upper Cretaceous	Grey shale and siltstone (Oil stained 6395-6420)	6,270'	-3221'
Middle Upper Cretaceous	Grey shale, chert & sandstone (Oil stained 7125-7130)	7,115'	-4066'
	Fault?	7,590'	
Age Unknown	Grey shale, chert & sandstone	7,590'	-4541'

GEOLOGICAL MARKERS - Continued

Age	Marker	Depth K.B.	Depth Subsea
Age Unknown	Chert	8,595'	-5546'
Age Unknown	Volcanic Breccia	8,914'	-5865'
Eocene	Volcanic lava and breccia	9,100'	-6051'
Age Unknown	Shale and siltstone	10,493'	-7444'
Cretaceous or Older	Granodiorite	10,603'	-7554'
	Total Depth	10,864'	-7813'

Age Determinations

The ages indicated for sedimentary markers in the Honolulu Nazko well were determined by palynological methods. The identification of fossils were made by Robert H. Tschudy, Palynological Research Laboratory, Jamestown, Colorado.

Dating of igneous rocks were done by the University of Alberta, using the potassium-argon method.

IV. SEISMIC REPORT NAZKO AREA

The Area contained within this report encompasses Permit Nos.

1119 (93-B-3), 1120 (93-B-3), 1125 (92-O-14),

1127 (93-B-11), 1128 (93-B-14), 1129 (93-B-13),

1252 (93-C-1).

A REFLECTION SEISMOGRAPH

Survey of the Nazko Area in Central B.C.

Period covered by this report - August 28th,1961 - December 4,1961

Author: W.B. Howard - March 24,1961

Four Maps in accompanying binder.

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Seismic Methods and Results in Puntzi and Alexis Creek Area	21
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Description of Shot Holes in the Nazko Area	25

Attached Maps

Drawing No.	Title of Map
2121-1	Dated Shot Point Map with Ground Elevations Alexis Creek Area
2122-1	Dated Shot Point Map with Ground Elevations Puntzi Area
2114-1	Dated Shot Point Map with Ground Elevations Nazko Area
2114-2	Interpretation of Seismic Shooting Nazko Area

A REFLECTION SEISMOGRAPH SURVEY OF THE NAZKO AREA IN CENTRAL B.C.

On September 1, 1960, the United Geophysical Company of Canada began a reflection seismograph survey for Honolulu Oil Corporation in the Puntzi Area (Permit No. 1252). The crew was quartered at Alexis Creek.

Attached are three maps (Drawing Nos. DE-2121-1 DE-2122-1 and 2114-1) which show dates worked in each location as well as ground elevation of the shot points using sea level as reference datum.

Two 1320 foot symmetrical split spreads were shot one mile northwest of the Tatla Lake Creek bridge. The first shot (D-BN-1), on the highway, was shot at 88 feet depth. The second shot (D-BN-2), at right angles to D-BN-1 was also a 1320 symmetrical split spread. It was shot at a depth of 48 feet. Six geophones per trace were used. Neither record showed any reflections. Both records were played back from magnetic tape through various filters and up to 40% mix. Neither filtering nor mixing improved the records.

The crew then began work in the near vicinity of Alexis Creek on Permit No. 1119 and 1120. Three weeks were spent in this area in an effort to obtain useable seismograms.

Drilling in this area was extremely difficult due to boulders and gravel which extended from the surface of the ground down to 60 feet. Underlying the gravel at the lower elevations was clay mixed with boulders. At the higher elevations the gravel was underlain by brown shale and lavas. A Mayhew 1000 drill was used in this drilling. It was necessary to use rock bits on every hole.

The instruments used in this survey were United Geophysical Company's 138 series, 24 trace instruments with magnetic tape recording. Eighteen Electro-Tech 28 cycle geophones per trace were used.

Shot depths were varied from 25 feet to 200 feet. Single shots, three-shot patterns, five-shot patterns and one fifteen-shot pattern were employed. All patterns were in line with spacing varying from 50 to 100 feet between shots. Spread lengths varied from 660 feet to 2640 feet.

Since the shooting was recorded on magnetic tape, it was quite simple to experiment with filters and mixing. No acceptable records were obtained in the area.

The records appear to contain signals of 30 to 50 cycles per second with a great deal of high frequency noise (up to 100 cycles per second) interfering with the signals. The noise-signal ratio was so unfavorable that it was not possible to follow a line up on the seismograms for more than a few traces - let alone picking reflectors (?) across the full 24 traces. Further shooting is not recommended in the Alexis Creek Area.

On September 21st the crew moved to the Nazko Area (Permit No. 1127, 1128, 1129) and were quartered at the ranches of Bill and Clarence Leake located about five miles west of the Nazko Indian Village. On December 4th the project was terminated.

Drilling was again difficult because of gravel extending from the surface down to 60 feet. Underlying the gravel were hard sandstones and basalts.

After the unacceptable results obtained near Alexis Creek considerable experimental shooting was conducted at the Honolulu Nazko No. 1 Well. The best results were found by using single holes at 90 feet.depth with 18 Electro Tech cycles geophones per trace. Symmetrical split spreads of 1320 feet were used.

Several circular spreads were shot. The shot point was located in the centre of a circle with a diameter of 400 feet, with the geophones laid out on the circumference of the circle. The geophones were placed in clusters of 18 per trace at each of the flags on the circumference. No. 1 and 24 were at the north point and No. 12 and 13 were at the south point of the circle. The other geophone station flags were equi-distantly placed along the circumference. The results of these circular spreads were fair.

Record quality in the Nazko Area was generally very poor. All records were played back from magnetic tape using a 33% mix and United Geophysical Company's 10-7 filter which peaks at 50 cps with 34 cps down 6 db on the low side of the curve and 66 cps down 6 db on the high side of the curve.

From the Acoustic log and a Conventional velocity survey in the Honolulu Nazko No. 1 well, a straight line velocity function of 15,000 fps was determined as correct. All seismograms were plotted in depth using the 15,000 fps straight line velocity function and all dips were migrated. Office work on this project extended from December 7th, 1960 thru March 24th,1961.

Geophysical Interpretation

Attached is a map (Drawing No. 2114-2) which depicts 3 scattered seismic prospects. Seismograms are of such poor quality that shooting can not be correlated between areas. All data is plotted in depth with sea level as the reference plane.

Line D-BS-1 shows four changes in control. These changes were necessitated by the sudden deterioration of the horizon being carried in each case. It can be inferred that faulting may be the cause of the mapped horizons lacking continuity.

Thrusting is shown at shot point D-BS-1-10. Erratic dips on the depth section suggest a low angle thrust at this point. The strike of this thrust can not be accurately defined, because of the lack of cross control. At shot point D-BS-2-13 erratic dips similar to those at D-BS-1-10 suggest similar thrusting at that point. Although these horizons, as mapped, are not the same geologic horizon the thrusting as shown is likely related.

Line D-BU-1 shows indications of thrusting at shot point 12. Control also changes here.

Results of circular spreads are shown as dip-strike symbols along with depth of the reflector.

No isochrons were drawn in the areas concerned as there was not enough information from the seismograms to draw more than the one structure map submitted.

Statement of qualifications in lieu of professional engineers membership in the Province of British Columbia.

BS degree Forest Engineering University of Montana 1940
One year seismic surveyor
Three years seismic party manager and computer
Nine years geophysicist.

Winston B. Howard

Winston B. Howard.

WBH/ht

This report covers Permit Numbers 1119 (93-B-3), 1120(93-B-3), 1125(92-O-14), 1127(93-B-11), 1128(93-B-14), 1129(93-B-13), 1252(93-C-1).

A Reflection Seismograph Survey of the Nazko Area in Central B.C.

Period covered by this report:

August 28, 1961 to December 4, 1961.

W. B. Howard

March 24, 1961

Four maps in accompanying binder.

DESCRIPTION OF SHOT HOLES IN THE NAZKO AREA

Profile	Depth	Average Charge in lbs.	Drillers log
Prospect D-BN			
1-1	90	15	0-55 Gravel, 55-90 clay and gravel
2-2	80	3 3/4	0-25 Gravel, 25-80 clay and gravel
Prospect D-BQ			
1-1	105	4 3 5/8 pattern	0-5 clay, 5-35 gravel, 35-105 clay, gravel, boulders
1-2	20	20	0-20 gravel
Prospect D-BP			
1-1	200	10	0-35 clay and rocks, 35-50 gravel sand, 50-200 clay and rocks with gravel
2-1	45	$2\frac{1}{2}$	0-45 gravel and clay
2-2	225	3 x 3/4 pattern	0-225 gravel and clay
2-3	30	10	0-30 clay and rocks
Prospect D-BQ			
1-1	200	12	0-180 clay and gravel, 180-200 basalt
1-1	45	(5 x 5/16 (3 x 5/16	5 hole pattern
1-2	45	(5 x 5/16 (3 x 5/16 (8 x $2\frac{1}{2}$ air shot	0-45 clay and gravel 5 hole pattern
1-3	45	(5 x 5/16 (3 x 5/8	0-45 clay and gravel 5 hole pattern
1-4	45	(5 x 5/8 (3 x $1\frac{1}{4}$ (5 x $1\frac{1}{4}$	0-45 clay and gravel 5 hole pattern
1-5	45	(5 x $1\frac{1}{4}$ (5 x 20 (5 x 5/16	0-45 clay and gravel 5 hole pattern
2-1	75	(15 x $1\frac{1}{4}$ (9 x $1\frac{1}{4}$	0-75 clay and gravel
	30	(7 x $1\frac{1}{4}$ (1 x 10	0-30 clay and gravel 15 hole pattern
Prospect D-BR			
1-1	45	(5 x $1\frac{1}{4}$ (3 x $1\frac{1}{4}$ (5 x 5	0-10 sand, 10-20 gravel, 20-25 clay 25-45 gravel 3 hole pattern
Prospect D-BS			
1-1	195	12	0-35 gravel, 35-195 blue shale and sandstone
1-1	90	20	5 hole pattern

Profile	Depth	Average Charge in lbs.	Drillers log
Prospect D-BS (Cont'd.)			
1-2	103	15	0-35 gravel, 35-105 shale and sandstone
1-3	90	20	0-15 sand and gravel, 15-45 clay and gravel, 45-90 hard shale
1-4	90	20	0-55 gravel, 55-90 hard shale and sandstone
1-5	75	20	0-35 gravel, 35-75 shale
1-6	75	20	0-25 gravel, 25-75 shale and sandstone
1-7	60	20	0-40 gravel, 40-55 clay 55-60 hard shale
1-8	75	15	0-65 clay and gravel 65-75 shale
1-9	75	20	0-75 clay and gravel
1-10	60	20	0-45 gravel, 45-55 clay, 55-60 rock
1-11	60	30	0-45 gravel, 45-60 clay and gravel
1-12	70	40	0-30 sand and gravel, 30-70 rock
1-13	75	40	0-45 gravel, 45-75 rock
1-14	75	40	0-15 sand and gravel, 15-35 sand 35-75 rock
1-15	60	40	0-10 sand 10-60 sandstone
1-16	60	40	0-25 sand, 25-60 rock
1-17	110	40	0-45 sand and gravel, 45-110 rock
1-18	120	40	0-45 sand and gravel, 45-120 rock
1-19	120	40	0-70 gravel and boulders, 70-90 rock, 90-120 boulders and gravel
1-20	120	40	0-40 gravel, 40-120 rock
D.B.S. 1-21	115	40	0-15 gravel, 15-60 rock 60-115 gravel and shale
1-22	80	40	0-80 clay and boulders and gravel, blind at 78 feet
1-23	117	40	0-65 gravel and boulders, 65-117 shale
1-24	75	40	0-75 gravel
1-25	70	53	0-70 gravel, boulders, clay
1-26	135	50	0-45 clay and gravel, 45-90 sandy blue clay, 90-135 shale
1-27	30	45	0-30 gravel went blind at 30 feet, skidded with same results
1-28	120	30	0-100, red shale, 100 to 120 sandstone
1-29	75	40	0-75 gravel, clay, boulders
1-30	120	40	0-60 gravel, 60-120 shale
1-31	120	50	0-60 gravel, 60-120 shale
1-32	118	75	0-90 sand and gravel, 90-118 rock
1-9-AC	65	20	0-25 clay and boulders, 25-60 shale
1-23-AC	65	40	0-25 gravel, 25-65 shale
1-32-AC	90	30	0-90 gravel

Profile	Depth	Average Charge in lbs.	Drillers log
Prospect D-BS (Cont'd.)			
2-1	118	50	0-90 sand and gravel, 90-118 rock
2-2	135	50	0-90 clay and gravel, 90-135 hard shale
2-3	135	40	0-40 gravel, 40-135 clay and gravel, shale
2-4	90	50	hard rock 0-90
2-5	120	50	0-15 clay and boulders 15-120 shale
2-6	180	75	0-180 shale
2-7	117	75	0-20 clay and boulders 20-117 shale
2-8	80	50	Hard rock
2-9	120	50	0-20 clay and boulders 20-120 shale
2-10	125	50	0-15 clay and boulders 15-125 shale and hard rock
2-11	130	50	0-15 gravel and clay, 15-80 hard rock 80-115 red shale 115-130 hard rock
2-12	135	50	0-135 layers of hard rock and shale
2-13	69	50	0-69 layers of hard rock and shale
2-14	109	50	0-12 clay and gravel, 12-109 hard rock with shale layers
2-15	120	50	0-25 gravel, 25-75 shale 75-120 hard rock
2-16	120	40	0-80 hard rock, 80-120 shale
2-17	78	50	0-70 gravel, 70-78 shale
Prospect D-BS redrills			
1-25	45	(5 x 10	5 hole pattern 0-45 gravel
		(5 x 20	
1-27	135	50	0-40 gravel, 40-60 shale 60-115 clay and gravel 115 - 135 shale
Prospect D-BT			
1-1	90	20	0-45 clay and gravel, 45-90 hard rock with shale layers
1-2	75	20	0-45 clay and gravel, 45-75 shale
1-3	90	35	0-45 clay and gravel, 45-90 hard rock and shale
1-4	90	40	0-90 clay and gravel
1-5	90	40	0-30 clay and gravel 30-90 clay with layers hard shale
1-6	120	40	0-45 clay and gravel, 45-120 shale and hard rock
1-7	120	40	0-45 clay and gravel 45-120 hard rock and shale
1-8	120	40	0-5 clay and gravel 5-120 hard rock and shale
1-9	120	40	0-30 clay and gravel, 30-120 hard rock and shale
1-10	90	20	0-35 clay and gravel, 35-90 hard rock and shale
1-11	95	20	0-45 clay and gravel, 45-55 gravel 55-95 hard rock

Profile	Depth	Average Charge in lbs.	Drillers log
Prospect D-BT (cont'td.)			
1-12	120	40	0-65 clay and gravel, 65-120 rock
1-13	120	40	0-15 clay and boulders, 15-30 clay and gravel 30-45 gravel 45-120 hard rock and shale
1-14	120	40	0-40 clay and gravel, 40-120 hard rock and shale
1-15	120	40	0-30 clay and gravel, 30-120 clay and hard rock
1-16	105	40	0-25 gravel, 25-105 clay with hard rock layers
1-17	120	40	0-60 clay and gravel, 60-120 hard rock
1-18	120	40	0-60 clay and gravel 60-120 hard rock
1-19	140	40	0-60 clay and gravel 60-105 hard rock, 105-140 shale
1-20	120	40	0-60 clay and gravel, 60-120 shale
1-21	120	40	0-20 gravel, 20-80 clay and gravel, 80-110 shale, 110-120 hard rock
1-22	135	40	0-15 gravel, 15-65 gravel and clay, 65-75 hard rock,75-135 clay gravel soft shale
1-23	120	30	0-50 clay and gravel, 50-120 shale and sandstone
1-24	120	18	0-20 clay and gravel, 20-120 shale
1-25	120	13	0-25 clay and gravel, 25-60 hard shale 60-75 gravel, 75-120 shale
1-26	120	13	0-70 clay and gravel, 70-120 shale
1-27	130	40	0-20 clay and gravel, 20-80 shale and sandstone, 80-130 shale
1-28	105	40	0-75 clay and gravel, 75-105 shale
2-1	135	20	0-125 clay and gravel, 125-135 shale
2-2	120	20	0-120 clay and gravel
2-3	120	20	0-90 clay and gravel, 90-120 shale
Prospect D-BU			
1-1	190	20	0-15 clay and gravel, 15-30 shale 30-190 hard rock and shale
1-2	120	45	0-15 clay and gravel 15-120 layers of shale and sandstone
1-3	120	7½	0-30 clay and gravel, 30-120 shale and sandstone
1-4	120	30	0-30 gravel, 30-120 shale
1-5	105	40	0-75 shale, 75-105 hard rock
1-6	120	20	0-15 clay, 15-120 shale
1-7	105	25	0-105 shale with hard rock layers
1-8	120	25	0-20 clay and gravel, 20-80 red clay, 80-120 shale
1-9	105	30	0-50 clay and gravel, 50-105 shale
1-10	120	25	0-80 clay and gravel, 80-120 shale

Profile	Depth	Average Charge in lbs.	Drillers log
Prospect D-BU (cont'd)			
1-11	120	30	0-30 gravel, 30-90 shale 90-120 hard rock
1-12	120	40	0-55 clay and gravel, 55-120 shale
1-13	105	40	0-60 gravel, 60-105 shale
1-14	135	40	0-45 clay and gravel, 45-135 shale with layers hard rock
1-15	135	40	0-40 gravel, 40-90 clay and boulders, 90-135 shale
1-16	135	16	0-90 clay and gravel, 90-135 soft shale
1-17	150	20	0-15 gravel, 15-40 clay and boulders, 40-150 shale
1-18	120	40	0-45 gravel, 45-70 clay and gravel, 75-120 hard rock
1-19	165	30	0-10 clay, 10-55 gravel, 55-90 shale 90-165 gray shale
1-20	120	40	0-50 gravel, 50-75 shale, 75-120 hard rock
1-21	150	18	0-55 gravel, 55-105 clay and rock stringers, 105-150 shale and sandstone stringers
1-22	135	13	0-60 clay and gravel, 60-135 shale
1-23	135	13	0-75 clay, 75-135 shale
1-24	135	12	0-65 clay and gravel 65-135 shale
2-1	105	25	0-105 shale with layers of hard rock
2-2	120	25	0-60 gravel, 60-120 shale
2-3	135	25	0-8 clay and gravel, 8-105 sandstone 105-135 gray shale
2-4	120	20	0-10 clay, 10-105 shale 105-120 blue clay
DBT-2-1C	132	40	0-80 clay 80-132 shale
DBT-2-2C	70	40	0-35 clay and gravel 35-70 shale
DBT-2-3C	120	40	0-50 clay and gravel, 50-120 shale and hard rock
DBT-31C	60	40	0-60 clay and gravel

CONCLUSIONS

In summing up this report I will first cover the effectiveness of the different methods used. The photogeology work supplied us with good base maps and the location of outcrop areas. They were of little help in determining lithology and local structure. Checking the data collected by surface work against the photogeology at the end of the season helped to interpret certain photogeology phenomena. In spite of this added information, the surface lavas and complexity of structure in the area would seem to preclude the using of photogeology for anything except position of outcrops and for base maps.

The surface geology study brought forth much more information but it was handicapped due to difficulties in determining the relative ages of different lava flows. Structure is so complex in the area that lava dating is almost a must in helping to solve it. Our surface work was able to determine from outcrop sectioning that there are certain sedimentary beds that may form hydrocarbon reservoirs at depth. The sedimentary sections encountered did not reveal any magoscopic palaeontological samples and the samples that were collected for palynological analyses were weathered and altered to a degree beyond accurate dating. Since this type of sample and dating are I believe unique to B.C., and most of Western Canada for that matter, we expected to have some difficulties. This season however points out that palynological samples taken from surface outcrops have to be taken five or six feet back from the weathered surface either by core drill or as we had to do, by trenching with shovel and dynamite. Samples so taken were able to be analysed. Helicopter transportation served us fine as it was a reconnaissance survey. However, future detail work, particularly along creeks, will have to use horses as the timber cover precludes helicopter in many areas.

The seismic portion of this report indicates that operating problems are no more difficult than in northeastern B.C. or northern Alberta. Our seismic program also proved that reasonable records can be obtained even when shooting through surface lavas in this area. It was, however, very difficult to interpret these records which is not a mechanical problem but rather one of complex subsurface structure and lithological relationships. Our surface work, and in fact the drilling of our well, indicate some beds are separated from their adjacent beds by what could be 8000' in depositional history. Multiple faults and extreme lateral variability in lithologic facies were indicated in surface sections and if such were to occur at depth, a seismic record although correct mechanically would be most difficult to interpret unless one knew a number of details of the subsurface. All in all the seismic experiment could be considered a success and the tool used again to solve problems when more is known of this basin.

The other section of this report covers the 10,864' well drilled by our company. This well proved that we had over 9000' of sedimentary section with no lava present. The first lavas encountered were at 9100'

and were of Eocene age as determined by potassium-argon dating methods. This is unusual as palynological analyses indicated we spudded in Upper Lower Cretaceous and drilled in this to 2275' where we faulted back into Upper Cretaceous and then drilled progressively older beds with depth to as old as Jurassic. At 6270' we faulted back to Upper Cretaceous again and drilled older beds with depth to a fault probably occurring at 7590', to get us into Eocene lava at 9100'. In other words we were drilling younger rocks at 9100' than what we had spudded in. Basement in this test consisted of a granodiorite encountered at 10,603' and penetrated for over 200'. Aging by potassium-argon would indicate this basement to be an intrusive no younger than Cretaceous and no older than Jurassic. The two most interesting facts revealed by the drilling of this test are: the thickness of sediments without lavas (9000') and the numerous shows of light oil staining; the thickest one being 70'. This light oil staining extended over nine scattered zones down to a depth of 7130' and totaled 280' in all. All staining was of a light asphalt base type commonly associated with commercially productive areas. However, the lack of porosity and permeability precluded testing except in some of the upper zones which may be worth stimulating with artificial methods. Artificial stimulation was not attempted in this test as the hole diameter and casing set in order to reach a total depth of over 10,000' would have made it most expensive to try and test the shallower oil stained zones. A future shallow well drilled expressly for this purpose may be the answer.

In summing up our work by photogeology, surface geology, seismic and deep drilling, we feel that we have proved the existance of a sedimentary basin that may yield commercial amounts of hydrocarbon in the future. It would also appear that Jurassic or late Cretaceous intrusives will form the basement of this basin rather than Permain carbonates as we had formerly thought. Our test well penetrated mainly Cretaceous sediments and these were found to be reasonably well sorted sediments of continental origin with just an indication of low grade metamorphism. This metamorphism does not appear to be enough to preclude hydrocarbon trapping as evidenced by the light to medium oil staining. Unfortunately, the Cretaceous continental beds penetrated, as well as having no present porosity, appear to have had little primary porosity. This would indicate slim chances for porosity and subsequent hydrocarbon trapping developments in the immediate area but such continental basins very often develop porosity in other clastics near the center of the basin. Further work, therefore, should be oriented along the line of determining the character of the basin and so finding its center.

A further conclusion to be drawn from the area is that there is a distinct possibility of a good section of Upper Cretaceous to Eocene existing beneath the lavas in some other sector of the basin. It would appear that the desire to locate our initial test in a lava window may have caused us to drill in an area where younger, less consolidated, sediments were eroded. The presence of Eocene lavas were proved at 9100' in the Nazko a-4-L well and it would seem logical that the sediments immediately adjacent to this are also of the same age. Further prospecting should, therefore, also concentrate on the dating of lava outcrops in the area with the hope that information as to amount of sediments present younger than those penetrated in our well can be determined. Such beds may have much better reservoir characteristics.

Finally, we feel our last year's work has proved these facts:

(a) The presence of a sedimentary basin.

(b) The presence of light to medium hydrocarbons.

(c) Such a basin can be drilled at reasonable cost.

(d) The seismic tool can be used to solve problems in certain local areas.

The only factor left is the amount of reservoir which can only be determined by a great deal more surface and subsurface work.

N. W. Taylor

March 1961