REPORT OF SEISMOGRAPH SURVEY

TAYLOR LAKE AREA

YUKON TERRITORY, CANADA

Submitted to:

GREAT PLAINS DEVELOPMENT COMPANY OF CANADA LIMITED

CALGARY, ALBERTA

Report by:

SEISMOTECH LIMITED

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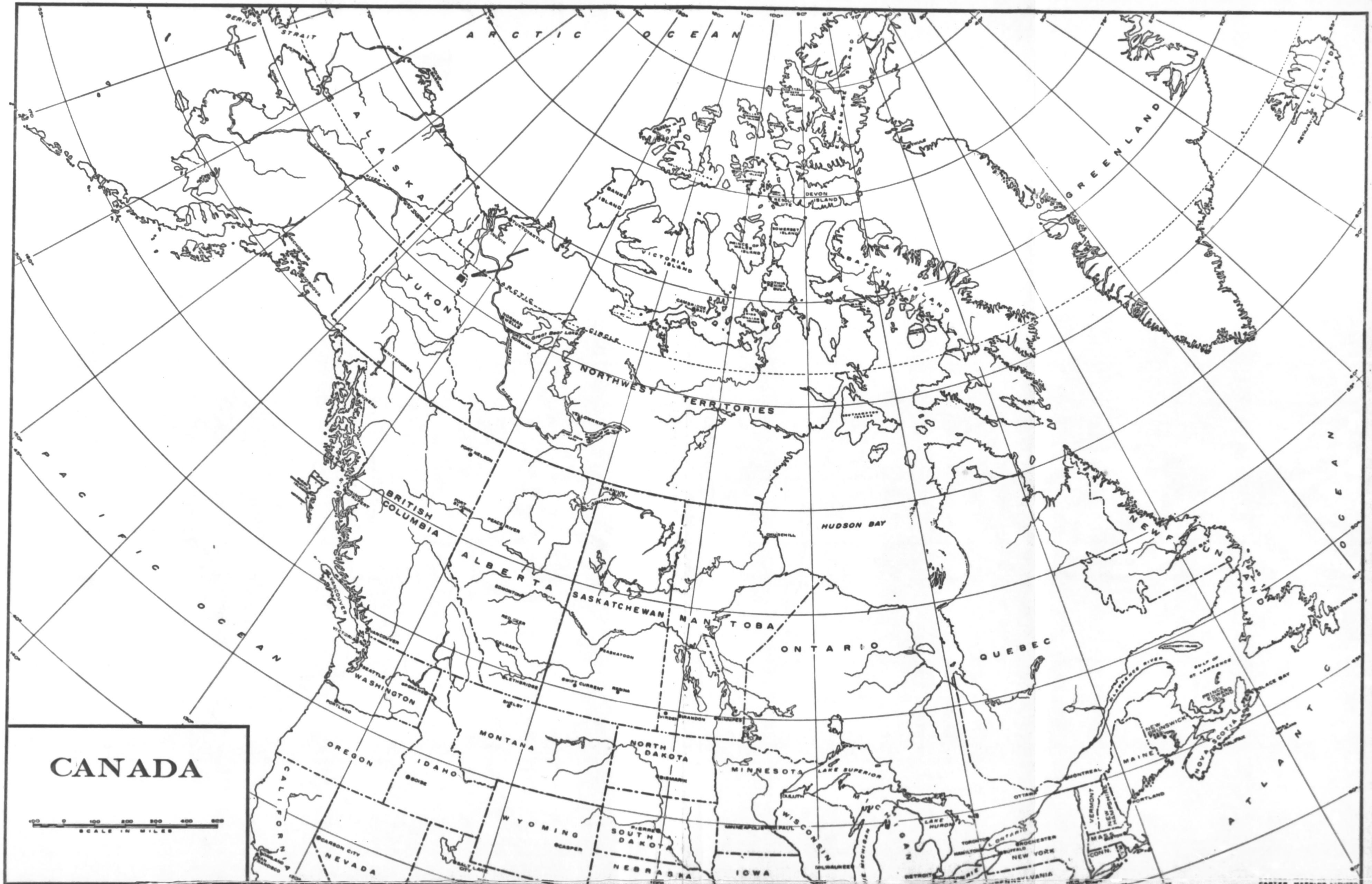
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ICELAND
HUDSON BAY
CHURCHILL
PORT NELSON
PEACE RIVER
BRITISH COLUMBIA
ALBERTA
SASKATCHEWAN
MANITOBA
ONTARIO
QUEBEC
NEWFOUNDLAND
PACIFIC OCEAN
ATLANTIC OCEAN
EDMONTON
RED DEER
CALGARY
LETHBRIDGE
SASKATOON
SWIFT CURRENT
REGINA
BRANDON
WINNIPEG
VANCOUVER
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SPOKANE
PORTLAND
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BOISE
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VERMONT
NEW HAMPSHIRE
MASS.
CONN.
MAINE
PORTLAND
NEW BRUNSWICK
NOVA SCOTIA
PRINCE EDWARD ISLAND
GULF OF ST. LAWRENCE

PREFACE

The main purpose of this seismic survey was to delineate the approximate limits of an anticynal type feature, reported by a surface geological survey to exist within the working area.

The prospect under discussion borders on the Snake River, Yukon Territory, 200 miles northwest of Norman Wells, Northwest Territories. Specifically, program is located between 133°00' and 133°45' Longitude, and 65°45' and 66°00' Latitude North.

Because of the remote location and rough terrain, equipment and personnel were transported by helicopter rather than in the more conventional manner with wheeled or traced vehicles.

Party 90 of Seismotech Limited, Calgary, Alberta, began field operations on March 21, 1961, from a tent camp on Snow Lake, located near 133°23' Longitude and 65°53' Latitude North. A total of 12.6 ten-hour days were worked, during which time a total of 35 split continuous profiles, one half-mile refraction profile and 3 dual profiles were shot. Field work was completed on April 18, 1961.

EVALUATION OF RESULTS

Reflection Records

The records are good enough to follow three main reflections throughout the survey with the exception of a few local obscurities. These reflections denoted A, B and C, are supplemented by intermediate reflections and, in the case of the better records, by at least two events which arrive earlier than the A.

Discontinuities of the traverse between Shot Points 10 and 20 and between 32 and 35 are the result of surface coulees over which no crossing could be made without a progress delay. The helicopter could not land the recording doghouse at Shot Point 34 as a result of updraft from the coulee and a hole could not be drilled at Shot Point 33 on account of surface rocks.

No attempt has been made to identify the reflections, although it is suggested that the "B" reflection is closely below the top of the Paleozoic.

The first breaks are not clear, especially from fractional charges, but reliable velocity determinations can be made from secondary breaks wherever the first arrivals are too weak to read accurately.

Seismic Maps

The following maps have been compiled:

Horizon A - time structure

Horizon B - time structure

Isochron A to B

√ Surface Topography

No map of Horizon C has been made because it so closely conforms to Horizon B.

Results and Conclusions

The Taylor Lake Area is one of high subsurface relief. For lack of a contourable configuration of shot points it has been conjectured that the structure consists of elongate folds striking northwest-southeast, or normal to the main traverse.

The most prominent structure is a high on Horizon A which reaches a maximum at Shot Point 16. The absence of clear reflections from Horizons B and C at Shot Points 15 and 16, may suggest the presence of faulting. This feature may be interpreted as an overthrust. Some diffracted energy is noted on Profile 15, arriving .200 second later than Reflection C, which event may represent some return from a fault plane dipping southwest. Although Reflections B and C are obscured, steep southwest dip is noted between Shot Points 14 and 16. To support the diagnosis of faulting, it is noted that southwest dip can be interpreted at Horizon C between Shot Points 18 and 20, where the two shallower reflections are obscured. However, these three records are of poor quality.

The prominent stratigraphic feature is seen on the Isochron A-to-B map in the form of an almost consistent loss of interval (.100 second between Shot Points 29 and 39) to the northeast throughout the entire traverse between Shot Points 41 and 12. Between Shot Points 12 and 16 a possible reversal of this trend is interpreted on poor records. However, it is most noteable that this trend is absent between Shot Points 20 and 28 where the interval is relatively constant.

The thinning trend between A and L is interpreted by a possible reversal of isochron data between Shot Points 1 and 2. This could represent a miscorrelation of data resulting from an apparently abrupt truncation or loss of section between Shot Points 1 and 2. This is interpreted as an erosional high which is accompanied by a scarp on its northeast flank. Faulting is not apparent.

The last feature of interest is a steep (.060 second per mile) segment of southwest dip on the B and C Horizons between Shot Points 38 and 41.

The reliability of computational data is regarded as sound in view of the consistency of the refractional velocity (9,500 plus or minus 1000 feet per second apparent) revealed by the first breaks. One extended refraction shot (two-thirds of a mile) showed a velocity of 12,000 feet per second. The presence of frost in the area has not introduced any problems with uphole times.

It is possible that the observed subsurface structures have affected the course of the Snake River.

It is concluded generally that the Taylor Lake Area holds great potential for the entrapment of oil and gas, both stratigraphically and structurally. In view of the success of a helicopter supported seismic crew in achieving most useful results it is respectfully recommended that this exploration method be adapted to an extended seismic program in the Taylor Lake Area. It is likely that the unit cost of future work can be reduced considerably by effective balancing of the recording and drilling capacities of the crew and some minor changes in the design of drilling equipment.

OPERATIONS

Operating Conditions

The Taylor Lake Area, so named from a major lake some twenty miles east of the prospect, is accessible only by air nearly 200 air miles northwest of the settlement of Norman Wells, N.W.T. It is situated in the north-east central portion of the Peel Plateau. Very little regional topographic change is encountered, although drainage patterns are made prominent by severe erosional action. Stream banks vary from 100 to 800 feet high, at slopes approaching 90 degrees.

A sparse growth of black spruce, ranging from six to ten inches in diameter, ten to twenty feet high, covers the area. It was not possible to make an evaluation of bush growth due to three or four feet of snow.

All lines traversed by the seismic crew were cut by five Indian boys employed at Fort Norman, N.W.T. A trail five feet wide was opened with the use of axes and power saws. It was possible to cut approximately three miles of line per day. Lines did not cross the Snake River.

Drilling

One portable rotary drill, designed expressly for this survey, was provided by Sedco Exploration Ltd. of Calgary. This 650 pound unit was powered by a small gasolene engine, and was capable of drilling a two to two and one-half inch hole to a depth of forty feet.

Two Ingersoll-Rand, gasolene driven air compressors, weighing 600 pounds, and producing 36 c.f.m. at 90 p.s.i. each, provided sufficient air volume for circulation purposes. It was discovered,

however, that the drilling capabilities were limited where water saturated, sandy clay was encountered. The rate of drilling was very good in continuous permafrost or hard sandstone. Drill stem was made up in five foot lengths for ease in moving and handling.

Hawthorne Insert Rockcutters, Varel two-cone rock bits and two-blade finger bits were used. Finger bits, developed jointly by Sedco and Rice Machine Services, were made in varied diameters, with several different water course sizes. This bit, when kept sharp, proved to be most efficient over the other type employed.

The drill was moved by suspending the unit beneath a helicopter. The trip between shot points took thirty seconds. The two compressors were moved as a single unit in the same manner. Personnel and fuel were transported separately by helicopter.

Recording

Split continuous profiles were shot at all locations, utilizing 1800 foot portable Vector cables. A 24 trace set of SIE-GA-11 amplifiers and oscillograph was used in conjunction with an Electro-Tech DS-7 bias-type tape recorder. These instruments were housed in a four foot square plywood and Dexion recording doghouse. This unit, weighing approximately 750 pounds, was "sling-loaded" between shot points by helicopter. Personnel were air lifted separately.

Nine Electro-Tech moded EV-15 seismometers per group, weighing 4 ozs. each, spaced 15 feet apart, astride flags placed at 150 foot intervals, were employed throughout the survey. Spreads were shortened where necessary by simply reducing the number of stations.

Magnetic tapes are recorded on a 1-30-92 filter straight circuit, fast AVC and 100% Gain. Conventional wiggly trace playbacks

were made on an 0-64 filter and 20% bilateral resistive mix, with other settings remaining constant.

The playback system allows the procurement of a record corrected for statics and normal moveout.

Three record cross sections were prepared:

(a) Wiggly trace uncorrected for either weathering or normal moveout.

(b) Wiggly trace structure, corrected by removing normal moveout only and uncorrected for weathering.

(c) Seismod structure, corrected for weathering and normal moveout. Dip was prorated across the spread between the centers or computational traces of adjacent profiles so that the time structure shown is similar to that on the prepared time cross sections.

Two, three and four hole patterns spaced five feet apart were shot at the first seven locations for experimental purposes only. Good useable records were obtained at depths of five to ten feet where only thin near surface weathering was encountered. Records taken northeast of Shot Point 20 were generally good if shot below the fifteen foot level.

Charge size varied from one-half to thirty-five pounds. Close proximity of the recording dog-house restricted the use of any larger charge sizes.

Surface charges to a maximum of thirty pounds were taken at Shot Point 29. Reflected energy return was too weak to warrant further experimentation of this technique.

Surveying

Surveying was done entirely on foot by Gurley transit and chain to assure control of less than three feet vertical on all tra-

verses. Ties were confirmed by "double running" the lines shot.

An elevation of 1000 feet above Sea Level was assumed at Shot Point Number One. No vertical elevation references were within or near the area.

Horizontal control was established from the south end of "Snow Lake" and referred directly to aerial photographs of the prospect. Farther correlation was made to several smaller lakes and drainage patterns outstanding on the aerial photos.

All geophone recording stations and shot points were chained and flagged.

The survey party was also responsible for the direction of the line cutting crew.

Helicopters

Two helicopters were ferried from Calgary to the prospect. Operated by Bullock Wings and Rotors Ltd., of Calgary, they were maintained by an aircraft engineer retained by Bullock.

One machine, a supercharged Bell Model 47-G3, was employed to sling-load all equipment. It was also capable of carrying two passengers plus pilot, when not lifting equipment.

The second machine, a Bell Model 47-J Ranger, was used exclusively for the transportation of personnel and small miscellaneous freight items. Three passengers and pilot made up a capacity load.

Helicopter fuel and lubricating oil was flown to camp by fixed-wing aircraft from the Imperial Oil Refinery, Norman Wells, in 45 gallon metal drums. Average fuel consumption per helicopter was 15 gallons per flying hour.

A five-channel transceiver in each aircraft provided com-

munication between helicopters, and a helicopter-to-camp frequency.

A total of three operating days was lost due to blizzard conditions and a consequent grounding of aircraft.

It was necessary to pre-heat both helicopter engines before starting each morning due to existing sub-zero temperatures.

Fixed-Wing Aircraft

Personnel and freight were flown from Norman Wells to camp by Beaver and Otter aircraft, both De Havilland machines, provided by Pacific Western Airlines of Edmonton.

The Beaver is capable of carrying pilot and five men, or ten kegs of fuel, or one thousand pounds of freight. Twenty-one empty fuel kegs could be loaded on return trips to Norman Wells.

The Otter aircraft is rated with a capacity of pilot plus fourteen men, or twenty-one kegs of fuel, or two thousand pounds of freight. Thirty-five empty fuel kegs could be loaded.

Camp

The field crew was quartered in a tent camp on the east shore of Snow Lake. Heating and cooking was done with wood stoves.

Woods "3-Star" sleeping bags were found satisfactory despite temperatures ranging to 45 degrees below zero.

Electricity was provided by a 5 Kilowatt air-cooled gasolene Onan Lighting Plant. The purpose of this unit was primarily to supply power for charging recording batteries and radio operation.

All food was flown in with initial freight shipments. Frozen foods proved most practical in view of temperatures encountered. Perishable foods were stored in a tent with the light plant in order to keep from freezing.

Communications

One AM type transceiver, a KAAR TR-248, was obtained from Hillhurst Radio of Calgary. With a transmission output of 28 watts, it was possible to communicate three times daily, on a frequency of 5122.5 kilocycles, with Pacific Western Airlines in Norman Wells.

A second frequency of 5619 kilocycles allowed communication with Pacific Western fixed-wing aircraft.

A frequency of 5350 kilocycles was intended for use with Canadian National Telegraph Service at Whitehorse, Watson Lake and Blueberry. Although incoming signals were frequently received from these stations, our transmission output was apparently not sufficient to reach them.

A fourth channel to Fort Good Hope was scheduled on 3317 kilocycles, although contact was never made with the Department of Transport there.

The fifth operating frequency of 4300 kilocycles was used for communicating between camp and the two helicopters.

All radio transmissions were made under the call letters CJP 941, assigned to Seismotech Limited by the Department of Transport.

OPERATIONAL RECOMMENDATIONS

Certain modifications could be made on the present drilling equipment in order to speed up drilling production, and to expand the somewhat limited capabilities of the rig under specific drilling conditions. The addition of a transmission would provide a variable power transfer with a resultant choice of rotary table speeds. This was most apparent where hard rock ledges were encountered. Excessive rotary table speed caused the bit to jump, rather than a consistent cutting action as might be achieved by slowing the table speed.

The inside diameter of each tool joint, at one-half inch, restricted air travel, causing the compressors to operate at 40 p.s.i. It is the opinion of the drilling engineers that by increasing the inside tool joint diameter to near 1¼ inches, would reduce the operating pressure to around 10 p.s.i. This lower air pressure would create less down-hole heat, thereby alleviating some of the thawing problems encountered in drilling permafrost.

It is respectfully recommended that the drill complement be increased to two complete drilling units on future work of this type. Experience has shown that the recording unit could quite readily shoot seven holes per day. The addition of a second drill would no doubt increase the efficiency of the recording crew, and would probably reduce the overall cost per profile of helicopter services.

Future helicopter-supported seismic ventures should include the employment of an efficient crew-to-helicopter form of communication.

The type of portable radio used by Seismotech was not successful when exposed to extreme cold temperatures.

Finally, the proper selection of base camp-to-town radio communication is of utmost importance. Transmission output, alternate frequencies, an efficient receiving expiditor and choice and erection of antennae should be given careful consideration. Although the AM type transmitter employed here proved successful on some frequencies, it is felt that a single side-band transceiver might prove equally useful as an alternate means of communication.

Respectfully submitted,

SEISMOTECH LIMITED.

M. E. Baker, P. Eng.

H. W. Godwin.

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SEISMOTECH LIMITED.

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H. W. Godwin

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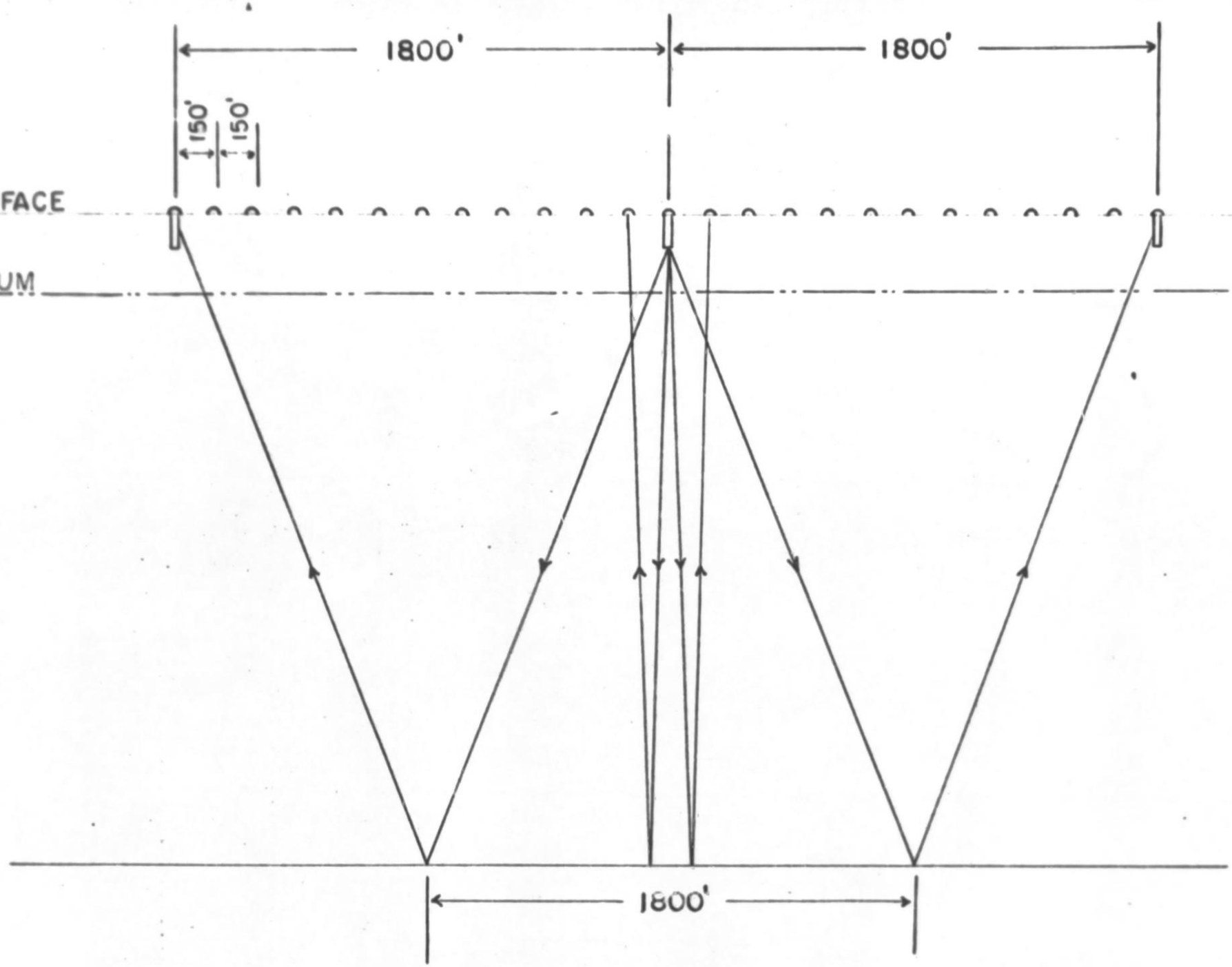
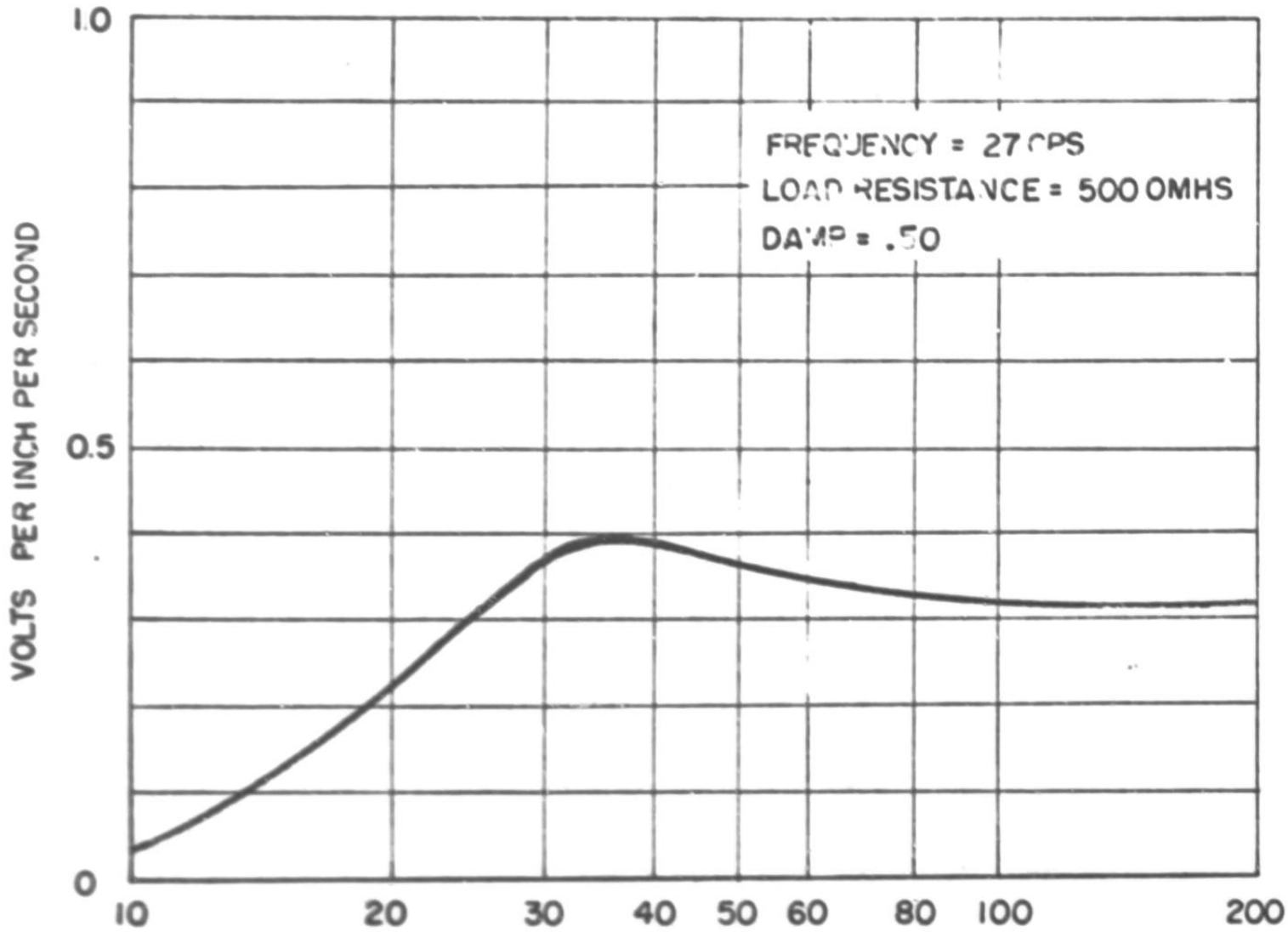


RECORDING SET-UP

24 STATIONS
9 PHONES PER STATION
PHONE INTERVAL 14'
S.P PHONE 10' FROM S.P

FIG. 2



OUTPUT vs FREQUENCY

of

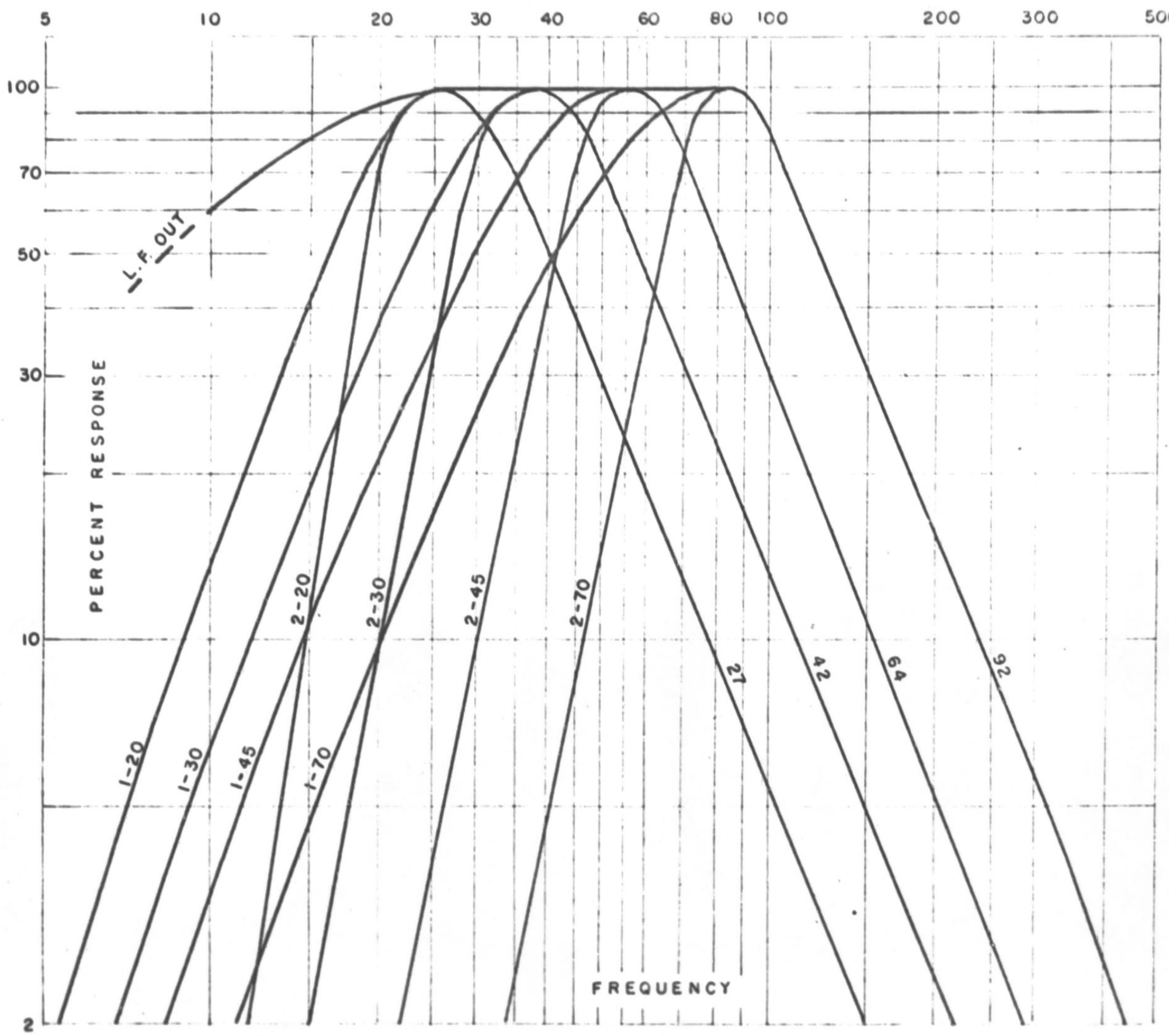
EV-15 GEOPHONES

9 GEOPHONES PER GROUP, SERIES-PARALLEL HARNESS

SEISMOTECH LIMITED

CALGARY, ALBERTA

Figure 3



AMPLIFIER RESPONSE

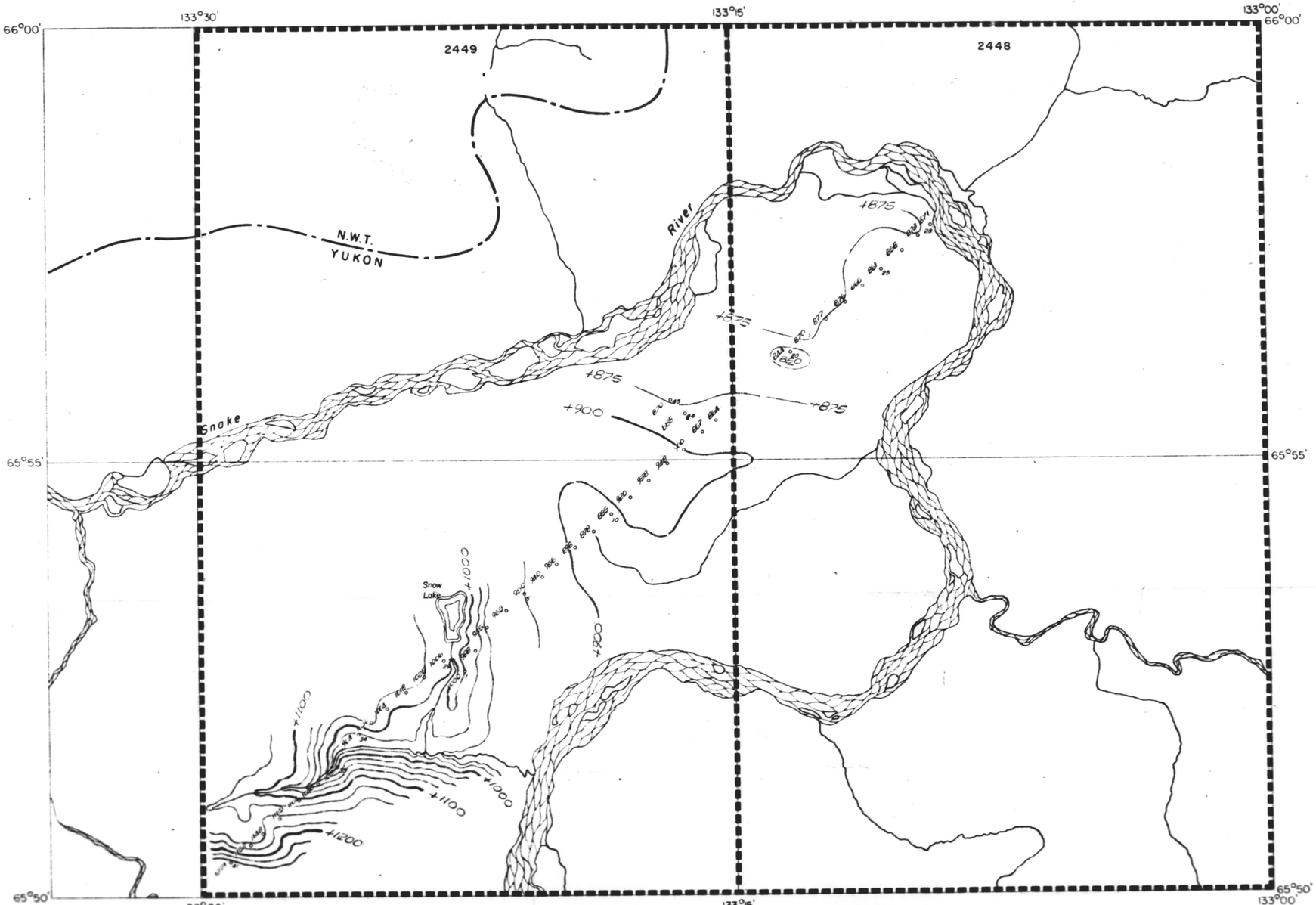
S.I.E. GA-II

AS EMPLOYED BY

SEISMOTECH LIMITED

CALGARY ALBERTA

Figure 4



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GREAT PLAINS DEVELOPMENT
COMPANY OF CANADA, LTD.

Seismograph Survey

SURFACE TOPOGRAPHY

TAYLOR LAKE AREA
YUKON TERRITORY, CANADA

Seismic Datum Reference Elevation Assumed
Seismic Datum Velocity 9000'/sec.
Date June 1961
Geophysical Contractor SEISMOTECH LIMITED

Contour Interval 25'
Contoured by M.E.Baker
Scale: 1" = 1 mile

76-6-13