SEISMOLOGICAL SERIES OF THE EARTH PHYSICS BRANCH

No. 68

SEISMOLOGICAL BULLETIN
JANUARY — DECEMBER 1973

Seismological Service of Canada
DEPARTMENT OF ENERGY, MINES AND RESOURCES

Ottawa, Canada 1974

SEISMOLOGICAL SERIES

OF THE

EARTH PHYSICS BRANCH

No. 68

SEISMOLOGICAL BULLETIN

January - December

1973

by

R.J. Halliday, W.E. Shannon, F. Lombardo and B. Compton

Seismological Service

of Canada

Ottawa, Canada

Department of Energy, Mines and Resources

Earth Physics Branch

1974

Cat. No.: M74-3/68

No. 68

SEISMOLOGICAL BULLETIN

January - December, 1973

INTRODUCTION

Previous issues of the Seismological Series of the Earth Physics Branch (formerly Seismological Series of the Dominion Observatory) have included the Canadian Seismological Bulletin. From 1964 to 1971 the Bulletin has contained summary information on seismological observatories operating in Canada, on the availability of data, on instrument changes, on calibration curves and a chronological list of P-phase arrival times, amplitudes, periods and directions of first motion.

Since information on P phases is now routinely printed in the monthly bulletins of the International Seismological Centre, and this Centre is now firmly established with a maintained schedule of publication, it has been decided to cease publication of the P-phase information from the 1972 and subsequent annual editions of the Bulletin.

STATIONS

Commencing in 1972, Canadian seismograph stations were classified as either "standard" or "regional" stations. A standard station consists, at minimum, of 3 orthogonal short-period and 3 orthogonal long-period seismographs, each producing a photographic record. The 3 short-period seismometers used in most standard stations are Willmores with a nominal period of one second. The seismometer signal, after passing through an attenuator which has resistors arranged in a TEE pad formation, is fed into a Tinsley galvanometer having a nominal period of one-quarter second. A Sprengnether 3-component photographic recorder is used for both short- and long-period seismographs. The short-period recorder drum rate is 60 millimeters per minute, while the long-period rate is 15 millimeters per minute. The 3 long-period Columbia seismometers used in a standard station have their free period nominally set to 15 seconds. The same attenuator TEE pad formation is used in the long-period seismographs as in the short-period. The long-period galvanometers are Lehner-Griffiths with a nominal period of 90 seconds.

Regional stations consist of a single component short-period seismograph only, using a Willmore short-period vertical seismometer. These stations are used in seismically active areas of Canada to supplement the standard network or for special studies. Most regional stations have electronic amplification using a Geotech preamplifier and a Geotech helicorder for visual recording. At one regional station, PBQ, SPNS and SPEW records are available, as well as SPZ records. At regional station SIC, a photographic system without electronic amplification is still in use.

During 1973, visual recorders were in operation at several standard stations, producing dual-band, extra long-period and experimental visual records. These additional records were not routinely microfilmed for the Seismological Data Center, Asheville, N.C. The additional visual records were, however, microfilmed for unusual events of significance.

In July 1972, 3-component, completely automatic, long-period digital tape systems were commissioned in British Columbia at Revelstoke, Wells and Alexis Creek by the Seismology Division, Earth Physics Branch.

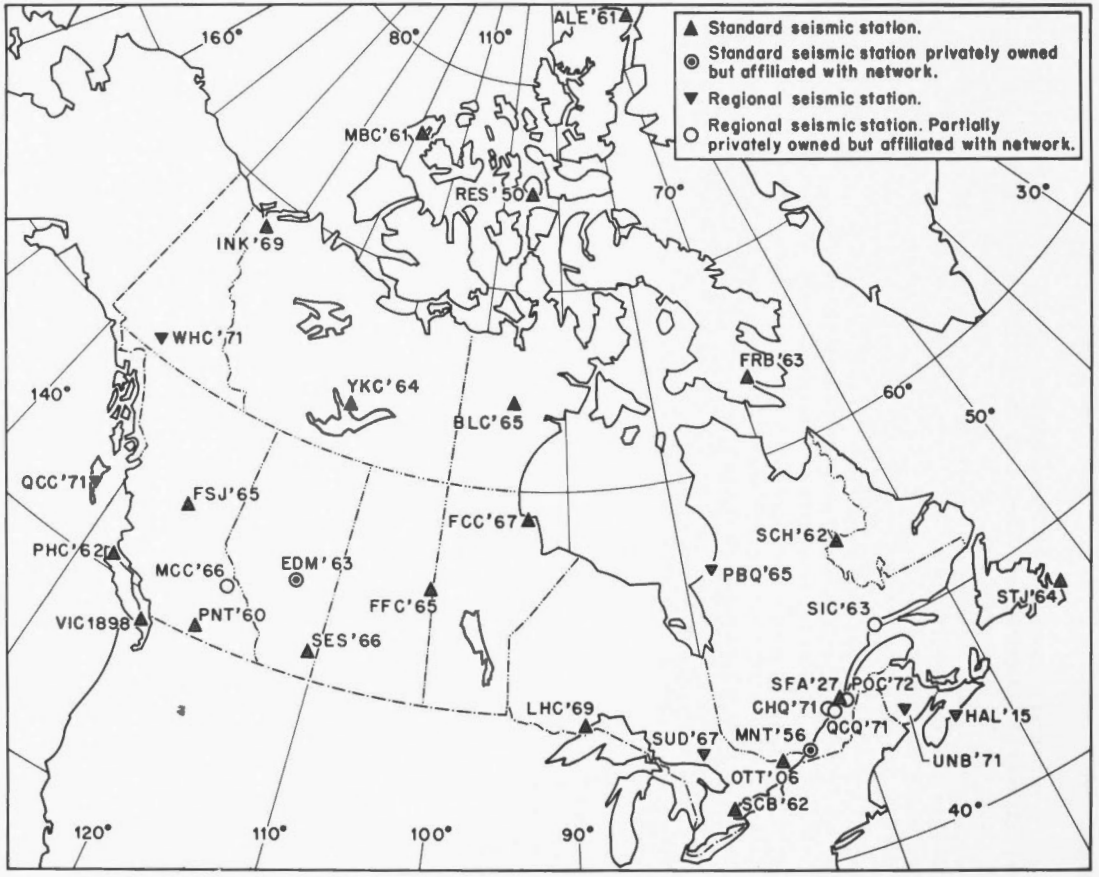


Figure 1. Canadian Seismograph Network 1973.

During 1973, other seismological stations, mainly short-period seismographs, were operated in Canada by other agencies, chiefly universities. Since these stations are not part of the Canadian Seismograph Network nor operated by the Seismology Division, they are not described in this Bulletin.

Figure 1 shows the operating standard and regional stations of the Canadian Seismograph Network in 1973, and a summary list of the 22 standard stations and 11 regional stations follows.

STANDARD SEISMOGRAPH STATIONS:

Alert, N.W.T. - station code, ALE
Owned and operated by the Earth Physics Branch. Station siesmologist in 1973 was W.T. Piché, succeeded by C.A. Cederstrand on September 7.

Baker Lake, N.W.T. - station code, BLC
Owned and operated by the Earth Physics Branch. Station seismologist in 1973 was O.J. Jensen.

Edmonton, Alberta - station code, EDM
Instrumented by the Earth Physics Branch. Operated by the Department of Physics, University of Alberta, with contract support from the Earth Physics Branch.

Flin Flon, Manitoba - station code, FFC
Owned and operated by the Earth Physics Branch. Station seismologist in 1973 was L. Marsh.

Fort Churchill, Manitoba - station code, FCC
Owned by the Earth Physics Branch. Operated under contract for the Earth Physics Branch by the Radiosonde Division, Atmospheric Environment Service, Department of Environment.

Fort St. James, British Columbia - station code, FSJ
Owned and operated by the Earth Physics Branch. Station seismologist during 1973 was T.S. Browne.

Frobisher, N.W.T. - station code, FRB
Owned by the Earth Physics Branch. Operated under contract by the Radiosonde Division, Atmospheric Environment Service, Department of Environment for the Earth Physics Branch.

Inuvik, N.W.T. - station code, INK
Owned by the Earth Physics Branch. Operated under contract for the Earth Physics Branch by the Radiosonde Division, Atmospheric Environment Service, Department of Environment.

Montreal, Québec - station code, MNT
Owned and operated by Jean-de-Brébeuf College with partial instrumental support and contract support from the Earth Physics Branch (courtesy M. Buist, S.J., Director).

Mould Bay, N.W.T. - station code, MBC
Owned and operated by the Earth Physics Branch. Station seismologist during 1973 was R.V. Green, succeeded by D.A. Wright on June 27.

Ottawa, Ontario - station code, OTT
Owned and operated by the Earth Physics Branch.

Penticton, British Columbia - station code, PNT
Owned and operated by the Earth Physics Branch. Station seismologist during 1973 was M. Wilde.

Port Hardy, British Columbia - station code, PHC
Owned by the Earth Physics Branch. Operated under contract for the Earth Physics Branch by the Radiosonde Division, Atmospheric Environment Service, Department of Environment.

Resolute, N.W.T. - station code, RES
Owned and operated by the Earth Physics Branch. Station seismologist was D.J. Showalter, succeeded by R.V. Green on July 1, 1973.

Saint John's, Newfoundland - station code, STJ
Owned by the Earth Physics Branch. Operated under contract for the Earth Physics Branch by the Department of Physics, Memorial University.

Scarborough, Ontario - station code, SCB
Owned by the Earth Physics Branch. Operated under contract for the Earth Physics Branch by the Radiosonde Division, Atmospheric Environment Service, Department of Environment.

Schefferville, Québec - station code, SCH
Owned by the Earth Physics Branch. Operated under contract for the Earth Physics Branch by McGill University Sub-Arctic Research Laboratory.

Seven Falls, Québec - station code, SFA
Owned and operated by the Earth Physics Branch. Station seismologist during 1973 was J.B. Racine.

Suffield, Alberta - station code, SES
Owned by the Earth Physics Branch. Operated for the Earth Physics Branch by the Defence Research Board, Department of National Defence.

Thunder Bay, Ontario - station code, LHC
Owned by the Earth Physics Branch. Operated under contract for the Earth Physics Branch by the Department of Geology, Lakehead University.

Victoria, British Columbia - station code, VIC
Owned and operated by the Earth Physics Branch. The seismograph observatory is part of the Victoria Geophysical Observatory, Department of Energy, Mines and Resources, 5071 W. Saanich Rd., R.R. #7, Victoria, B.C., V8X 3X3. This unit constitutes the West Coast office of the Earth Physics Branch.

Yellowknife, N.W.T.- station code, YKC
Owned and operated by the Earth Physics Branch. Station seismologists during 1973 were C. Huibers, A/O.I.C., N. Case and I. Ladd.

REGIONAL SEISMOGRAPH STATIONS:

Charlesbourg, Québec - station code, CHQ
Instrumented by the Department of Geology, Laval University, with contract support from the Earth Physics Branch.

Fredericton, New Brunswick - station code, UNB
Instrumented by the Earth Physics Branch. Operated under contract for the Earth Physics Branch by the Physics Department, University of New Brunswick.

Halifax, Nova Scotia - station code, HAL
Owned by the Earth Physics Branch. Operated under contract for the Earth Physics Branch by Dalhousie University.

La Pocatière, Québec - station code, POC
Instrumented by the Department of Geology, Laval University, with contract support from the Earth Physics Branch.

Mica Creek, British Columbia - station code, MCC
Vault owned and operated by B.C. Hydro and Power Authority, but instrumented by the Earth Physics Branch.

Poste-de-la-Baleine, Québec - station code, PBQ
Instrumented by the Earth Physics Branch. Operated under contract for the Earth Physics Branch by Laval University.

Québec, Québec - station code, QCQ
Owned and operated by the Department of Geology, Laval University, with contract support from the Earth Physics Branch.

Queen Charlotte, British Columbia - station code, QCC
Instrumented by the Earth Physics Branch. Operated under contract for the Earth Physics Branch by the B.C. Forest Service.

Sept-Iles, Québec - station code, SIC
Owned and operated by the Iron Ore Company of Canada, Sept-Iles, Québec, with support from the Earth Physics Branch.

Sudbury, Ontario - station code, SUD
Instrumented by the Earth Physics Branch. Operated under contract for the Earth Physics Branch by the Department of Geology, Laurentian University.

Whitehorse, Yukon Territory - station code, WHC
Instrumented by the Earth Physics Branch. Operated under contract for the Earth Physics Branch by the Radiosonde Division, Atmospheric Environment Service, Department of Environment.

SEISMOGRAMS

Seismograms from all stations were mailed to Ottawa weekly. Phase report sheets listing the arrival times of all P phases of teleseisms and local earthquakes having a magnitude equal to or greater than $M_L 3$ were submitted on a weekly basis by all standard stations. Local earthquake monthly summary sheets, seismogram log sheets and instrument log sheets from standard stations were mailed to Ottawa monthly. Regional stations submitted only seismogram log sheets. Seismograms, data sheets and log sheets were examined by Network Section staff in Ottawa in order to maintain quality control on all phases of station operation. This included instrument performance, neatness and proper annotation of records and accuracy in the interpretation and reporting of events read from seismograms.

Original seismograms are normally available only to qualified Canadian research scientists, since microfilm is available at Asheville, N.C., to all others. On special request, original Canadian seismograms may be

loaned to qualified foreign requestors, but in each such case permission of the Chief of the Seismology Division must be sought. This loan, in general, can be made only after the seismograms have been photographed: this avoids undue delay in getting complete microfilm from the Canadian Seismograph Network deposited in the World Data Center for use of all scientists.

At the end of 1973, original Canadian seismograms dating back to and including 1965 were stored in Ottawa. Seismograms previous to that date were on permanent loan to Lamont-Doherty Geological Institute, Palisades, N.Y., U.S.A., 10964.

MICROFILM

Thirty-five millimeter negative microfilm rolls of Canadian seismograms are stored in Ottawa. Microfilm of records prior to 1962 is available to cooperating institutions on request to the Chief of the Division of Seismology, Earth Physics Branch, Department of Energy, Mines and Resources, Ottawa, Canada, K1A 0E4. Copies of Canadian seismogram microfilm from January 1, 1962, to the present time have been deposited with the Seismological Data Center, National Weather Records Center, Federal Bldg., Asheville, N.C., U.S.A., 28801. Requests for this microfilm or full-scale copies are handled by the Center at reasonable cost. Canadian microfilm up to June 30, 1966, was compiled in chronological order, in alphabetical order by stations. From July 1, 1966, till December 31, 1967, the U.S. Department of Commerce photographed Canadian seismograms in monthly station blocks in order to be compatible with the photography of World-Wide Standard Seismograph Station records. This service by the U.S. Department of Commerce was discontinued on December 31, 1967, and photography was again performed in Ottawa. From January 1, 1968, all standard seismograms were photographed in monthly blocks by station.

TELEX DATA

Throughout 1973 the U.S. Department of Commerce, NOAA, continued to make immediate use of the Canadian P-phase data in their fast hypocentre determinations. All Canadian standard seismograph stations sent telegraphic reports of all P-phase arrivals to Ottawa, five days a week. Additional information, such as P first motions and pP phase arrivals, were also telegraphed when clearly seen. The P-phase arrival time for all local earthquakes of magnitude equal to or greater than 3 were included in the telegraphed messages. The S-P interval, maximum S-phase amplitude and period for local events were also telegraphed to Ottawa, but were not relayed to NOAA. When the P amplitude of an earthquake was greater than 4 mm (peak-to-peak) within the first five seconds of the P-wave train and had at least one undisturbed cycle at this maximum amplitude, the period measurement and ground amplitude calculation in millimicrons were also telegraphed to Ottawa. A copy of this telegraphed data was kept in Ottawa and within 48 hours was sent to NOAA on computer cards in a format compatible with the NOAA operation. Most Canadian P-wave data arrived at the NOAA data centre within 10 days of the occurrence of each event.

Duplicate copies of the telegraphed P-arrival data were airmailed to Britain, Sweden and the U.S.S.R. for use of seismological institutions in those countries. In order to get telegraphed data to the countries listed above as quickly as possible, it was possible to make only a very limited check on data at the Seismic Network control office in Ottawa.

NOAA relayed Canadian telegraphed data to the International Seismological Centre, Edinburgh, for inclusion in the I.S.C. definitive calculations bulletin. The listing of Canadian station data in the I.S.C.

bulletins gives residual errors for each P arrival.

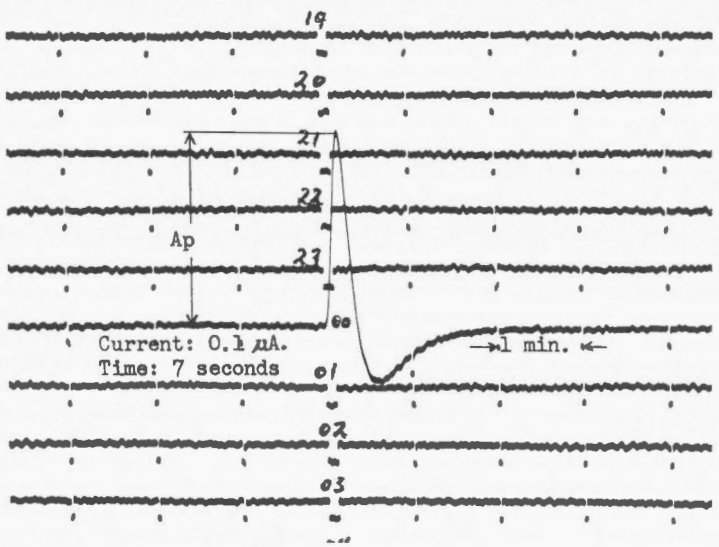
CANADIAN EARTHQUAKES

Preliminary epicenters and magnitudes of earthquakes in or near Canada in 1973 have been determined in Ottawa. This information was issued in monthly mimeographed lists. A separate report entitled "Canadian Earthquakes - 1973" will be published. Further details are available by writing to the Canadian Seismicity and Engineering Seismology Section of the Division of Seismology.

INSTRUMENT CHANGES DURING 1973

Starting in 1971, a rectangular (boxcar) pulse was applied twice daily to some of the long-period seismographs. The pulse consists of a known value of current for a specified time (nominally 0.1 microampere for 7 seconds) and is applied automatically by the chronometer and time control unit at 0000 hours and at 1200 hours U.T. The result of this twice-daily pulse is a response curve (see below) which can be seen on the long-period seismograms. By the simple procedure of superimposing a standard pulse response curve to the daily pulse response curve on the seismograms, any significant change in the seismograph response characteristics can be detected. For a more complete description of the pulse calibration, see "Pulse Calibration and its Application to the Daily Calibration of the Canadian Standard Seismograph Network Long-Period Seismometers", by A.J. Wickens, H.S. Hasegawa and M.N. Bone, in the Canadian Journal of Earth Sciences, Vol. II, No. 5, May 1974.

During 1973, the long-period pulse calibration circuitry was installed at FFC, LHC, MBC, MNT, PHC, RES, SCH and STJ. By the end of 1973, the only standard stations which did not have the pulse calibration circuitry were VIC and YKC.



Fredericton - UNB

On February 7, the short-period vertical (visual recording) seismograph was calibrated. The instrument response was the same as that determined on April 1, 1971; consequently, only the curve dated February 7, 1973, is included in this Bulletin.

Frobisher - FRB

On December 7, 1972, at $14^h\ 22^m$ U.T., the long-period vertical seismometer period was accidently lowered from 14.9 seconds to 10.0 seconds. On June 7, 1973, the LPZ seismometer period was reset to 14.9 seconds. During the interval, December 7 to June 7, all LPZ seismogram title blocks were changed to give the corrected T_s of 10.0 seconds. A theoretical calibration curve calculated in Ottawa was drawn to conform to the existing instrument parameters and is included in this Bulletin.

Halifax - HAL

On March 9 the single short-period vertical seismograph (visual recording) was calibrated. The calibration curve calculated in Ottawa was similar to that obtained in the April 1, 1971, calibration. Both curves are included in this Bulletin.

Mould Bay - MBC

The seismograph station was calibrated during the first week of May. Since all 6 instrument responses were within acceptable tolerances, no instrumental changes were made and the resultant calibration curves are labelled "As Found and Left". The standard control panel was installed and the long-period pulse calibration circuitry, described on page 6, was incorporated.

Ottawa - OTT

On February 8, an "As Found" calibration was performed on the long-period vertical seismograph. Following changes to the LPZ instrument parameters, a final calibration was performed on February 13. "As Found and Left" calibrations were performed on the 2 long-period horizontal seismographs on February 13 and 14. The four calibration curves are included in this Bulletin.

Poste-de-la-Baleine - PBQ

On October 26, the data cable between the seismometers and the recording instruments was accidently broken. Only the short-period vertical seismograph was operational for the next two weeks. The cable was repaired by November 9, at which time all three short-period seismographs were restored to normal operation.

Resolute - RES

From May 3 to 10, the station was calibrated and the standard control panel and long-period pulse calibration circuitry installed. Since the three short-period seismograph calibrations were within acceptable tolerances, no instrumental changes were made. The resultant "As Found and Left" short-period calibrations are included in this Bulletin. The long-period seismographs were calibrated "As Found". After instrument maintenance, a "final" calibration was performed on all three long-period seismographs.

Schefferville - SCH

From February 20 to 24, the seismograph station was calibrated. Since no changes were made to affect the instrument responses, all short- and long-period calibration curves are marked "As Found and Left". The standard control panel and long-period pulse calibration circuitry were installed at this time.

Seven Falls - SFA

From May 10, 1972, to February 1, 1973, the long-period vertical seismometer period was accidently set to 31 seconds instead of the calibrated value of 15.3 seconds. Unfortunately, the long-period vertical microfilm of the seismograms do not indicate this change of seismometer period from May 10, 1972, to October 31, 1972. From November 1, 1972, to February 1, 1973, the correct period is noted on all the LPZ seismograms and microfilm.

St. John's - STJ

From August 13 to 20, the seismograph station was calibrated and the standard control panel and long-period pulse calibration circuitry installed. Since there was negligible change in the short-period seismograph instrument response from the February 1, 1968, calibration, the three short-period calibration curves are marked "As Found and Left". The "final" long-period seismograph calibration curves were set about a factor of two higher than the 1968 calibration values. No "As Found" curves were drawn for the long-period seismographs. The long-period east-west seismograph had an approximate 10% drop in its "As Found" sensitivity for the longer periods. The long-period vertical and north-south "As Found" sensitivities were very close to those of the 1968 values.

Thunder Bay - LHC

Starting on March 26, the short-period east-west and all three long-period seismographs were calibrated. The SPEW seismograph parameters were changed to match more closely the SPZ and SPNS instrument response which was changed in September 1972. The change in response will, hopefully, increase the station's teleseismic detection capability while maintaining the relatively constant magnification at the higher frequencies. "As Found and Left" calibration curves were produced for the long-period seismographs. The standard control panel and long-period pulse calibration circuitry were installed at this time.

Victoria - VIC

On August 23, 1972, the long-period north-south galvanometer was replaced and the polarity was reversed. On February 26, 1973, this reversal was corrected. The correct direction of ground motion is noted on all LPNS seismograms and microfilm of seismograms. In the 1972 Seismological Bulletin No. 66 there is a typographical error on Page 8, under instrument changes for Victoria. The last sentence should read: "On November 7, 1972, the gain on the LPNS (not LPEW) seismograph was increased 10% and a curve indicating this change is also included in this Bulletin".

POLARITY CHECKS

During 1973, instrument polarity checks were made on all stations at irregular intervals using large located events. The only known reversal was the long-period north-south seismograph at Victoria (see listing below).

A listing of all known polarity reversals at CSN stations from 1962 to the present is given below. This listing was compiled by searching all Seismological Bulletins back to 1954. The information given for each reversal at any particular station may not be complete. For instance, for any particular reversal, the correct polarity may not be noted on each seismogram; or, if it was, the seismograms may have been microfilmed before the correction was made. Occasionally, first motions published in previous Bulletins were incorrect if the polarity reversal was not discovered until after the Bulletin had been published. Because complete information on polarity reversals is not readily available in some instances, this listing is intended only as a guide when using CSN seismograms.

Alberni - ALB

1969

From November 7, 1969, until early 1971, the polarity of the SPZ seismograph was reversed.

1970

In 1970, the polarity of the short-period vertical seismograph was reversed. All data found in the Seismological Bulletin is correct and the correct polarity has been noted on each seismogram.

1971

From January 1 to February 20, the polarity of the short-period vertical seismograph was reversed. From February 20 to March 12, the polarity is correct. On March 12, 1971, a new amplifier was installed and the seismograph polarity was again reversed. On June 9, 1971, the polarity was finally corrected. All data in the Seismological Bulletin is correct and polarity reversals have been noted on each seismogram where applicable.

Banff - BAN

1963

The station was out of operation for September and most of October. Since the polarity may be reversed, no first motions were given in this Bulletin.

1965

SPZ polarity is believed to be reversed all year (downtrace equivalent to earth compression). The directions printed in the Bulletin have been corrected for this error.

1966

On May 21 a polarity check was made on the SPZ seismograph and it was found to be reversed. This reversal existed probably from April 1964. Polarity was corrected on May 21, 1966. Direction of motion as given on the SPZ seismograms from January 1 to May 21, 1966, are incorrect and should be read as dilatation up. The directions of motion printed in the Bulletin are correct.

Edmonton - EDM

1966

Polarity checks made in April 1967 indicate the LPNS and LPEW were reversed for the entire year. It is assumed the polarity corrections were made in April 1967.

Frobisher - FBC

1964

From August 8, 1963, until August 24, 1964, the polarities of the LPZ and LPEW seismographs were reversed. After August 24, 1964, all polarities were correct.

1968

On June 28, the short-period vertical galvanometer was broken and replaced. The polarity was reversed at this time until August 23. All seismograms were changed to correct this error before being microfilmed.

Halifax - HAL

1962

From June 17, 1960, to July 25, 1962, uptrace indicates dilatation of the ground on the Columbia LPZ seismogram.

From October 31, 1960, to June 11, 1962, uptrace indicates ground motion west on the Columbia LPEW seismograms.

Inuvik - INK

1972

During the installation of the new short-period vertical galvanometer on June 1, the polarity of the seismograph was reversed. This polarity was corrected August 1, 1972. All SPZ seismograms have been marked to show that downtrace indicates compression for the period June 1 to August 1, 1972.

London - LND

1962

December 7, 1961, to September 25, 1962, uptrace indicates dilatation of the ground on the Willmore SPZ seismograms.

Mica Creek - MCC

1969

From November 11, 1969, until September 3, 1970, the polarity of the SPZ seismograph was reversed.

1970

From November 11, 1969, until September 3, 1970, the polarity of the SPZ seismograph was reversed. All data in the Seismological Bulletin are correct and the correct polarity noted on each seismogram.

Montreal - MNT

1965

From October 6 to November 6, 1965, the LPNS Columbia seismograph was reversed in polarity.

Ottawa - OTT

1963

The LPZ seismograph was reversed in polarity from May 22 to August 16, 1963.

1965

The SPZ Willmore seismograph was reversed in polarity August 10 to October 22, 1965 (downtrace equivalent to earth compression). The directions in the Bulletin have been corrected for this error.

Penticton - PNT

1962

The Columbia LPZ seismograms were recording uptrace as dilatation from the end of July 1961 until June 22, 1962.

1970

On July 9, a new attenuator was installed in the circuit for the short-period seismographs. As a result, the polarities were reversed until September 25, 1970, at which time the polarity was corrected.

Schefferville - SCH

1962

Commenced operations July 11, 1962.

Willmore SPNS - uptrace indicated ground moves south.
Willmore SPEW - uptrace indicated ground moves west.
The polarities of these two instruments were changed February 6, 1963, to conform to standard.

1964

From December 1963 until August 24, 1964, the polarity of the LPNS seismograph was reversed. After August 24, 1964, all polarities are correct as noted.

Seven Falls - SFA

1965

The SPZ polarity was corrected on February 25, 1965 (to make uptrace equivalent to earth compression). The first motions printed in the Bulletin have been corrected for this error.

Sudbury - SUD

1969

During the relocation of the visual recording short-period vertical Willmore

seismograph, the polarity was reversed. This condition continued from June 3 to October 11, 1969.

Victoria - VIC

1972

On August 23, 1972, the long-period, north-south galvanometer was replaced. During the installation of the new LPNS galvanometer, the polarity was reversed. This condition remained until February 26, 1973, when the error was corrected. This polarity reversal was shown on all original seismograms. From November 1, 1972, to February 26, 1973, this is also shown on the microfilm. Since the August 29, 1972, to October 31, 1972, records were microfilmed before the correct polarity was noted on the seismograms, the microfilm of LPNS seismograms indicates incorrect polarity.

Yellowknife - YKC

1964

On October 19, 1964, the SPEW cable between the seismometer vault and the recording room was cut and during repairs the instrument was accidentally reversed in polarity.

1965

The SPEW seismograph was reversed in polarity from October 19, 1964, to November 4, 1965. The SPNS seismograph was reversed from August 16, 1965, to February 17, 1966.

1966

On February 17, the SPNS polarity was found reversed and corrected. The condition existed since August 16, 1965.

MAGNIFICATION CURVES

Magnification curves for all the various seismographs operated at the stations are found on the following pages. Calibration curves for both standard and regional stations are given alphabetically by station name, not code. The curves for the photographic seismographs were obtained by application of the Willmore bridge method on site. Earlier Bulletins have given an explanation of these curves; the magnification and acceleration sensitivity of any instrument is determined simply by multiplying the velocity sensitivity by $2\pi/T$ or $T/2\pi$, respectively. The magnification curves show the periods of the seismometers and the galvanometers, and include summary information on the coordinates, altitude, foundation material and date of calibration.

The phase response as a function of period of the various seismographs has been calculated in Ottawa and is available on request.

PERSONNEL

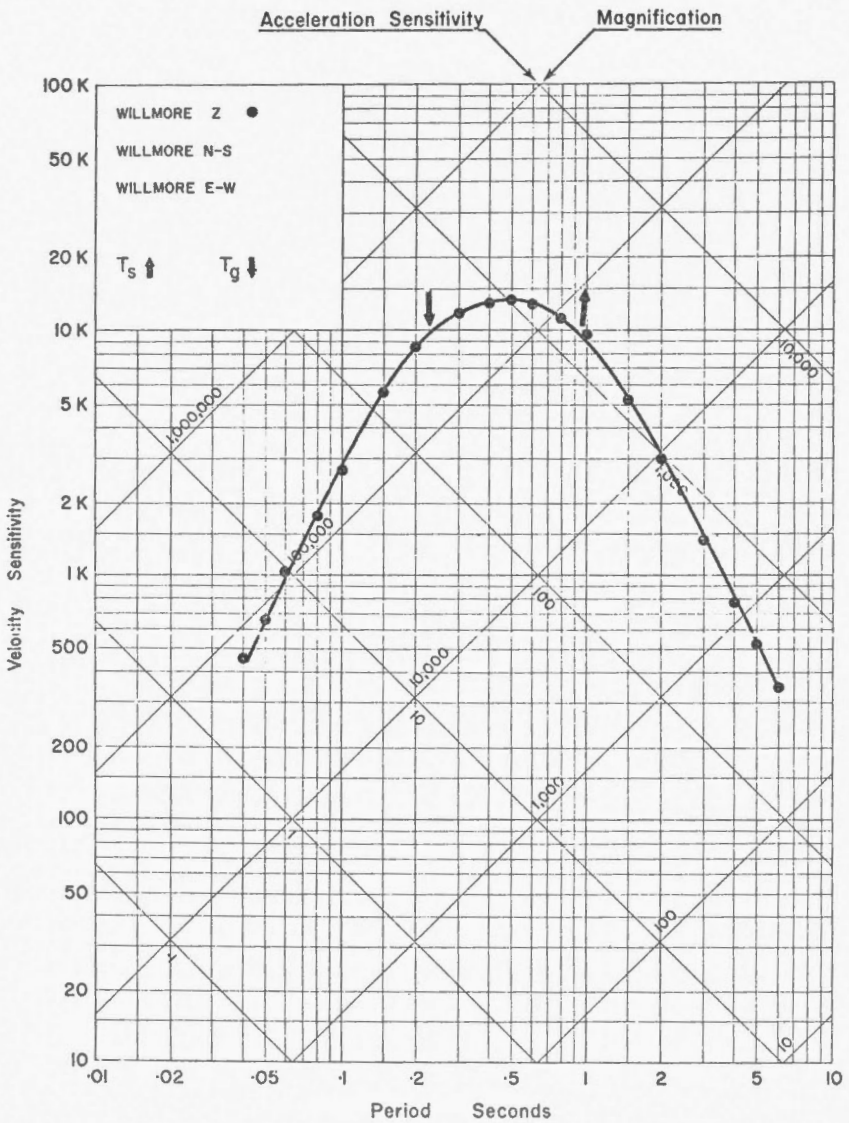
During 1973, Mr. R.J. Halliday was in charge of the Canadian Seismograph Networks Section and was assisted in quality control and network management by Mr. W.E. Shannon. Mr. F. Lombardo continued as the Senior Technical Officer for station maintenance, calibration and installation, assisted by Mr. B.A. Compton. Mr. R.B. Hayman was in charge of the Seismic Instrumentation Section laboratory in Ottawa, supporting and servicing the

network. Dr. F. Kollar gave particular attention to network instrumental problems and their solution.

STATION: ALERT, N.W.T. (AS FOUND AND LEFT) (ALE)

ϕ= 82°29' N λ= 62°24' W Altitude 65M

Foundation: Permanently frozen glacial debris overlying Palaeozoic limestone



Dates of Calibration:

WILLMORE Z ● April 11, 1972

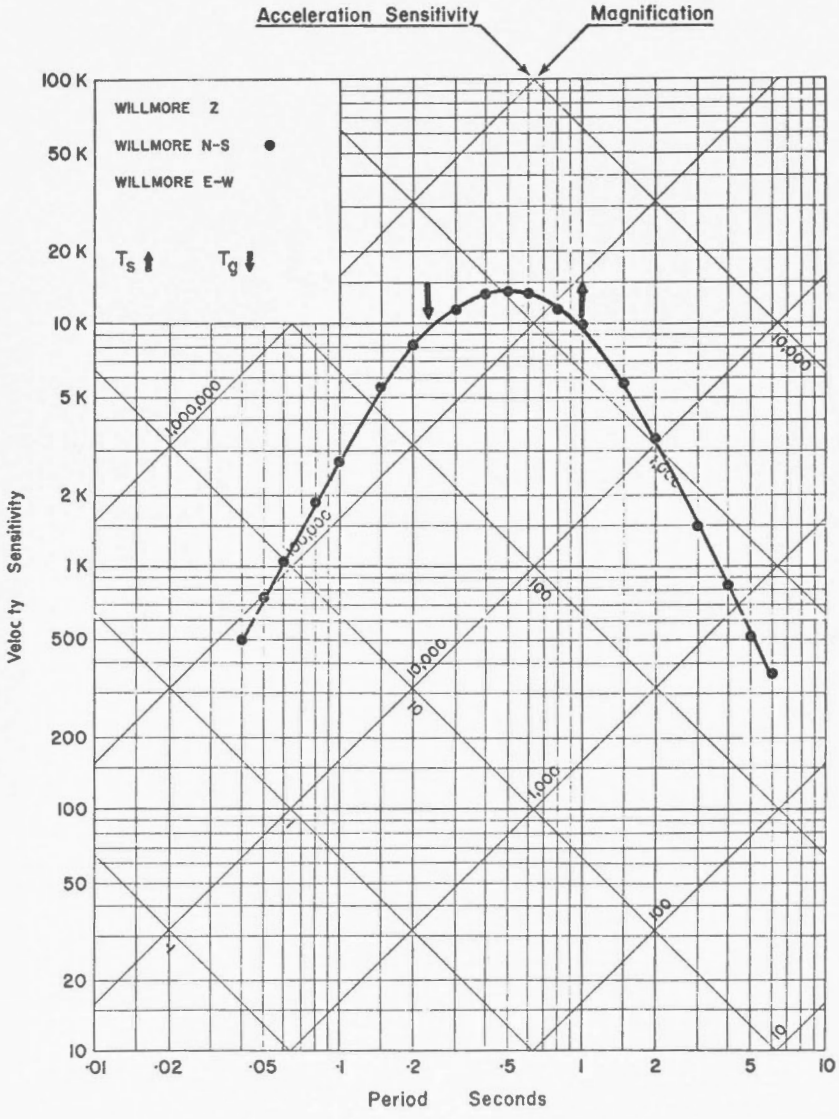
WILLMORE N-S

WILLMORE E-W

STATION: ALERT, N.W.T. (AS FOUND AND LEFT) (ALE)

ϕ= 82°29' N λ= 62°24' W Altitude 65M

Foundation: Permanently frozen glacial debris overlying Palaeozoic limestone.



Dates of Calibration:

WILLMORE Z

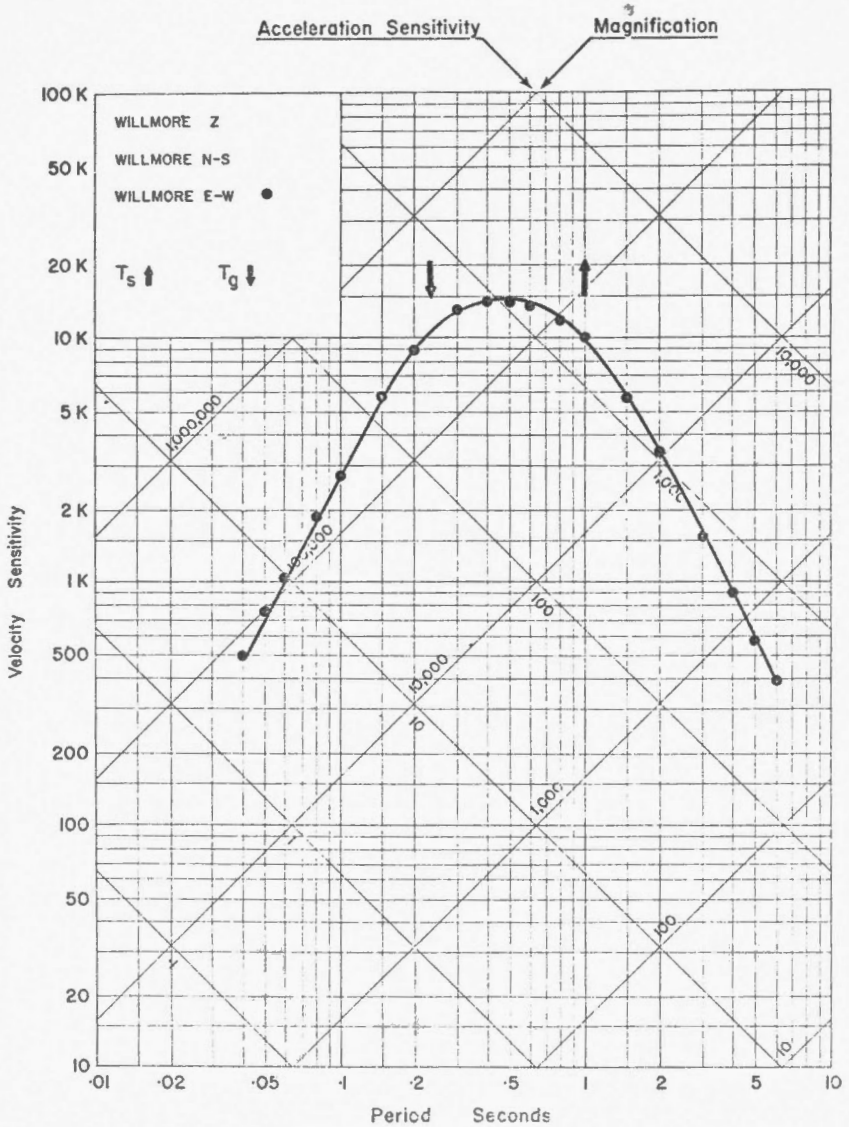
WILLMORE N-S ● April 11, 1972

WILLMORE E-W

STATION: ALERT, N.W.T. (AS FOUND AND LEFT) (ALE)

ϕ= 82°29' N λ= 62°24' W Altitude 65M

Foundation: Permanently frozen glacial debris overlying Palaeozoic limestone.



Dates of Calibration:

WILLMORE Z

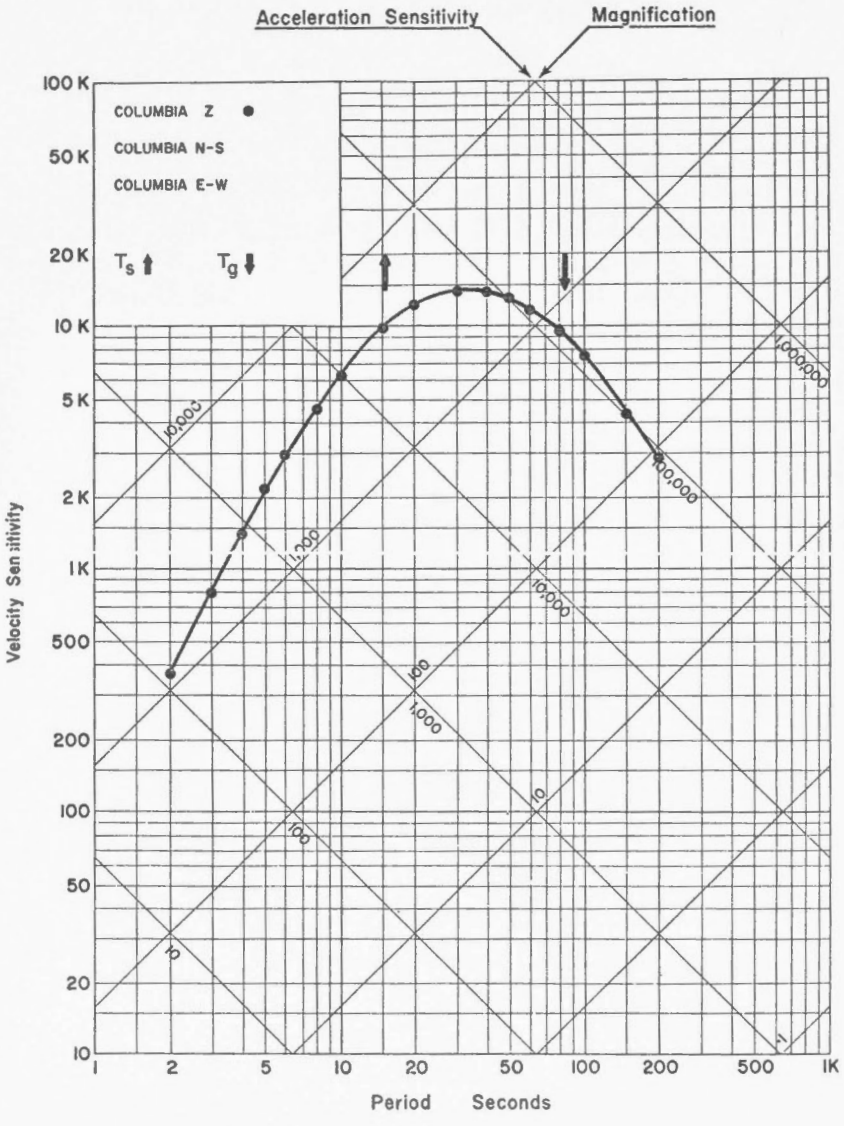
WILLMORE N-S

WILLMORE E-W · April 11, 1972

STATION: ALERT, N.W.T. (FINAL) (ALE)

ϕ= 82°29' N λ= 62°24' W Altitude 65M

Foundation: Permanently frozen glacial debris overlying Palaeozoic limestone.



Dates of Calibration:

COLUMBIA Z ● April 11, 1972

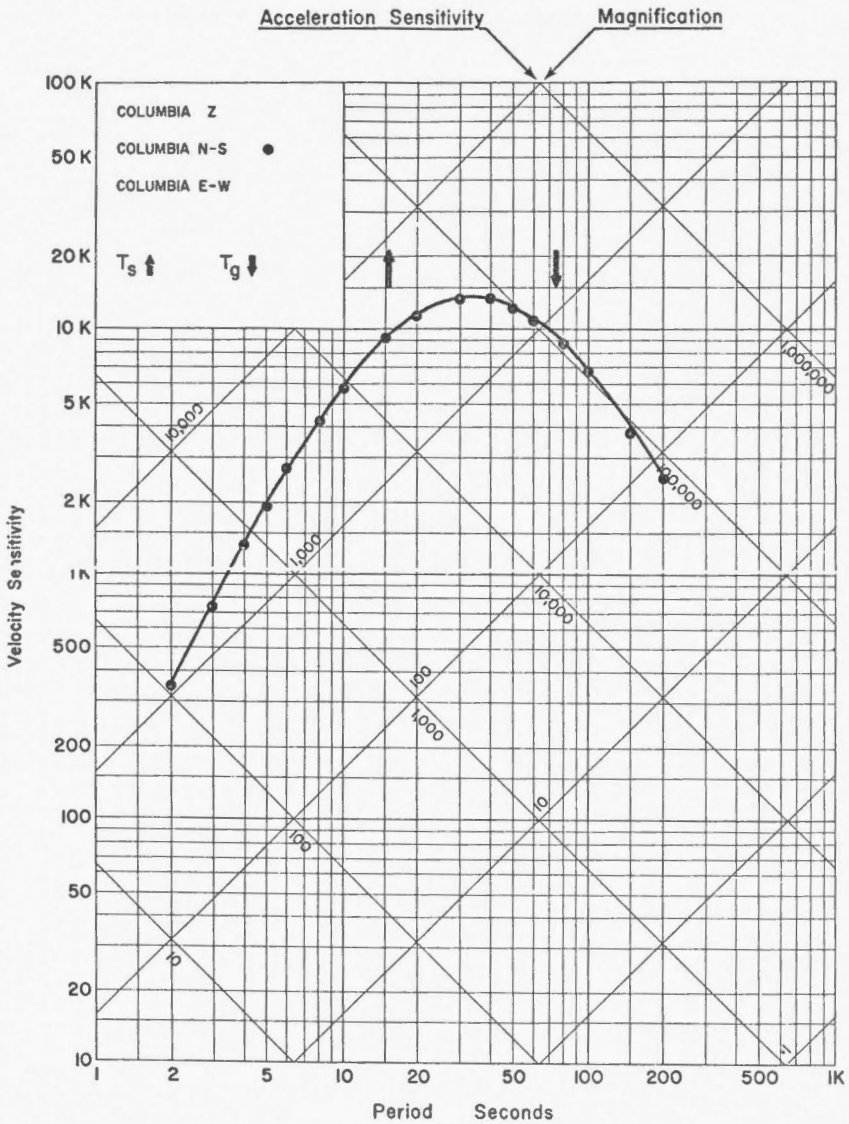
COLUMBIA N-S

COLUMBIA E-W

STATION: ALERT, N.W.T. (FINAL) (ALE)

$\phi = 82^{o}29'$ N $\lambda = 62^{o}24'$ W Altitude 65M

Foundation: Permanently frozen glacial debris overlying Palaeozoic limestone.



Dates of Calibration:

COLUMBIA Z

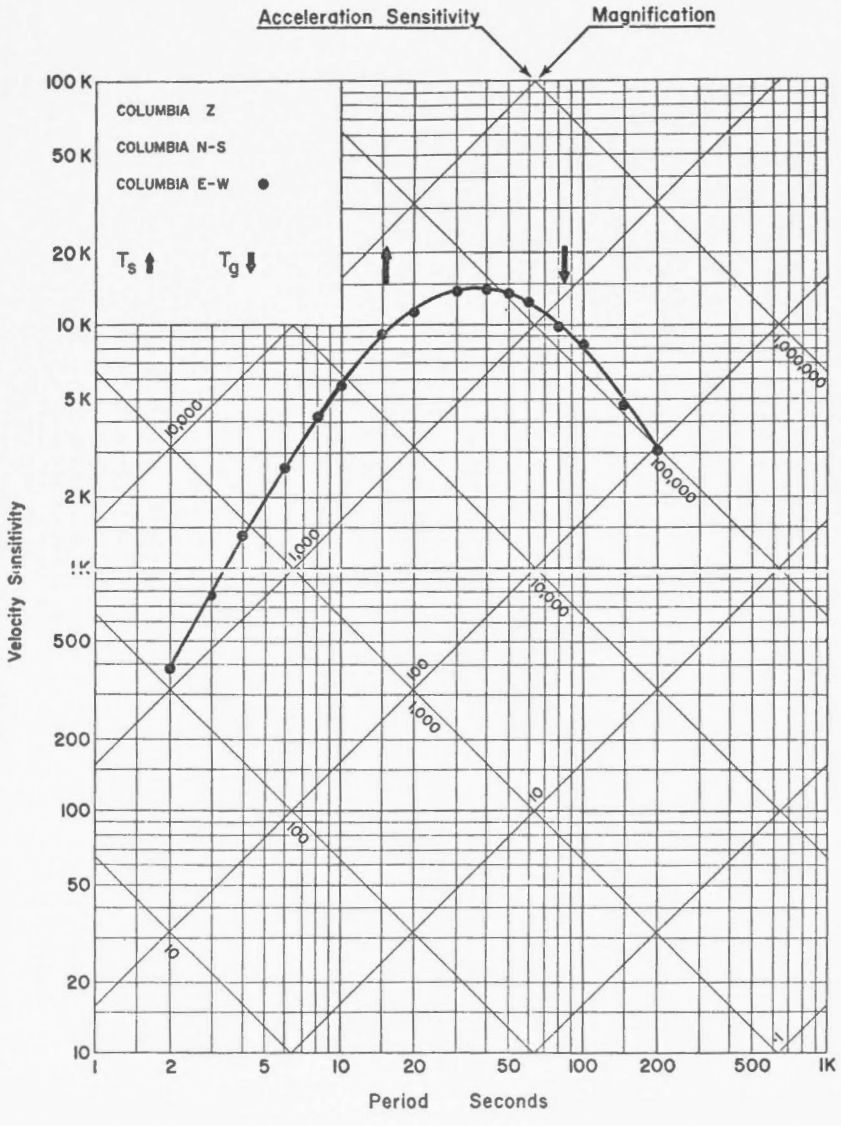
COLUMBIA N-S ● April 9, 1972

COLUMBIA E-W

STATION: ALERT, N.W.T. (FINAL) (ALE)

ϕ = 82°29' N λ = 62°24' W Altitude 65M

Foundation: Permanently frozen glacial debris overlying Palaeozoic limestone.



Dates of Calibration:

COLUMBIA Z

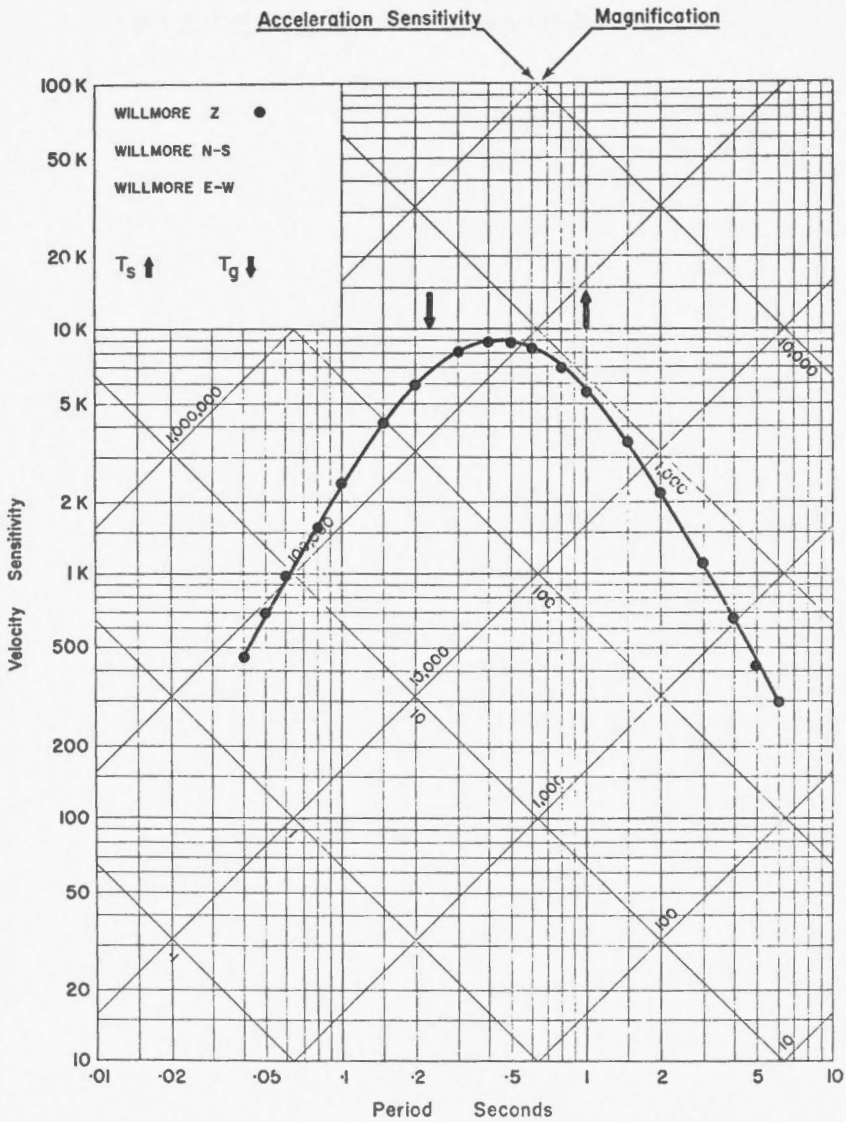
COLUMBIA N-S

COLUMBIA E-W • April 8, 1972

STATION: BAKER LAKE, N.W.T. (As found and left) (BLC)

ϕ= 64°19'N λ= 96°01'W Altitude 16 M

Foundation: Granite Gneiss



Dates of Calibration:

WILLMORE Z ● June 7, 1971

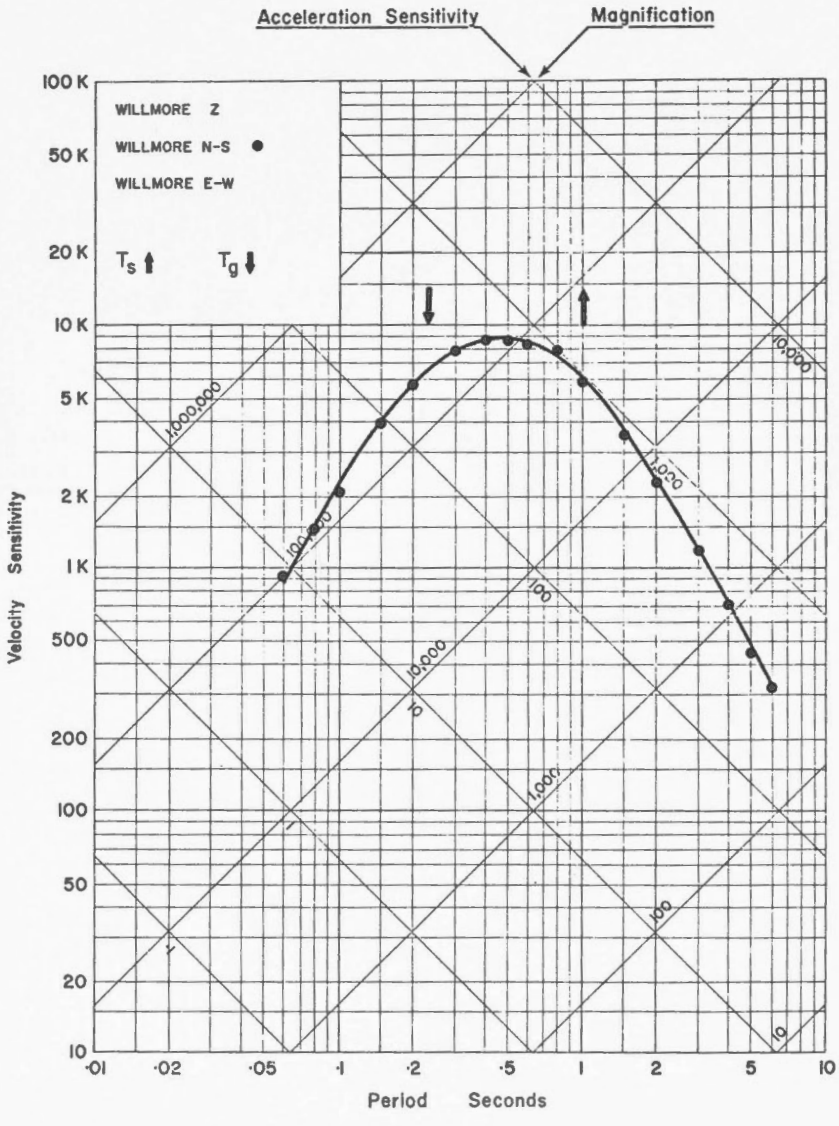
WILLMORE N-S

WILLMORE E-W

STATION: BAKER LAKE, N.W.T. (As found and left) (BLC)

ϕ= 64°19'N λ= 96°01'W Altitude 16 M

Foundation: Granite Gneiss



Dates of Calibration:

WILLMORE Z

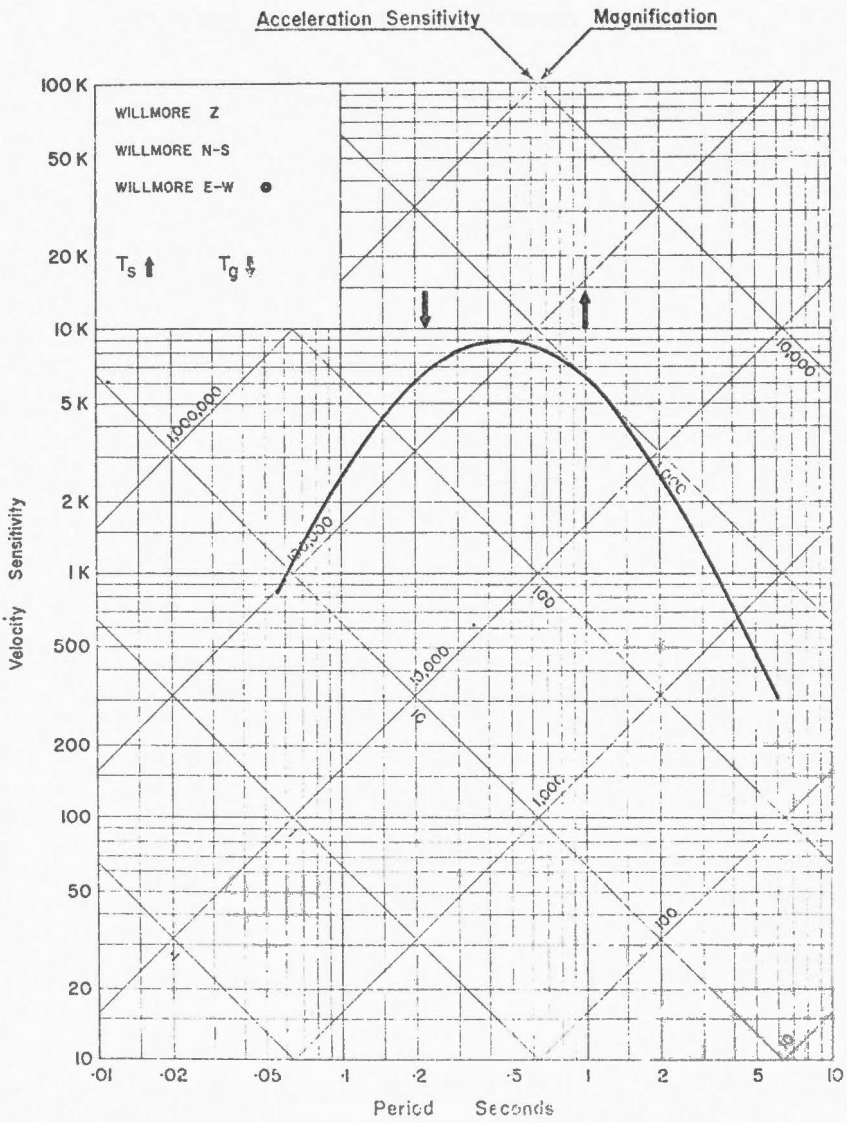
WILLMORE N-S ● June 7, 1971

WILLMORE E-W

STATION: BAKER LAKE, N.W.T. (BLC)

ϕ= 64°19'N λ= 96°01'W Altitude 16 M

Foundation: Granite Gneiss



Dates of Calibration:

WILLMORE Z

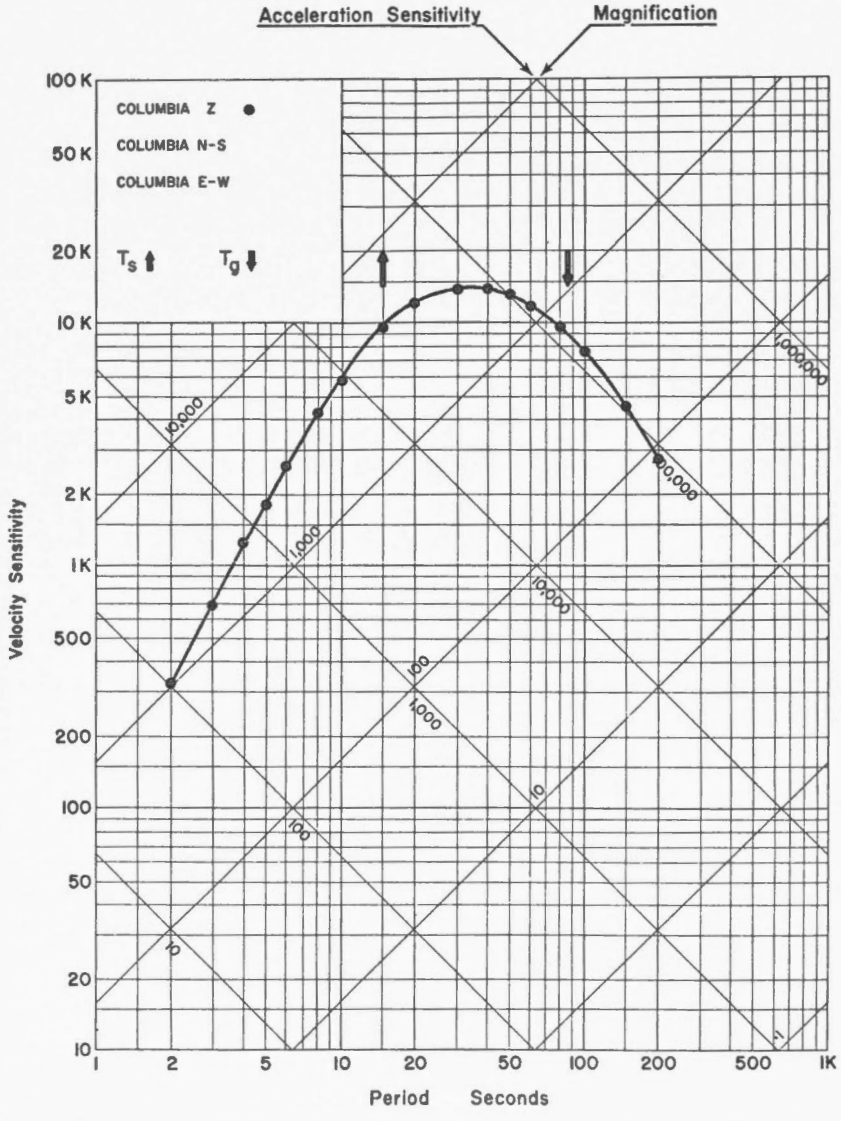
WILLMORE N-S

WILLMORE E-W ● March 17, 1972
(calibrated in Ottawa)

STATION: BAKER LAKE, N.W.T. (As found and left) (BLC)

ϕ= 64°19'N λ= 96°01'W Altitude 16 M

Foundation: Granite Gneiss



Dates of Calibration:

COLUMBIA Z • June 9, 1971

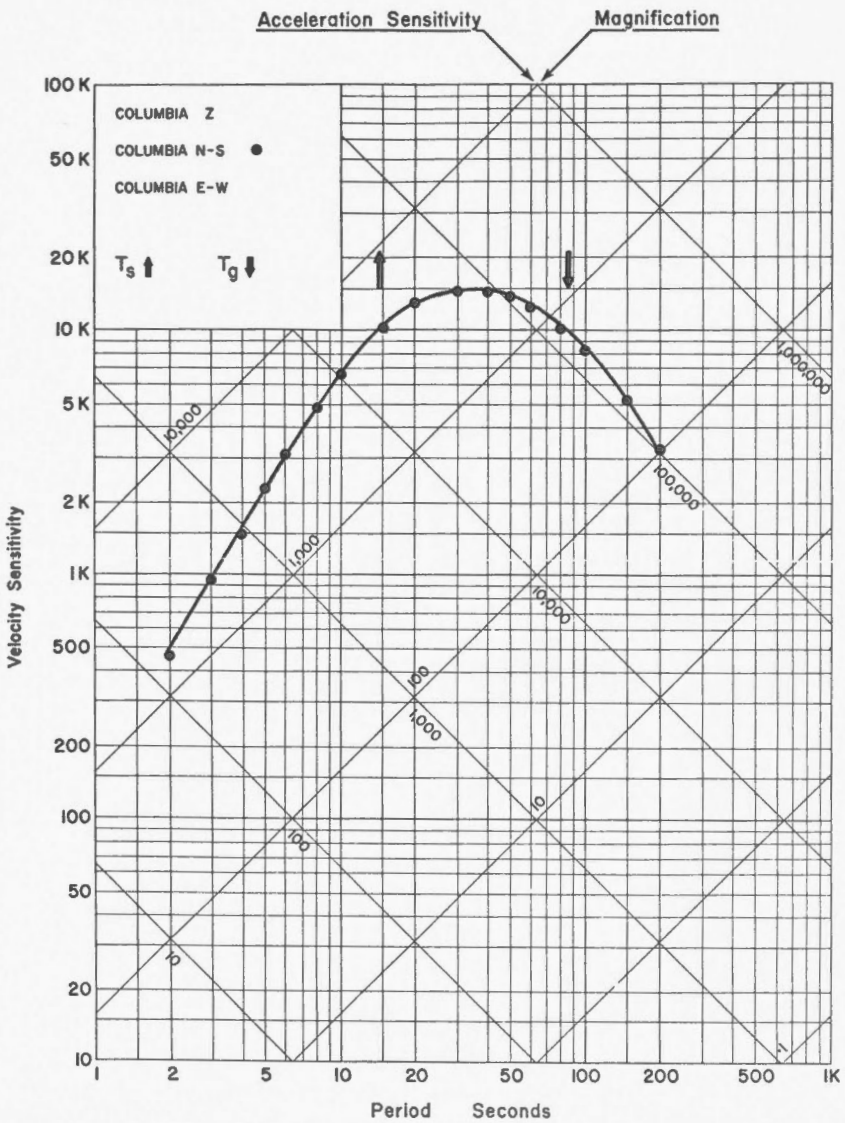
COLUMBIA N-S

COLUMBIA E-W

STATION: BAKER LAKE, N.W.T. (As found and left) (BLC)

ϕ = 64°19'N λ = 96°01'W Altitude 16 M

Foundation: Granite Gneiss



Dates of Calibration:

COLUMBIA Z

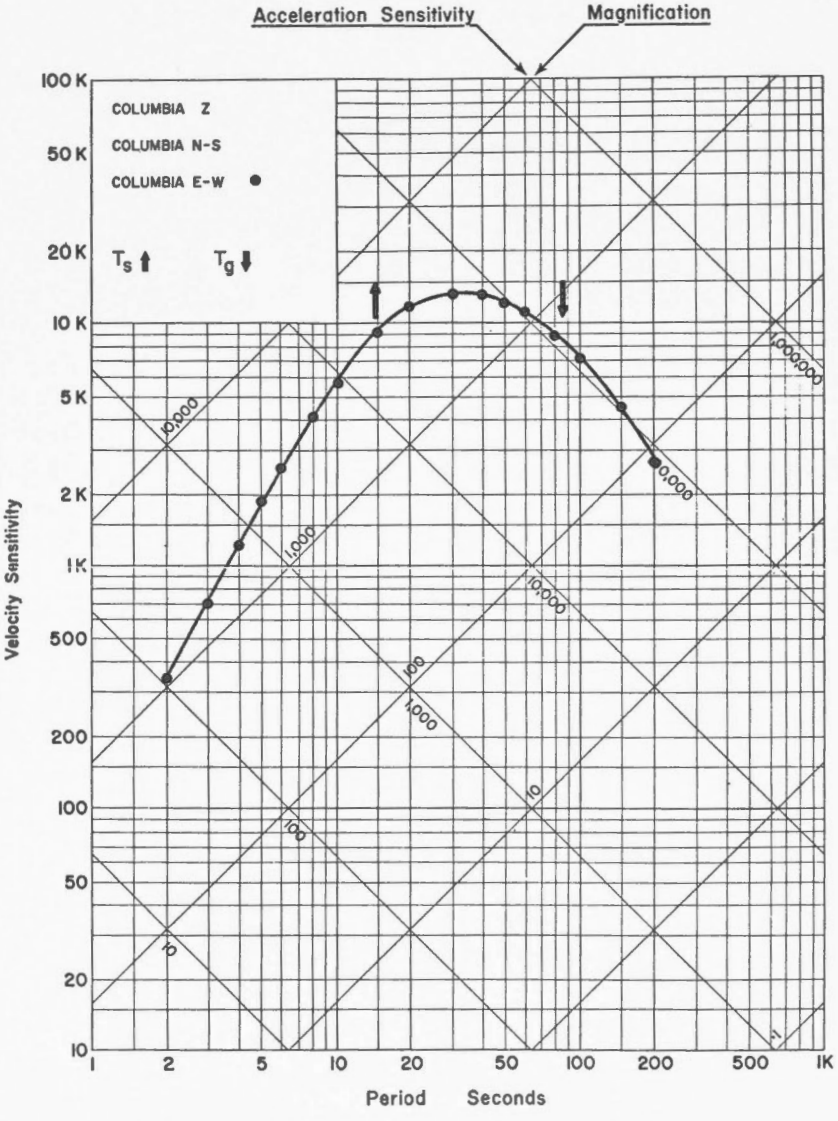
COLUMBIA N-S ● June 9, 1971

COLUMBIA E-W

STATION: BAKER LAKE, N.W.T. (As found and left) (BLC)

ϕ= 64°19'N λ= 96°01'W Altitude 16 M

Foundation: Granite Gneiss



Dates of Calibration:

COLUMBIA Z

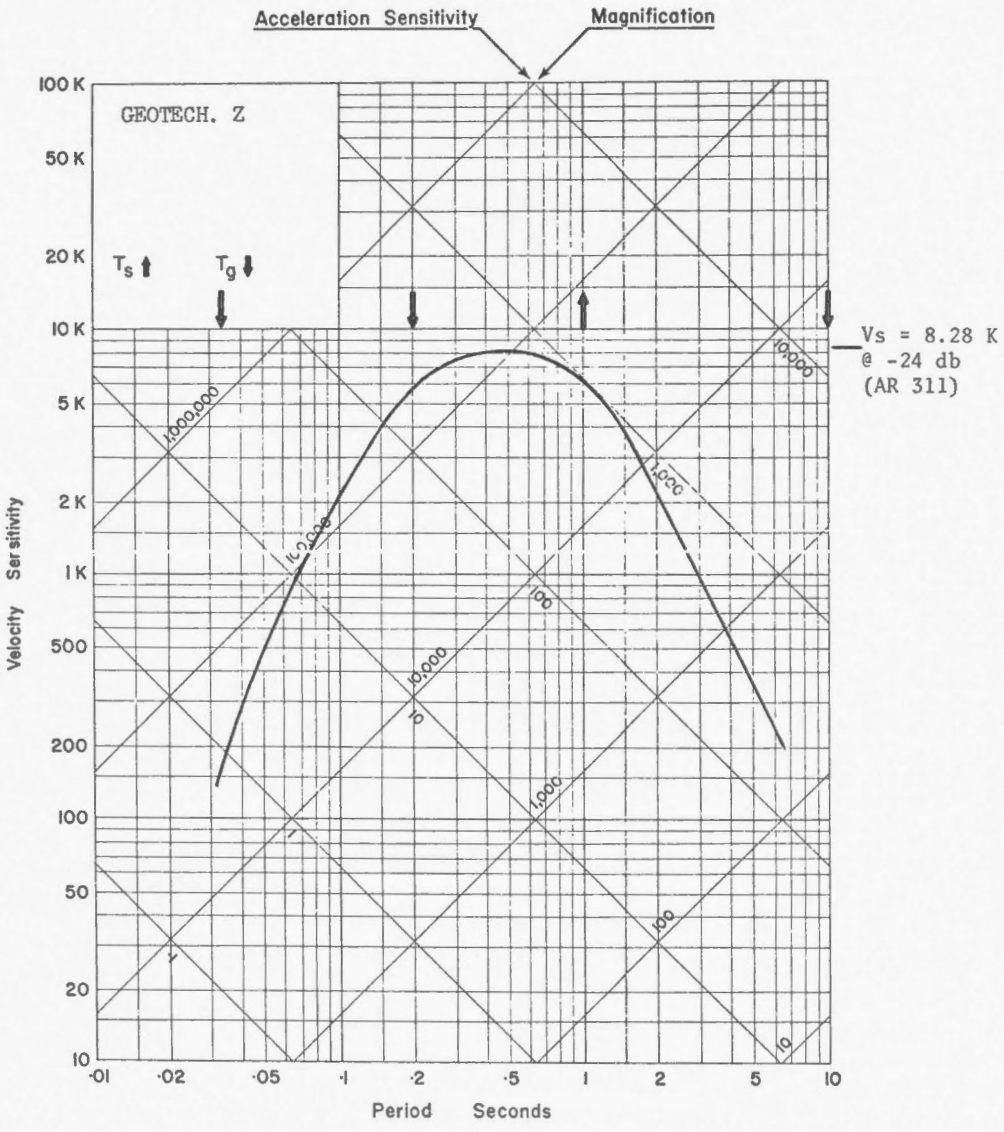
COLUMBIA N-S

COLUMBIA E-W ● June 9, 1971

STATION: CHARLESBOURG, QUEBEC (CHQ)

ϕ = 46°53'23"N λ = 71°18'00"W Altitude 145 M

Foundation: Precambrian Gneiss



Dates of Calibration: October 1972

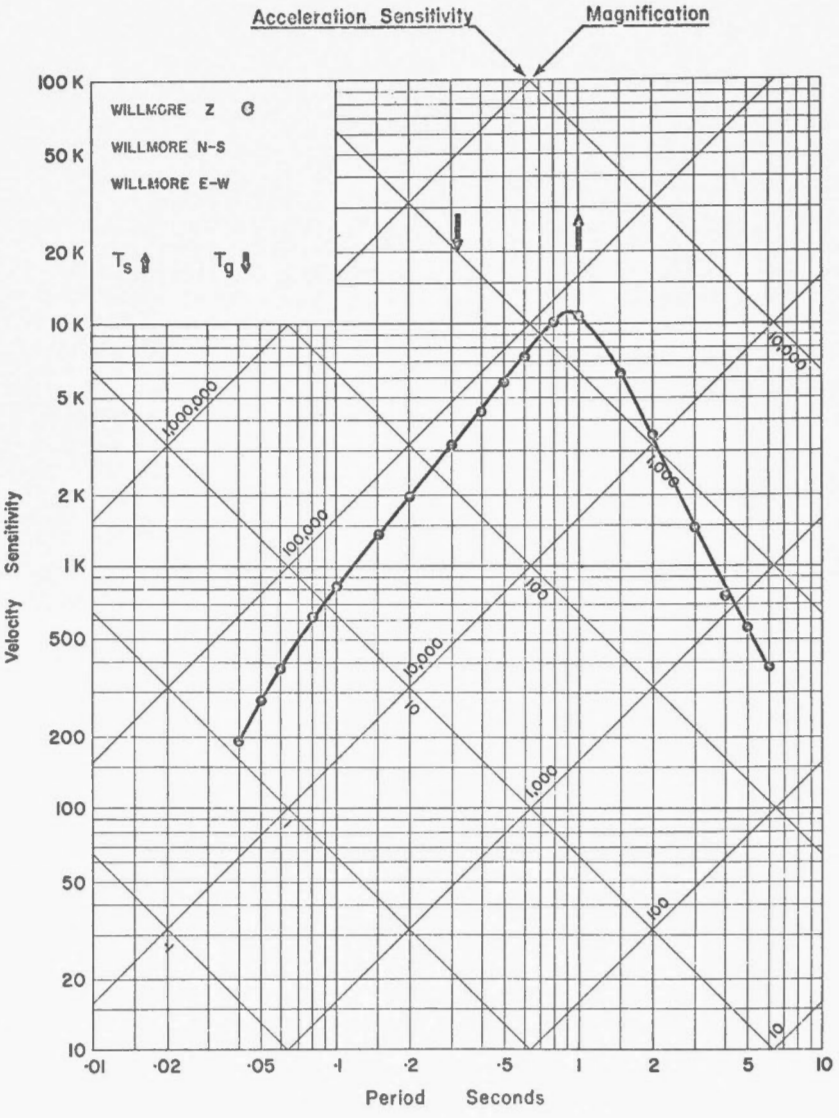
SEISMOMETER: Geotech. S13 G_L = 2.62 V.S./C M.
PREAMPLIFIER: AS330 operated at 30-30 db (SEP.-ATT.)
Filter Bandpass 0.1 - 5 Hz
AMPLIFIER: AR 311 - 1 CM./Volt @ 24 db
HELICORDER: RV 301 - 0-30 Hz

Corner frequencies indicated by "T_g" arrows.

STATION: EDMONTON, ALTA. (EDM)

ϕ= 53°13.3'N λ= 113°21'W Altitude 730M

Foundation: Unconsolidated Shales, Edmonton Formation



Dates of Calibration:

WILLMORE Z ○ May 20, 1970

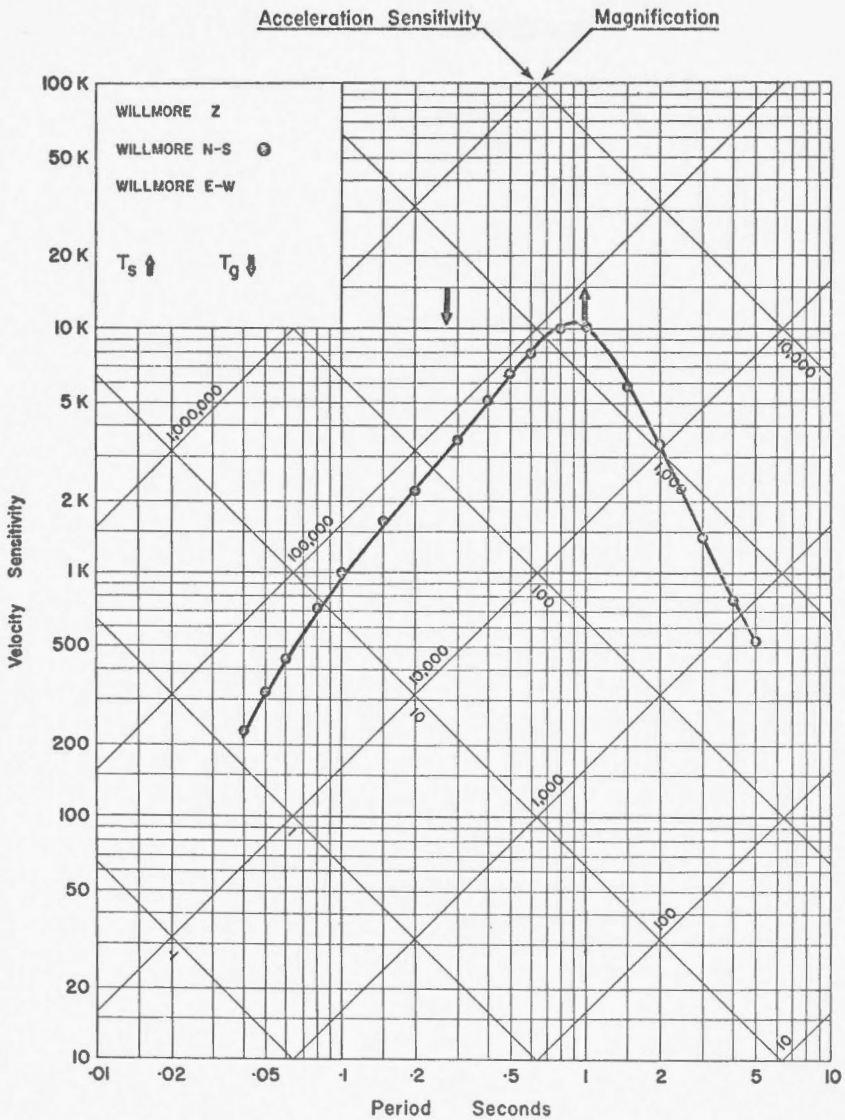
WILLMORE N-S

WILLMORE E-W

STATION: EDMONTON, ALTA. (EDM)

ϕ= 53°13.3'N λ= 113°21'W Altitude 730M

Foundation: Unconsolidated Shales, Edmonton Formation



Dates of Calibration:

WILLMORE Z

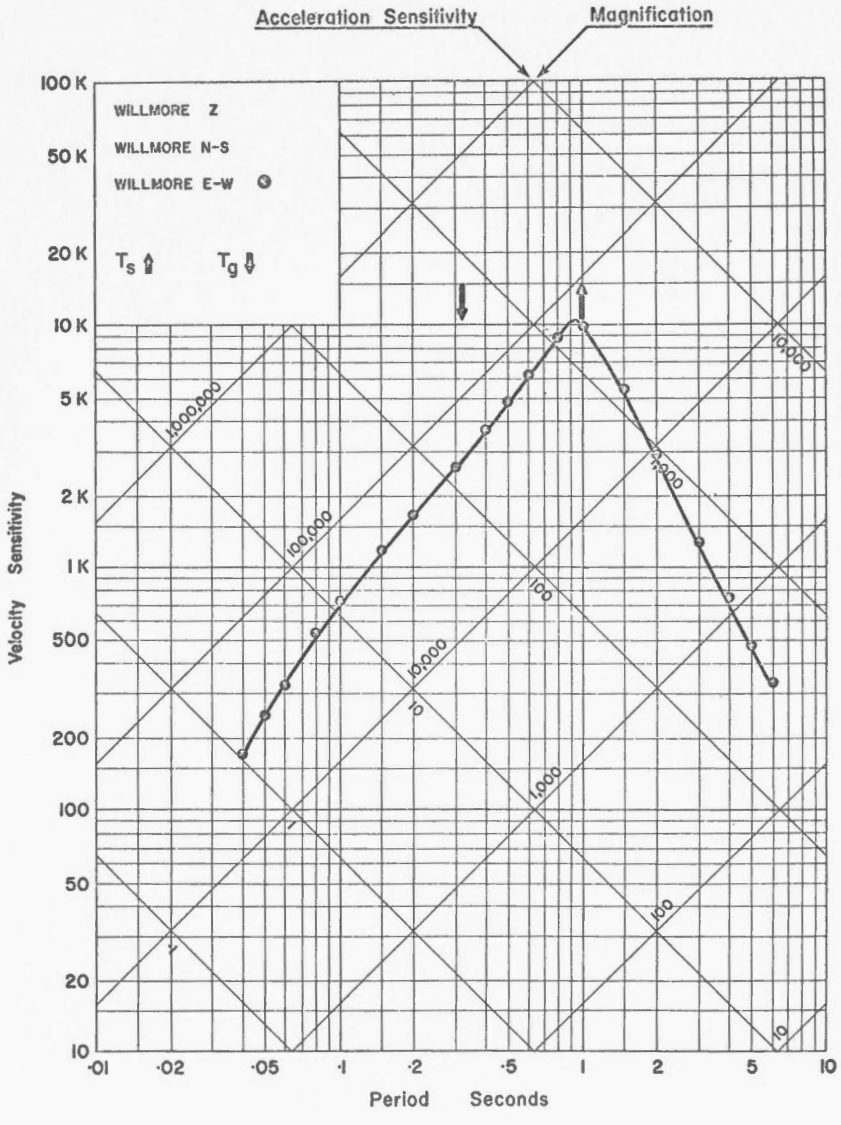
WILLMORE N-S May 19, 1970

WILLMORE E-W

STATION: EDMONTON, ALTA. (EDM)

ϕ= 53°13.3'N λ= 113°21'W Altitude 730M

Foundation: Unconsolidated Shales, Edmonton Formation



Dates of Calibration:

WILLMORE Z

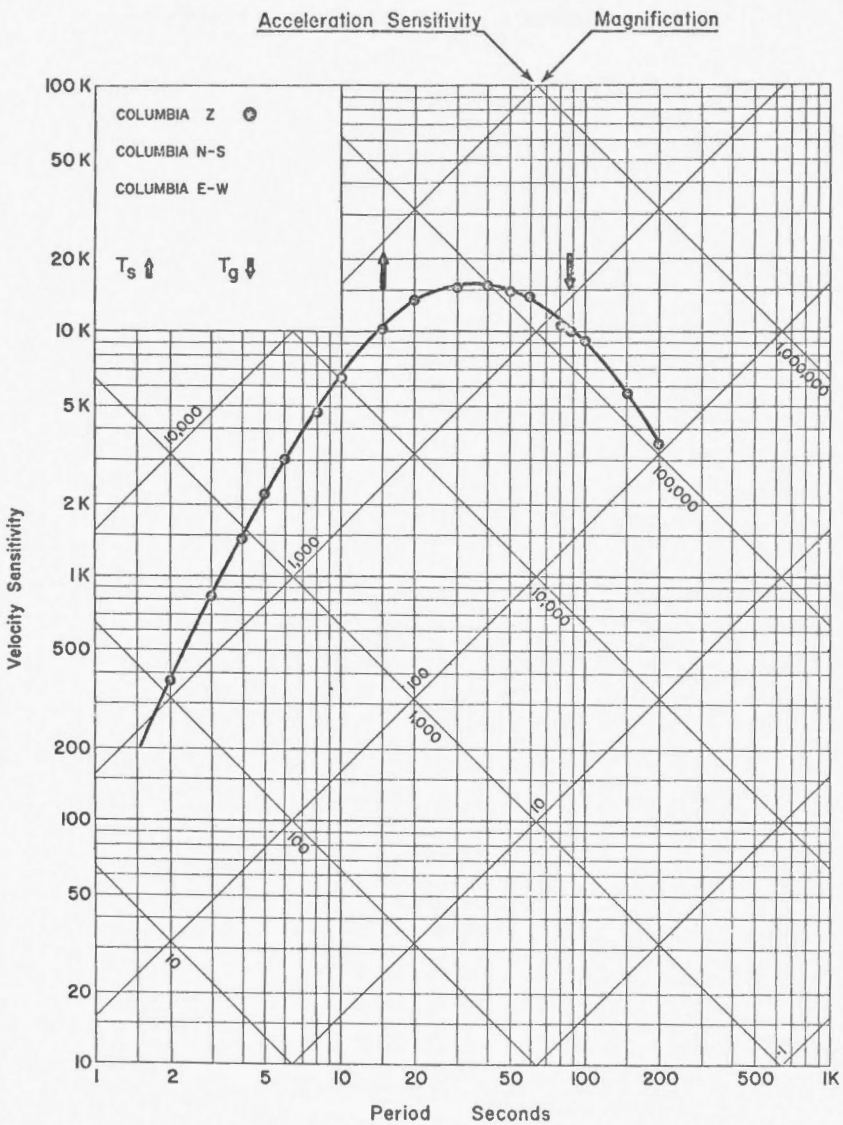
WILLMORE N-S

WILLMORE E-W May 19, 1970

STATION: EDMONTON, ALTA. (EDM)

ϕ= 53°13.3'N λ= 113°21'W Altitude 730M

Foundation: Unconsolidated Shales, Edmonton Formation



Dates of Calibration:

COLUMBIA Z ⊙ May 18, 1970

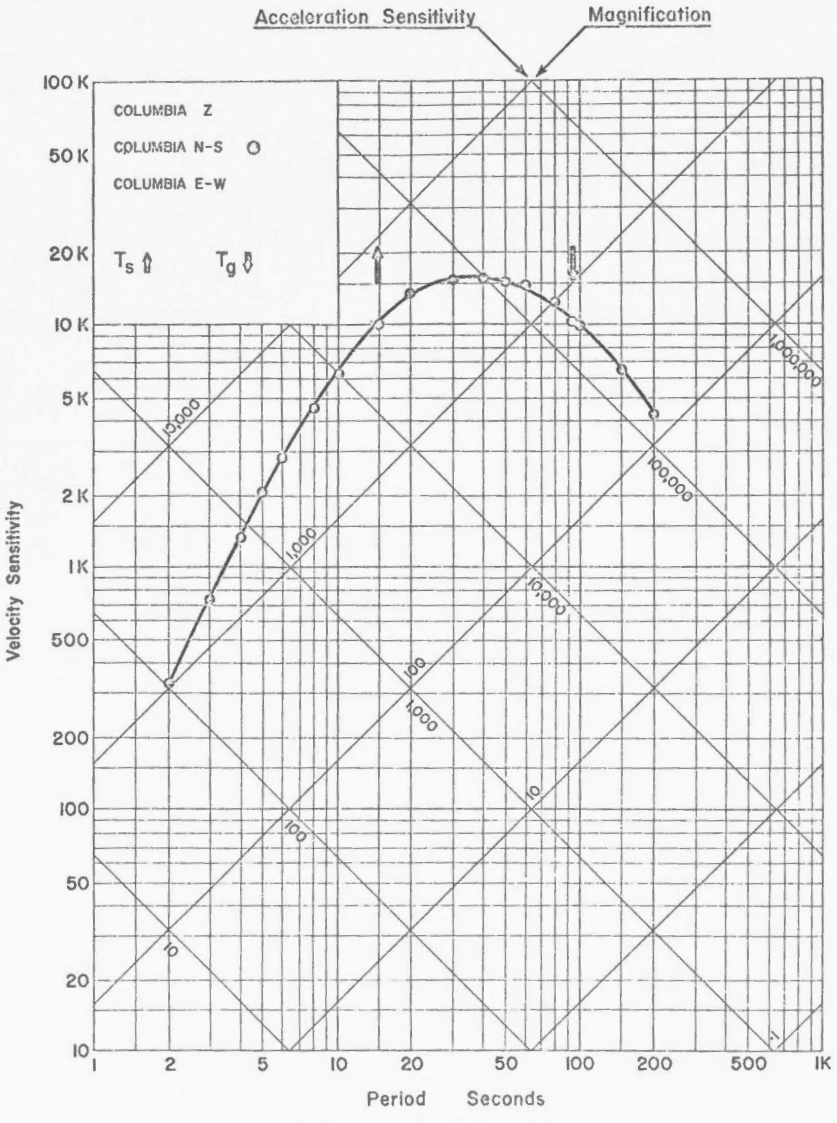
COLUMBIA N-S

COLUMBIA E-W

STATION: EDMONTON, ALTA. **(EDM)**

ϕ= 53°13.3'N λ= 113°21'W Altitude 730M

Foundation: Unconsolidated Shales, Edmonton Formation



Dates of Calibration:

COLUMBIA Z

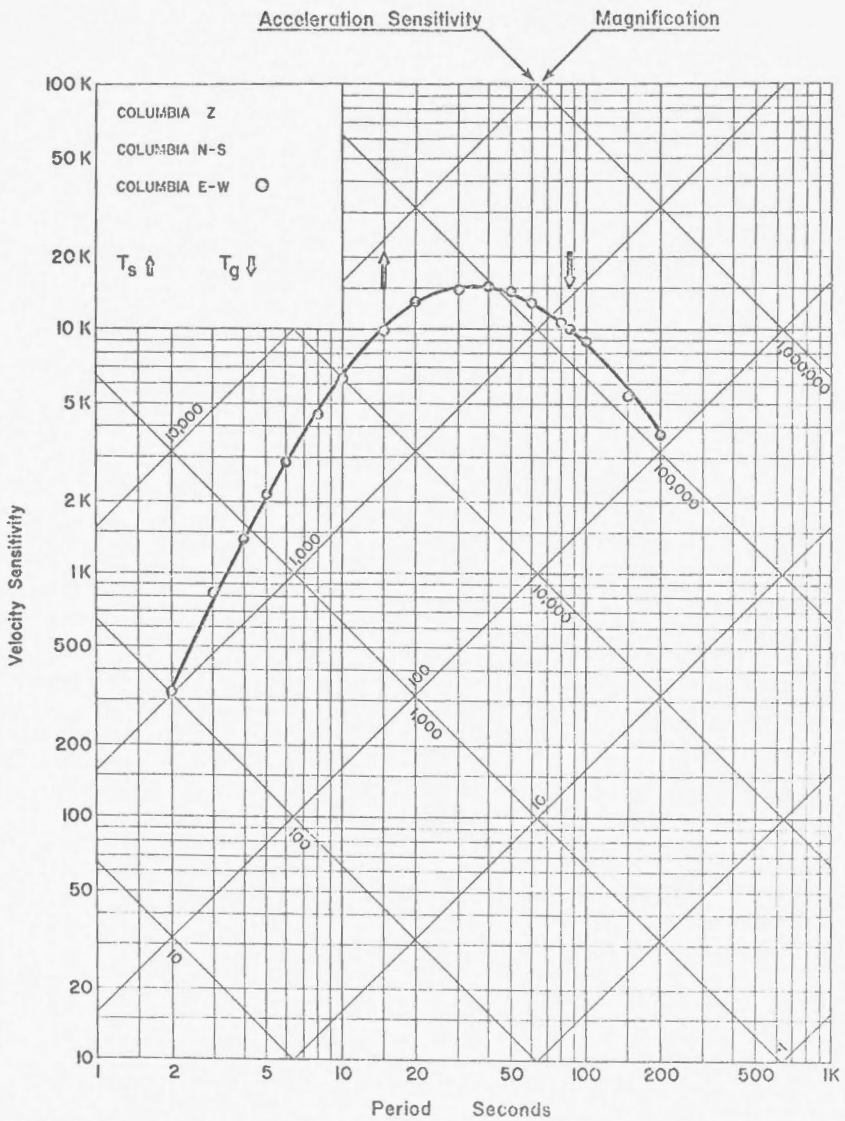
COLUMBIA N-S O May 19, 1970

COLUMBIA E-W

STATION: EDMONTON, ALTA. (EDM)

$\phi = 53^{\circ}13.3'N$ $\lambda = 113^{\circ}21'W$ Altitude 730M

Foundation: Unconsolidated Shales, Edmonton Formation



Dates of Calibration:

COLUMBIA Z

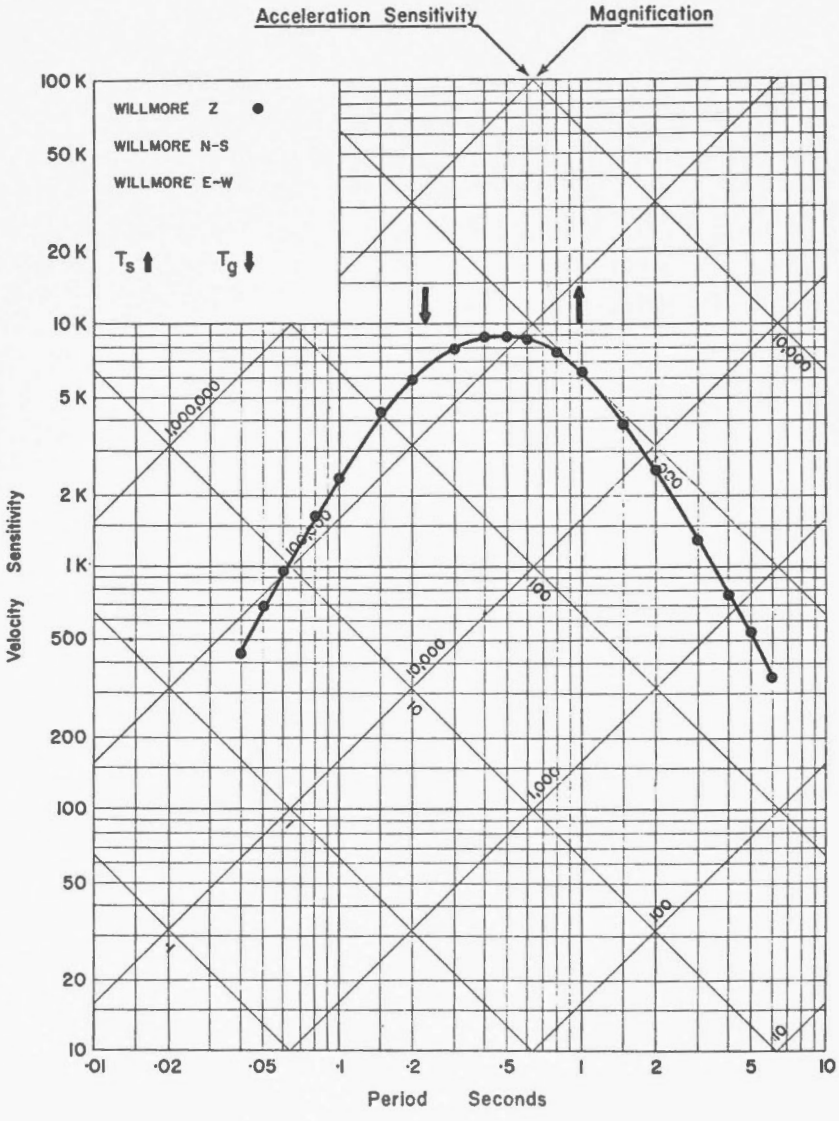
COLUMBIA N-S

COLUMBIA E-W O May 18, 1970

STATION: FLIN FLON, MANITOBA (As found and left) (FFC)

ϕ= 54°43'.5N λ= 101°58.7'W Altitude 338 M

Foundation: Granite Gneiss



Dates of Calibration:

WILLMORE Z ● Oct. 22, 1971

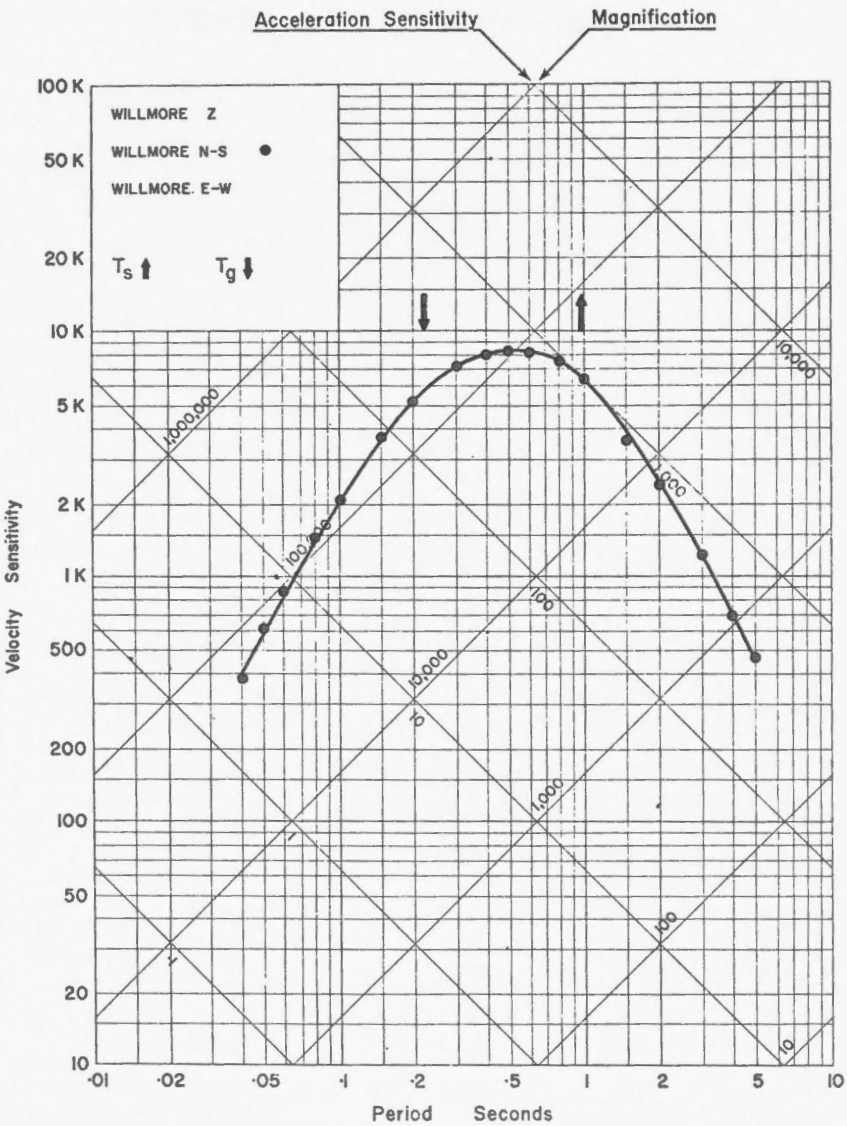
WILLMORE N-S

WILLMORE E-W

STATION: FLIN FLON, MANITOBA (As found and left) (FFC)

ϕ= 54°43.5'N λ= 101°58.7'W Altitude 338 M

Foundation: Granite Gneiss



Dates of Calibration:

WILLMORE Z

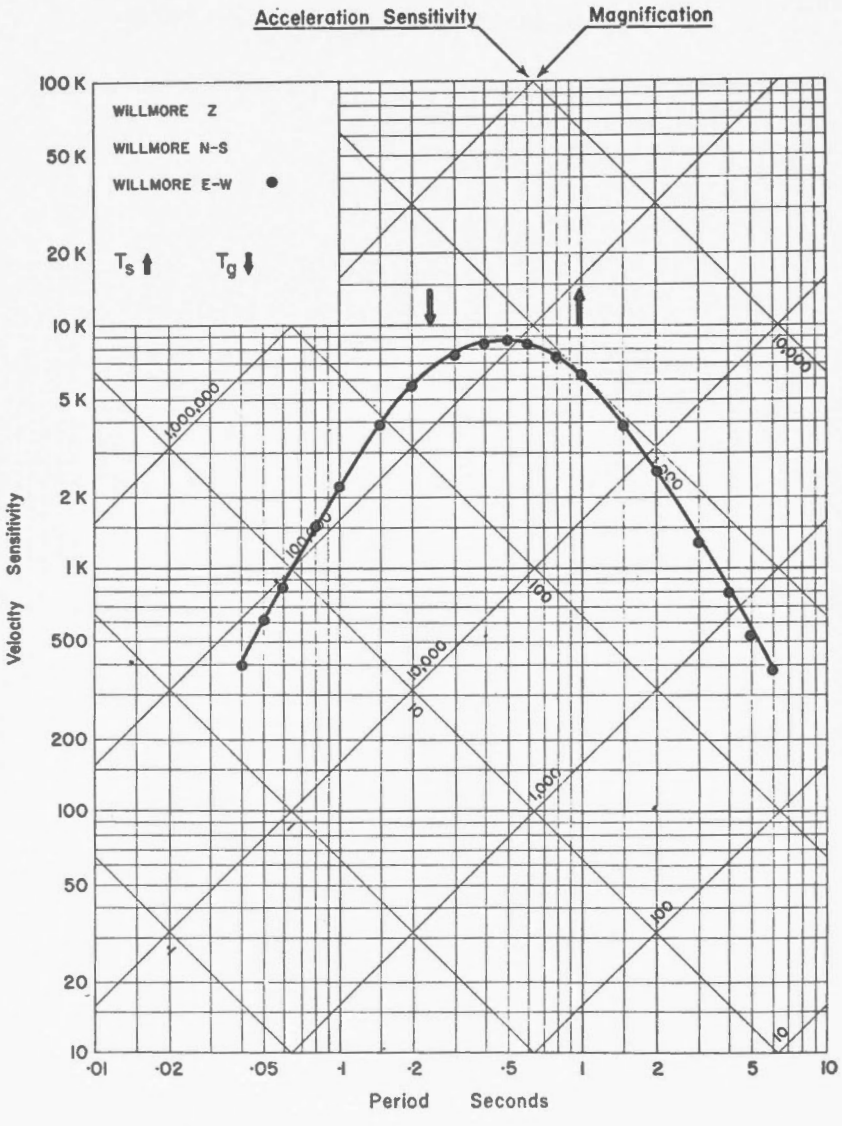
WILLMORE N-S ● Oct. 22, 1971

WILLMORE E-W

STATION: FLIN FLON, MANITOBA (As found and left) (FFC)

ϕ= 54°43.5'N λ= 101°58.7'W Altitude 338 M

Foundation: Granite Gneiss



Dates of Calibration:

WILLMORE Z

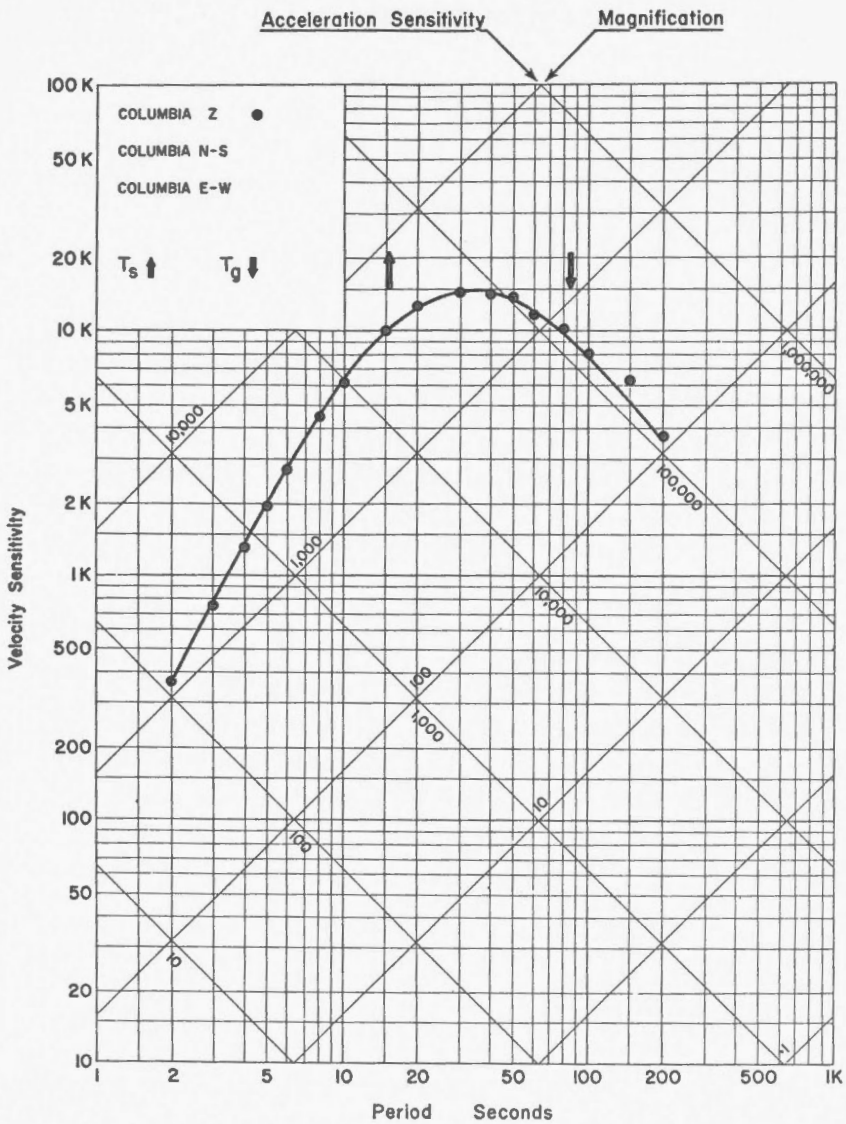
WILLMORE N-S

WILLMORE E-W ● Oct. 22, 1971

STATION: FLIN FLON, MANITOBA (As found and left) (FFC)

ϕ= 54°43.5'N λ= 101°58.7'W Altitude 338 M

Foundation: Granite Gneiss



Dates of Calibration:

COLUMBIA Z ● Oct. 20, 1971

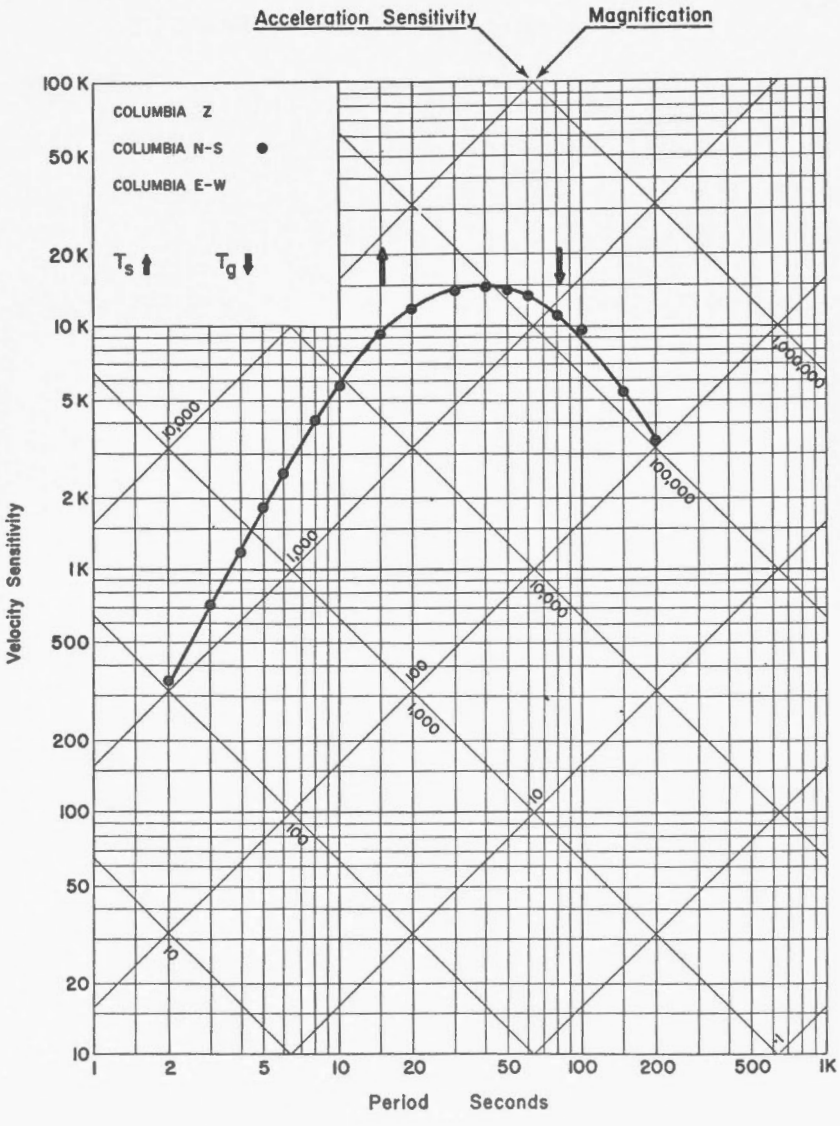
COLUMBIA N-S

COLUMBIA E-W

STATION: FLIN FLON, MANITOBA (As found and left) (FFC)

ϕ= 54°43.5'N λ= 101°58.7'W Altitude 338 M

Foundation: Granite Gneiss



Dates of Calibration:

COLUMBIA Z

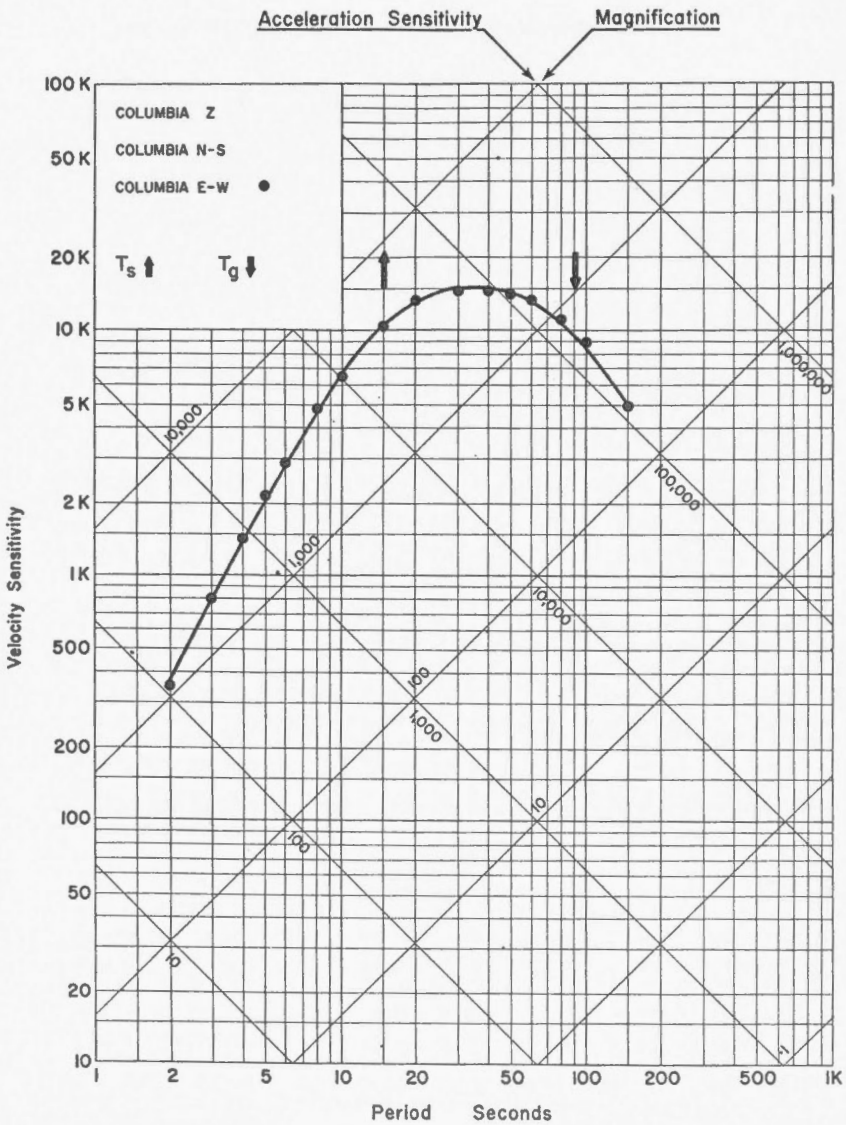
COLUMBIA N-S ● Oct. 21, 1971

COLUMBIA E-W

STATION: FLIN FLON, MANITOBA (As left) (FFC)

ϕ= 54°43.5'N λ= 101°58.7'W Altitude 338 M

Foundation: Granite Gneiss



Dates of Calibration:

COLUMBIA Z

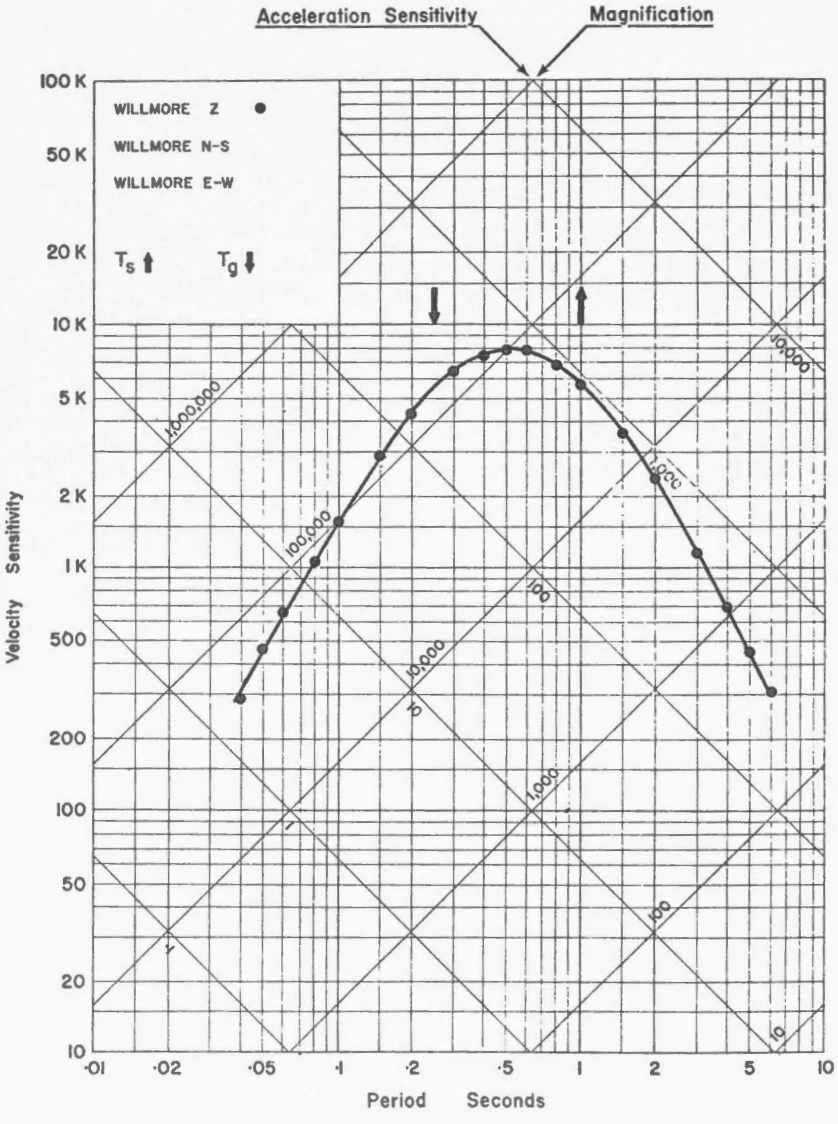
COLUMBIA N-S

COLUMBIA E-W ● Oct. 25, 1971

STATION: FORT CHURCHILL, MAN. (As found and left) (FCC)

ϕ= 58°45.7'N λ= 94°05.2'W Altitude 39 M

Foundation: Precambrian sediments and volcanic rocks.



Dates of Calibration:

WILLMORE Z ● June 14, 1971

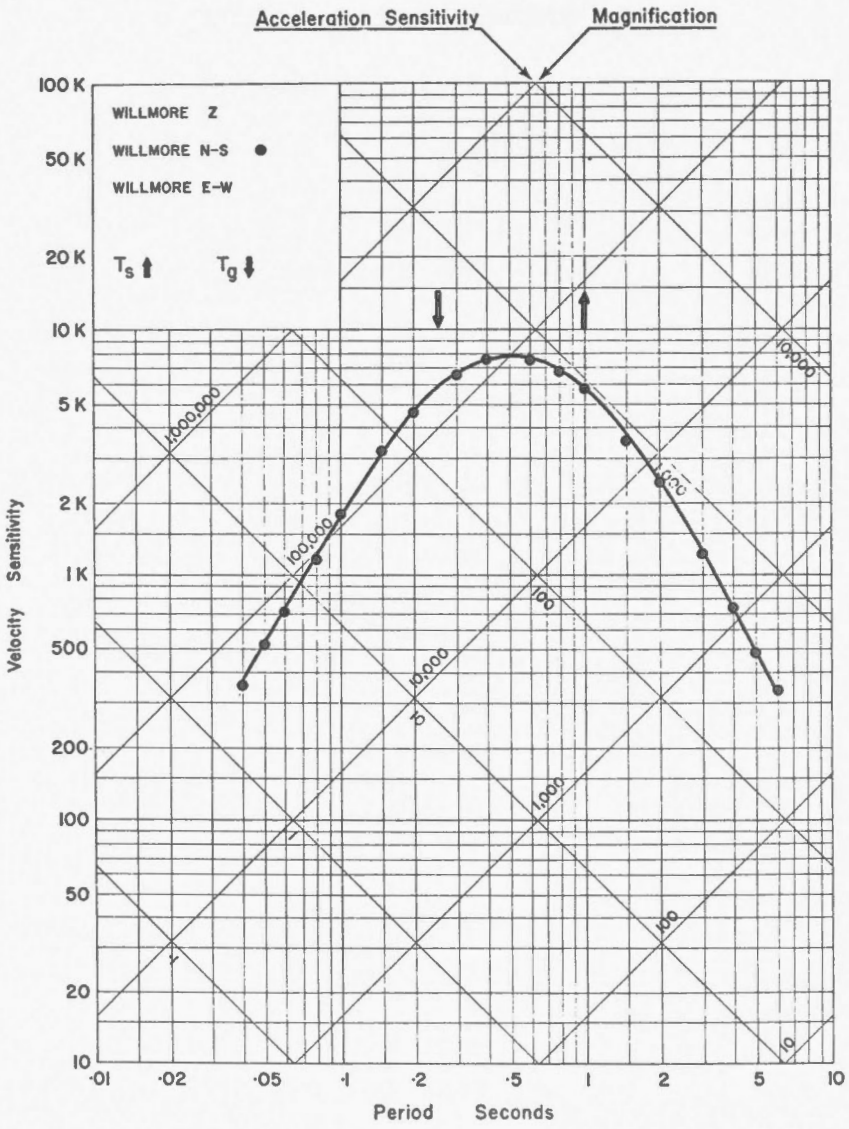
WILLMORE N-S

WILLMORE E-W

STATION: FORT CHURCHILL, MAN. (As found and left) (FCC)

ϕ= 58°45.7'N λ= 94°05.2'W Altitude 39 M

Foundation: Precambrian sediments and volcanic rocks.



Dates of Calibration:

WILLMORE Z

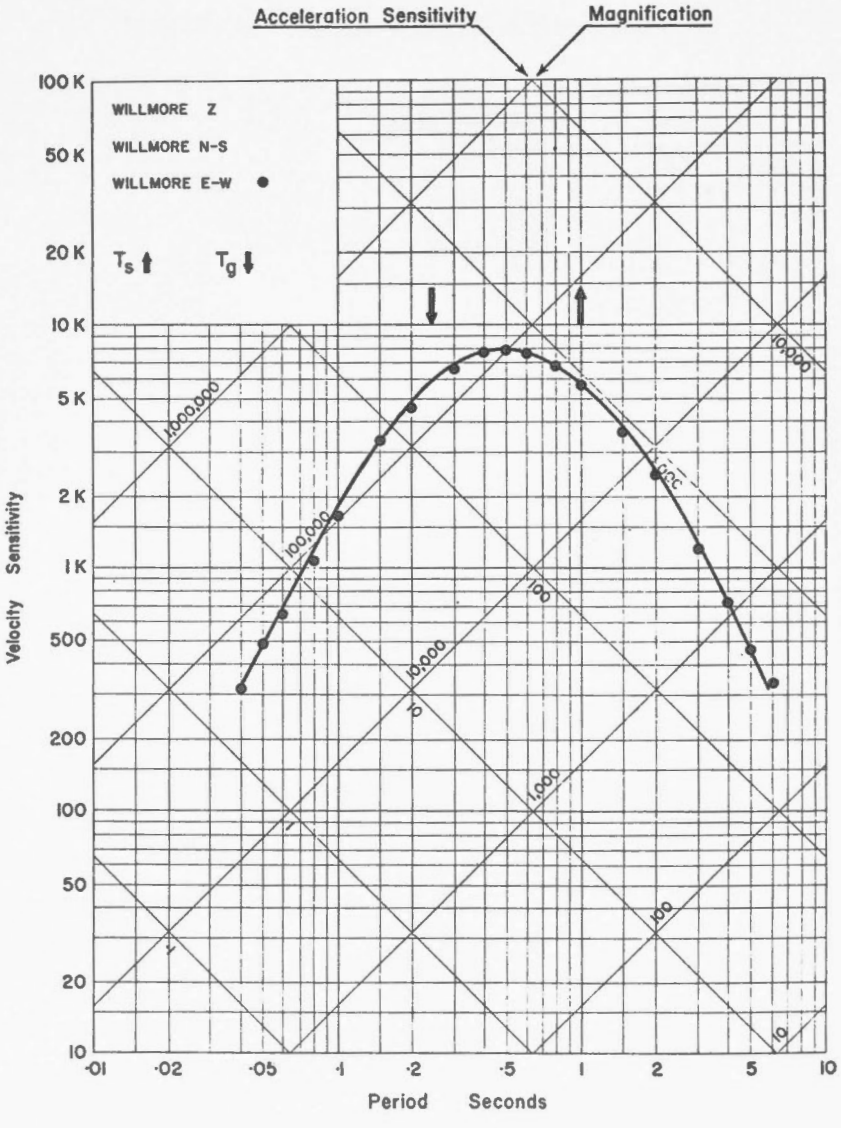
WILLMORE N-S ● June 14, 1971

WILLMORE E-W

STATION: FORT CHURCHILL, MAN. (As found and left) (FCC)

ϕ= 58°45.7'N λ= 94°05.2'W Altitude 39 M

Foundation: Precambrian sediments and volcanic rocks.



Dates of Calibration:

WILLMORE Z

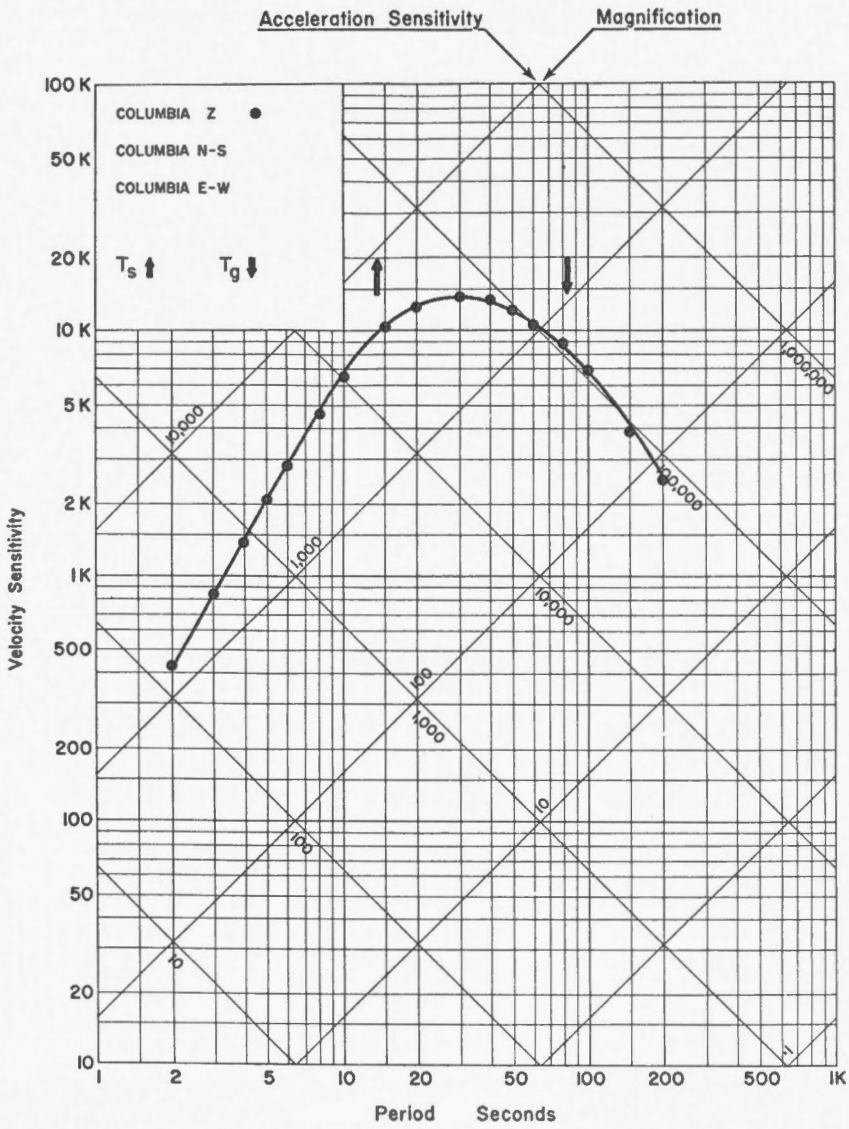
WILLMORE N-S

WILLMORE E-W ● June 14, 1971

STATION: FORT CHURCHILL, MAN. (As left) (FCC)

ϕ= 58°45.7'N λ= 94°05.2'W Altitude 39 M

Foundation: Precambrian sediments and volcanic rocks.



Dates of Calibration:

COLUMBIA Z • June 15, 1971

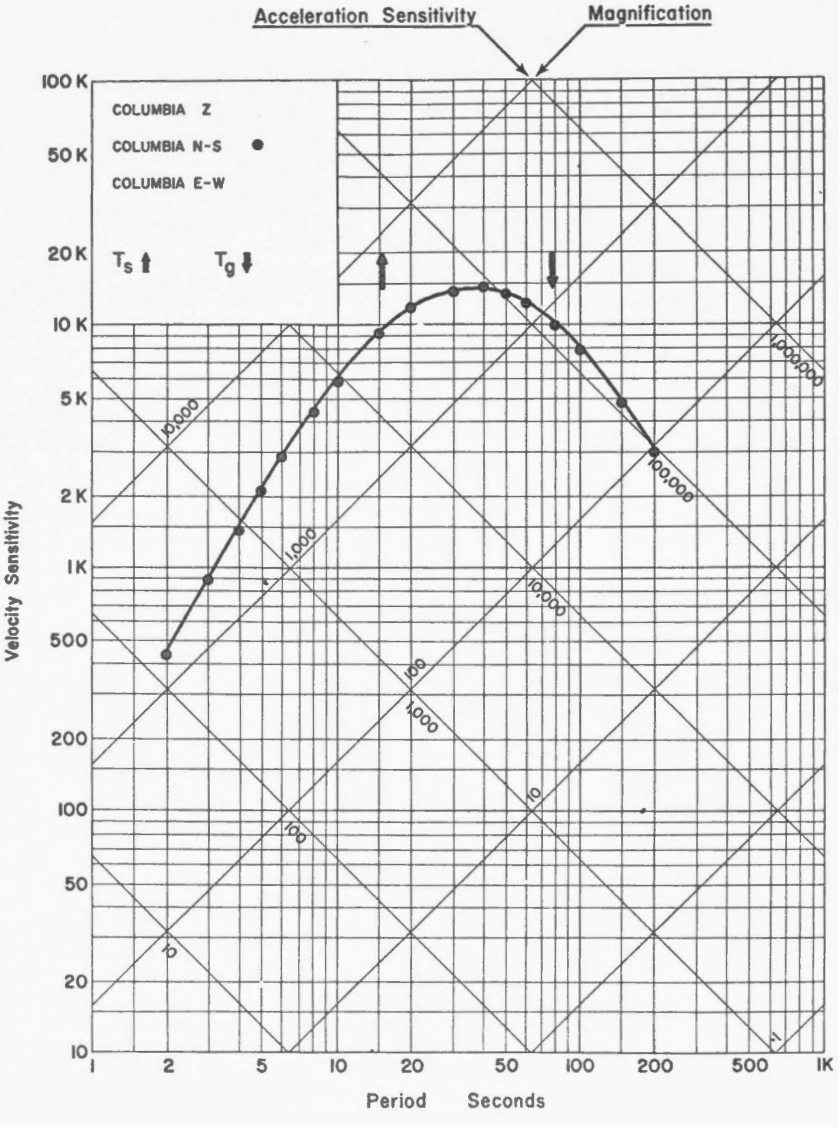
COLUMBIA N-S

COLUMBIA E-W

STATION: FORT CHURCHILL, MAN. (As found and left) (FCC)

ϕ= 58°45.7'N λ= 94°05.2'W Altitude 39 M

Foundation: Precambrian sediments and volcanic rocks.



Dates of Calibration:

COLUMBIA Z

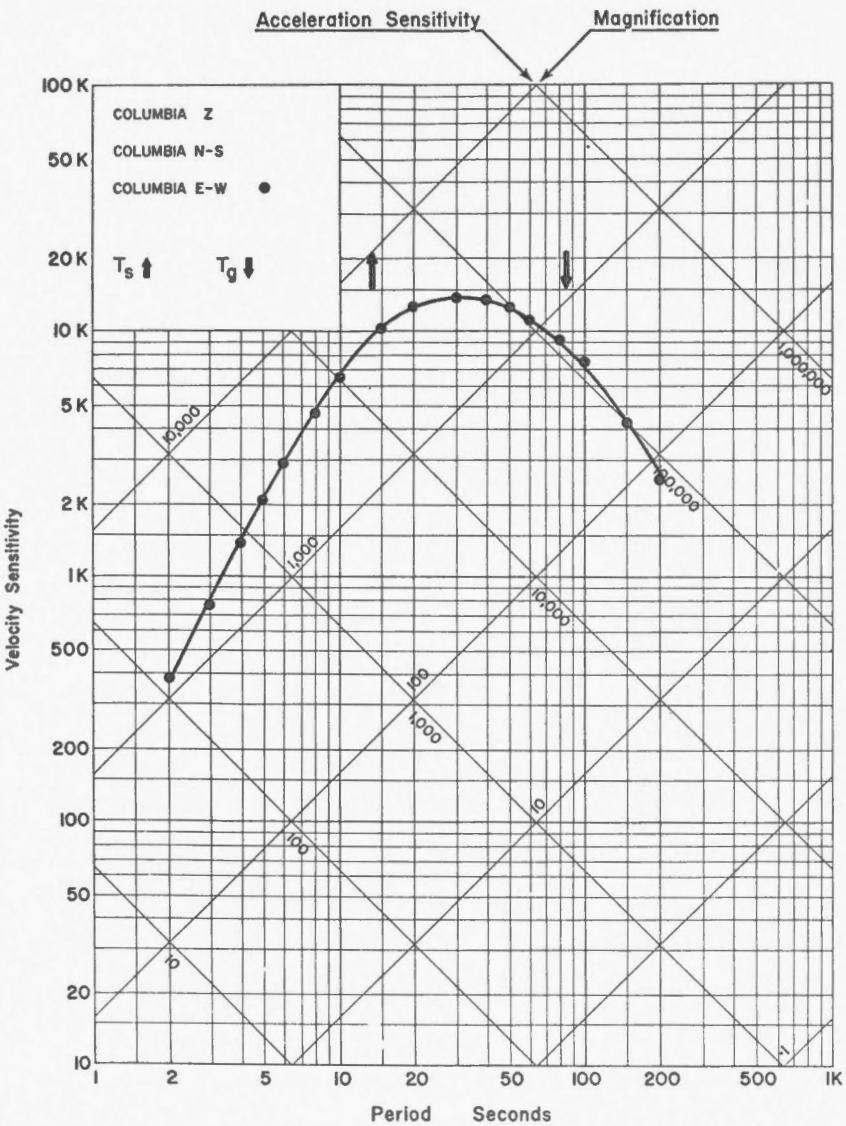
COLUMBIA N-S • June 15, 1971

COLUMBIA E-W

STATION: FORT CHURCHILL, MAN. (As found and left) (FCC)

ϕ= 58°45.7'N λ= 94°05.2'W Altitude 39 M

Foundation: Precambrian sediments and volcanic rocks.



Dates of Calibration:

COLUMBIA Z

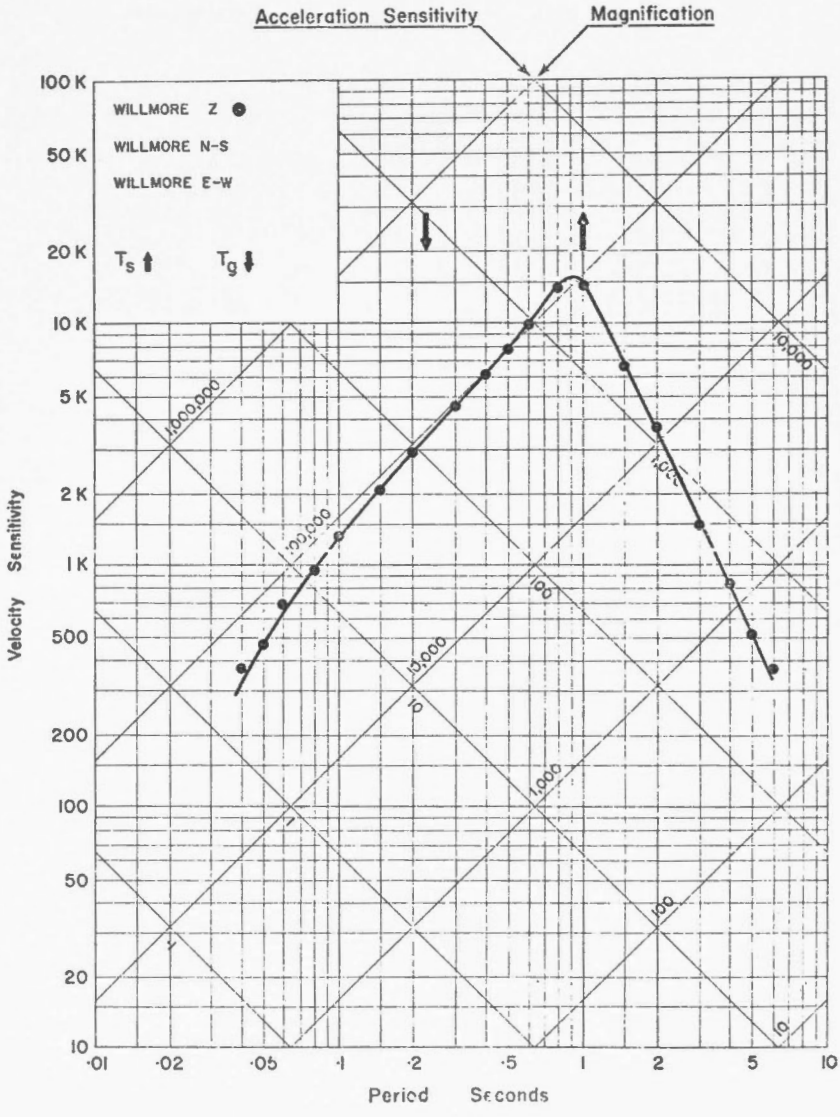
COLUMBIA N-S

COLUMBIA E-W • June 15, 1971

STATION: FORT ST. JAMES, B.C. (FSJ)

ϕ= 54°26'N λ= 124°15'W Altitude 772 M

Foundation: Palaeozoic Sediments



Dates of Calibration:

WILLMORE Z Oct. 29, 1970

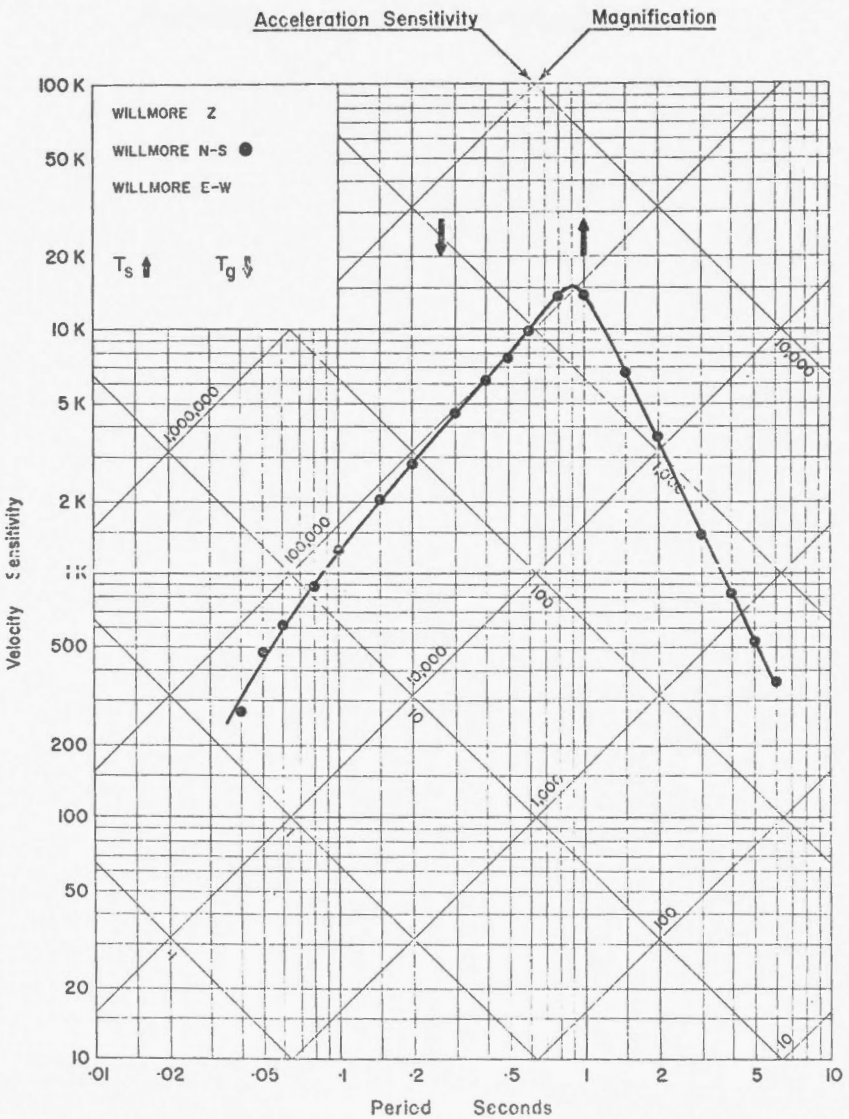
WILLMORE N-S

WILLMORE E-W

STATION: FORT ST. JAMES, B.C. (FSJ)

ϕ= 54°26'N λ= 124°15'W Altitude 772

Foundation: Palaeozoic Sediments



Dates of Calibration:

WILLMORE Z

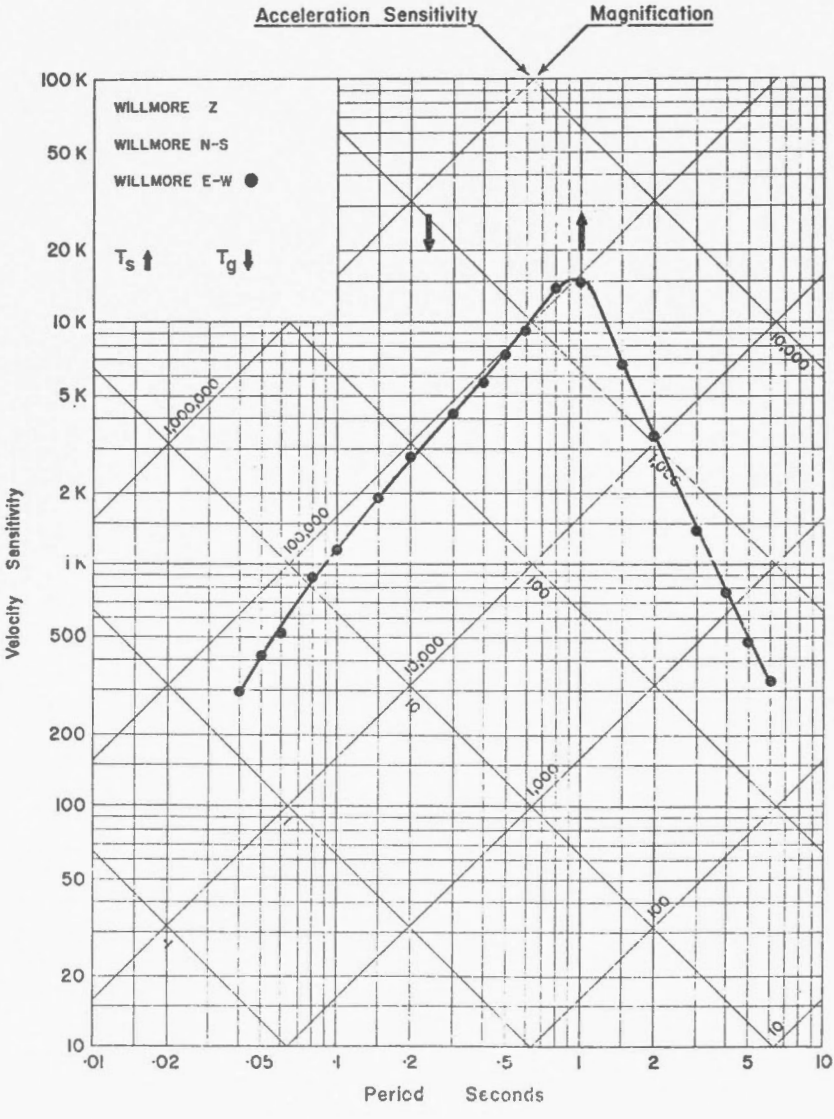
WILLMORE N-S ● Oct. 29, 1970

WILLMORE E-W

STATION: FORT ST. JAMES, B.C. (FSJ)

ϕ= 54°26'N λ= 124°15'W Altitude 772

Foundation: Palaeozoic Sediments



Dates of Calibration:

WILLMORE Z

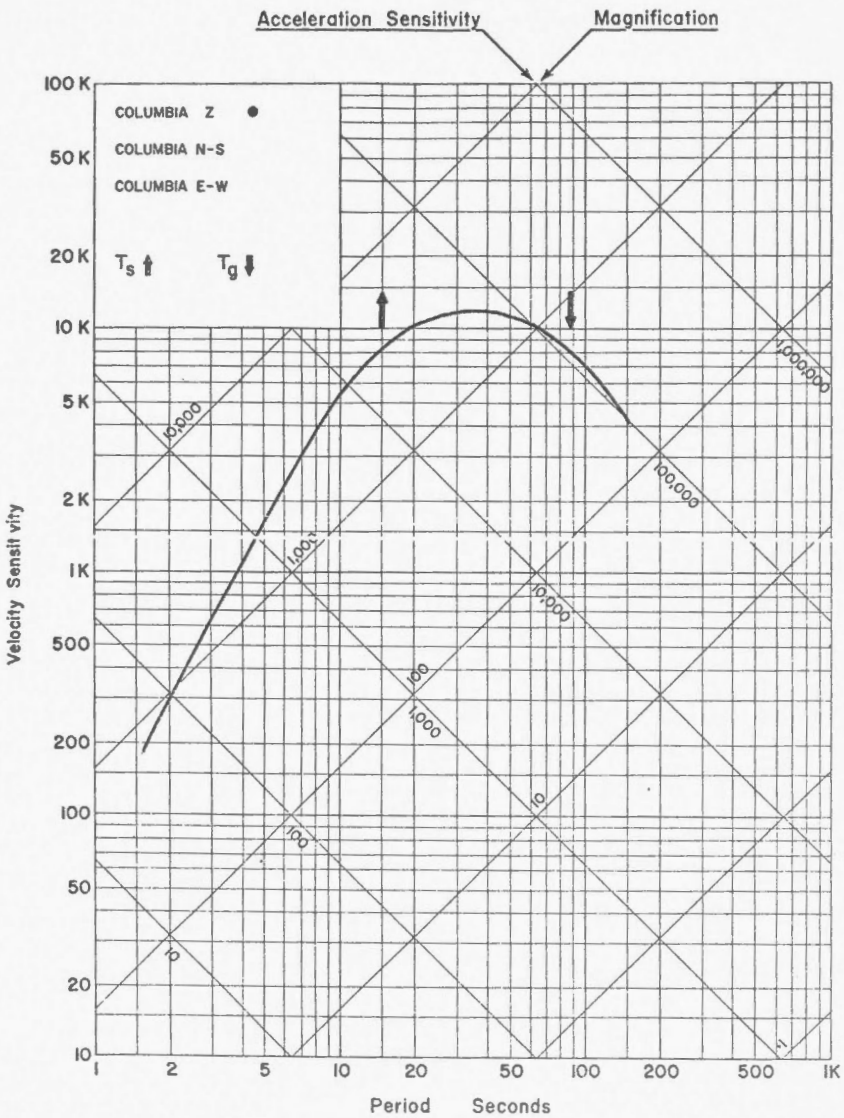
WILLMORE N-S

WILLMORE E-W ● Oct. 29, 1970

STATION: FORT ST. JAMES, B.C. (FSJ)

ϕ= 54°26'N λ= 124°15'W Altitude 772 M

Foundation: Palaeozoic Sediments



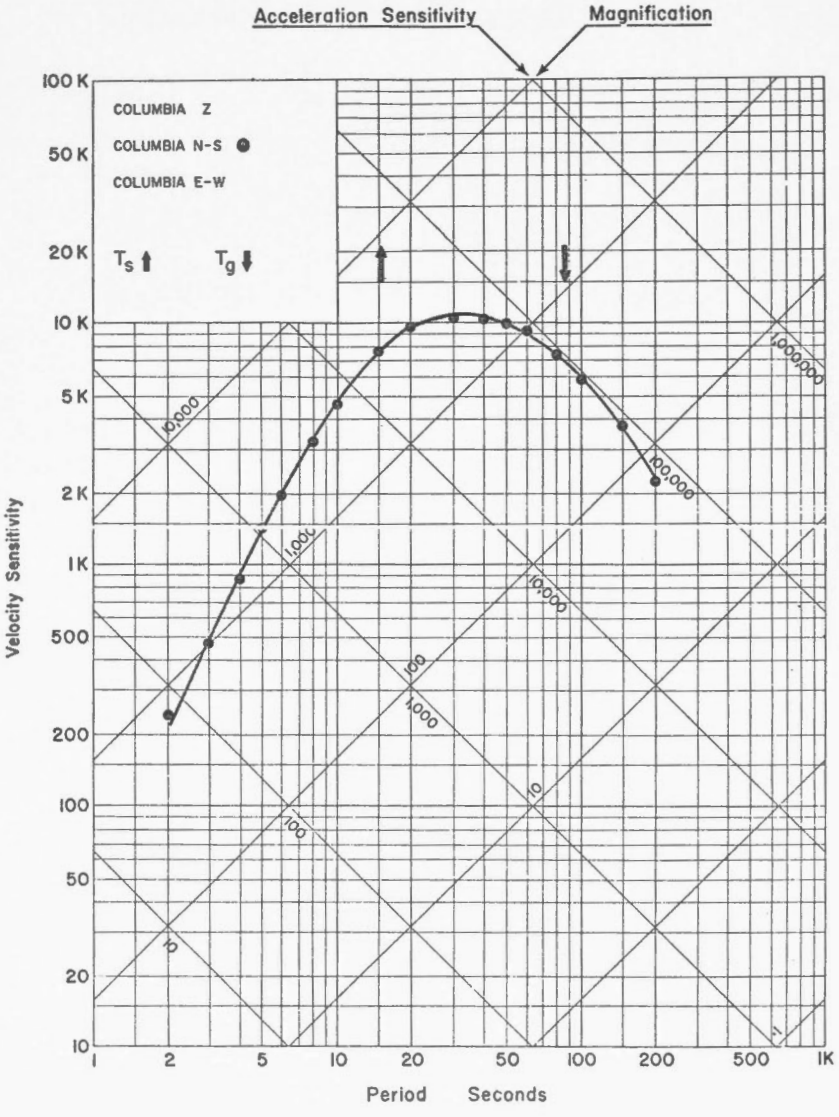
Dates of Calibration:

COLUMBIA Z ● 12 Jan. 1971
COLUMBIA N-S (Calibrated in Ottawa)
COLUMBIA E-W

STATION: FORT ST. JAMES, B.C. (FSJ)

ϕ= 54°26'N λ= 124°15'W Altitude 772 M

Foundation: Palaeozoic Sediments



Dates of Calibration:

COLUMBIA Z

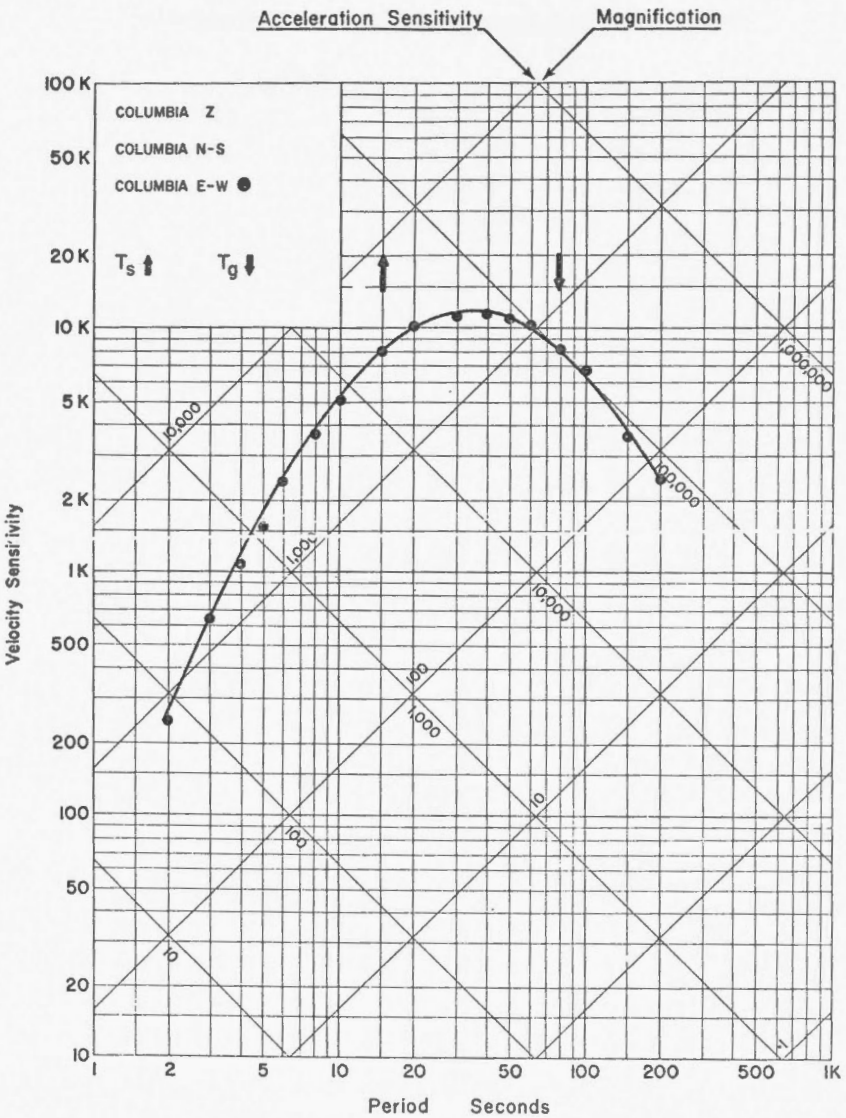
COLUMBIA N-S Oct. 27, 1970

COLUMBIA E-W

STATION: FORT ST. JAMES, B.C. (FSJ)

ϕ= 54°26'N λ= 124°15'W Altitude 772 M

Foundation: Palaeozoic Sediments



Dates of Calibration:

COLUMBIA Z

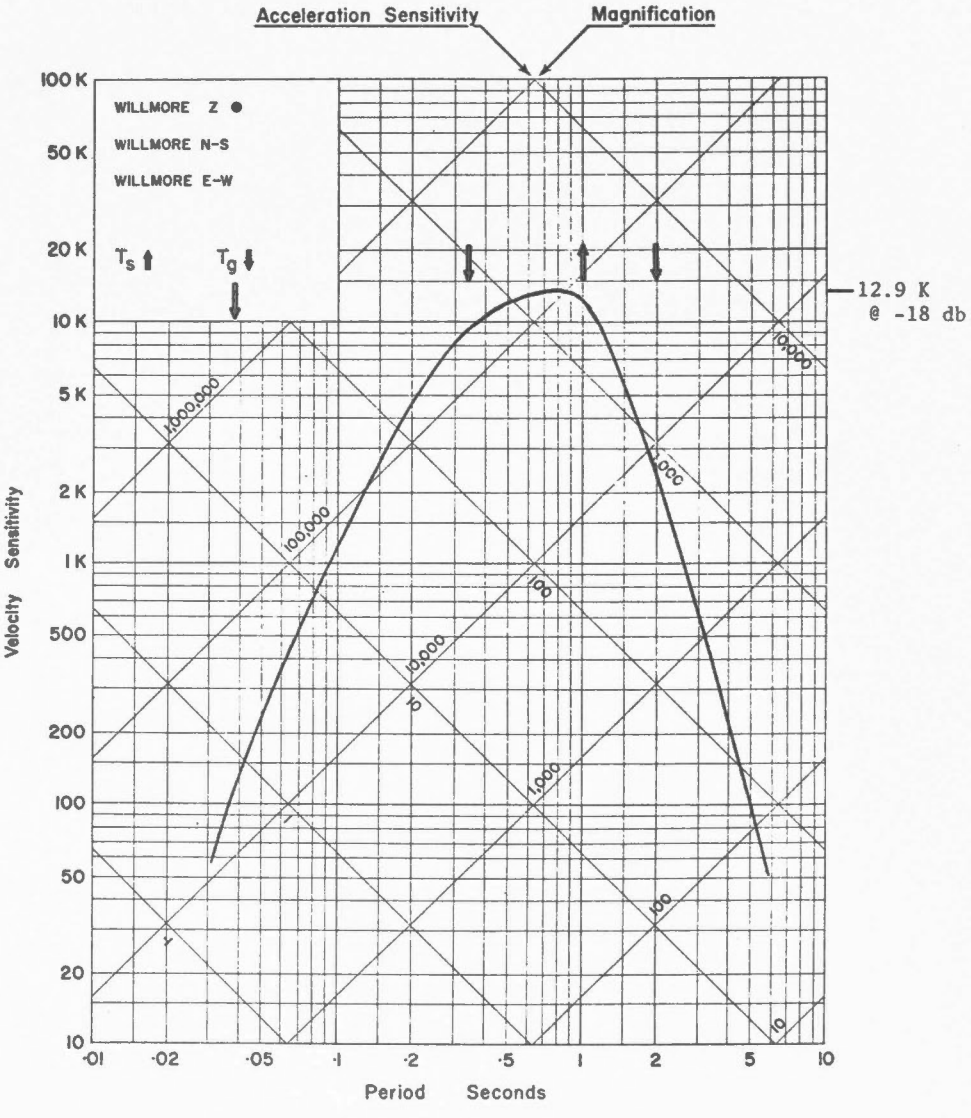
COLUMBIA N-S

COLUMBIA E-W ● Oct. 28, 1970

STATION: FREDERICTON, N.B. (UNB)

ϕ= 45°57'N λ= 66°38'W Altitude 56 M

Foundation: Cenozoic, early post-glacial rock



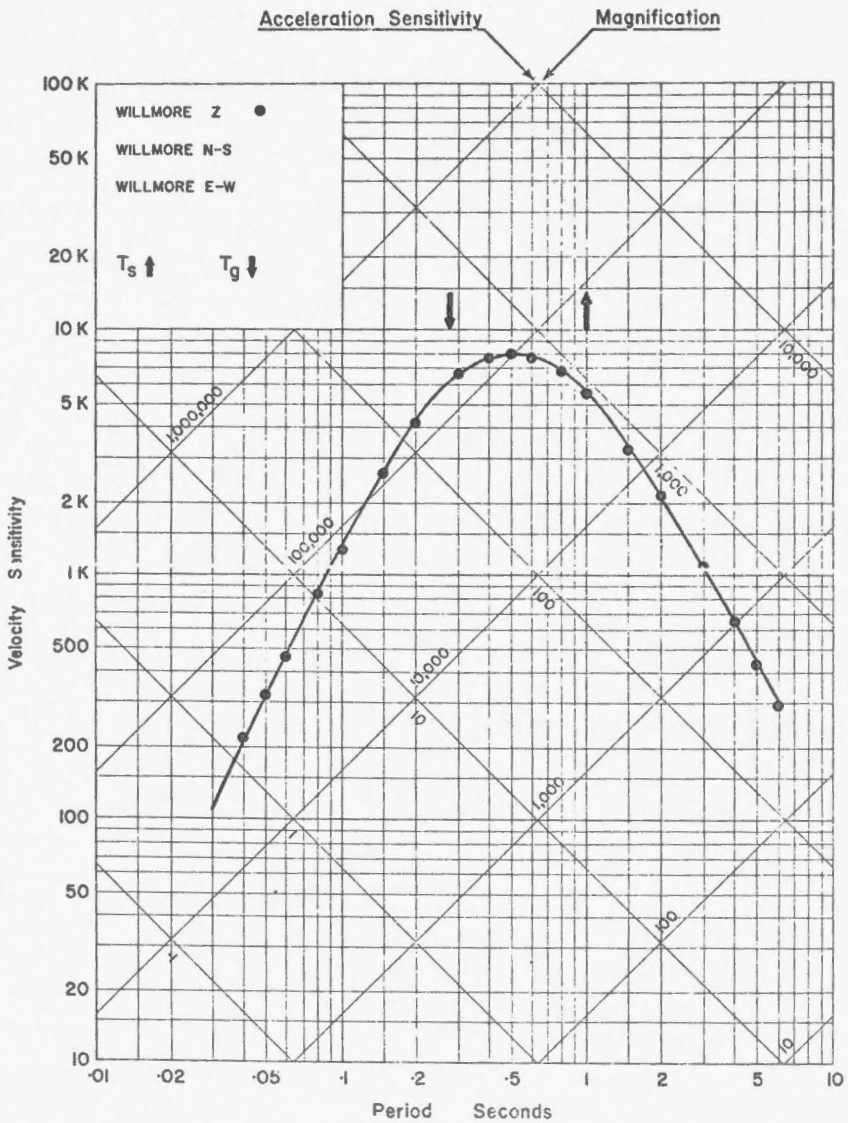
Dates of Calibration: February 7, 1973

SEISMOMETER: Willmore MKII G_L=1.75 v.s./cm
PREAMPLIFIER: Teledyne EA310 operated at 30 db sep.
Filter Bandpass 0.5-3 Hz
HELICORDER: 2484 0-25Hz
Corner frequencies indicated by "T_g" arrows.

STATION: FROBISHER, N.W.T. (FRB) (FINAL)

ϕ= 63°44.8'N λ=68°32.8'W Altitude 18 M

Foundation: Precambrian metamorphic rock.



Dates of Calibration:

WILLMORE Z ● Nov. 28, 1972

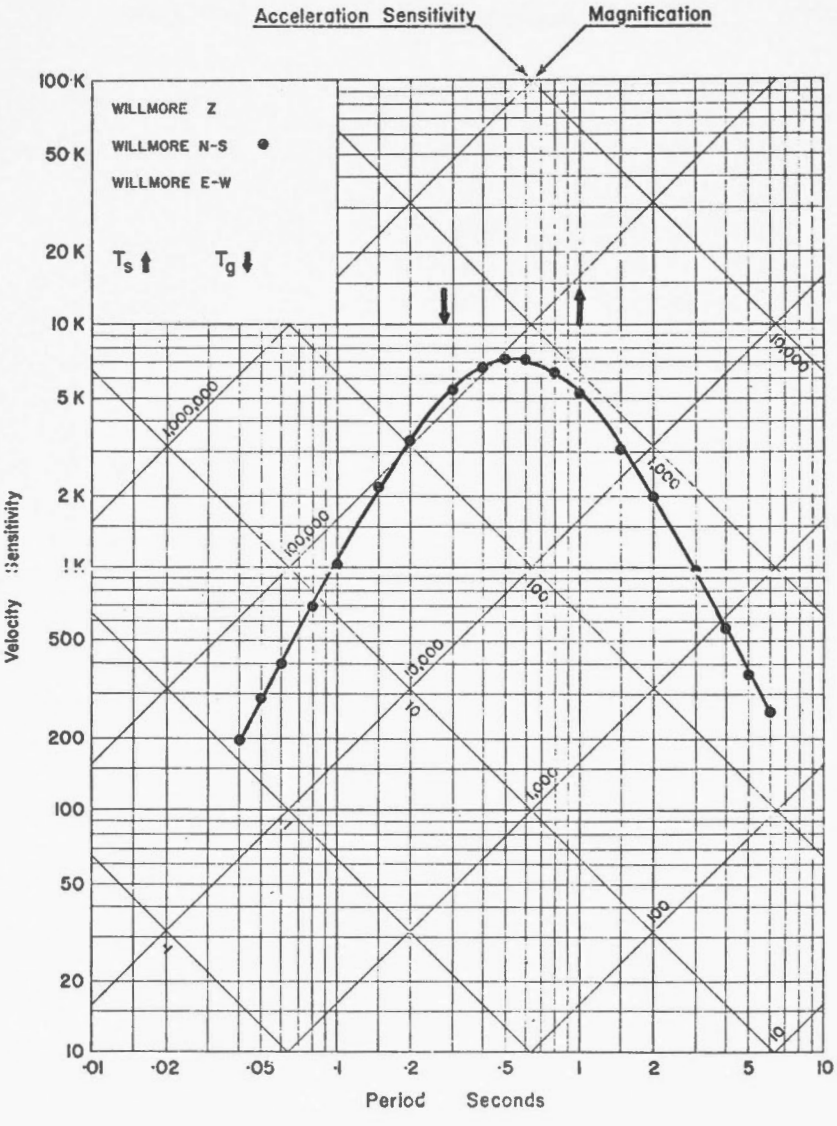
WILLMORE N-S

WILLMORE E-W

STATION: FROBISHER, N.W.T. (FRB) (FINAL)

ϕ= 63°44.8'N λ= 68°32.8'W Altitude 18 M

Foundation: Precambrian metamorphic rock



Dates of Calibration:

WILLMORE Z

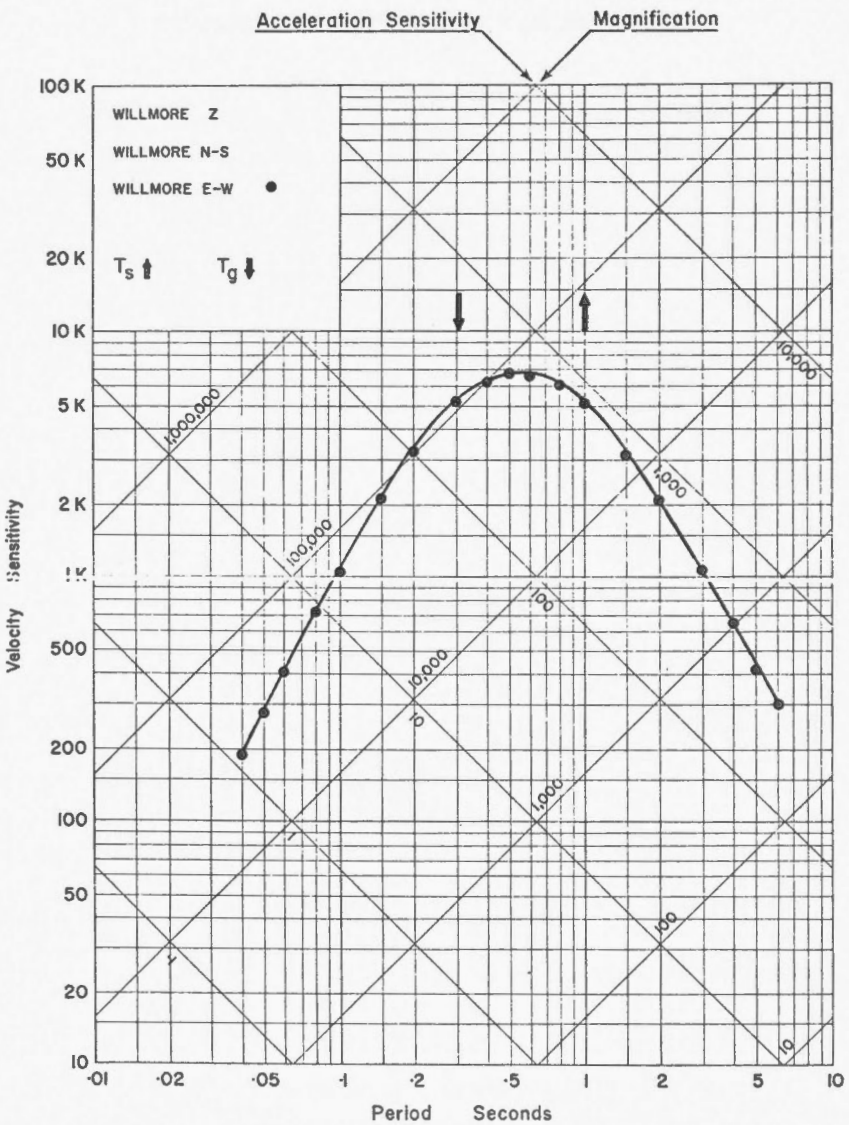
WILLMORE N-S ● Nov. 28, 1972

WILLMORE E-W

STATION: FROBISHER, N.W.T. (FRB) (FINAL)

ϕ= 63°44.8'N λ=68°32.8'W Altitude 18 M

Foundation: Precambrian metamorphic rock



Dates of Calibration:

WILLMORE Z

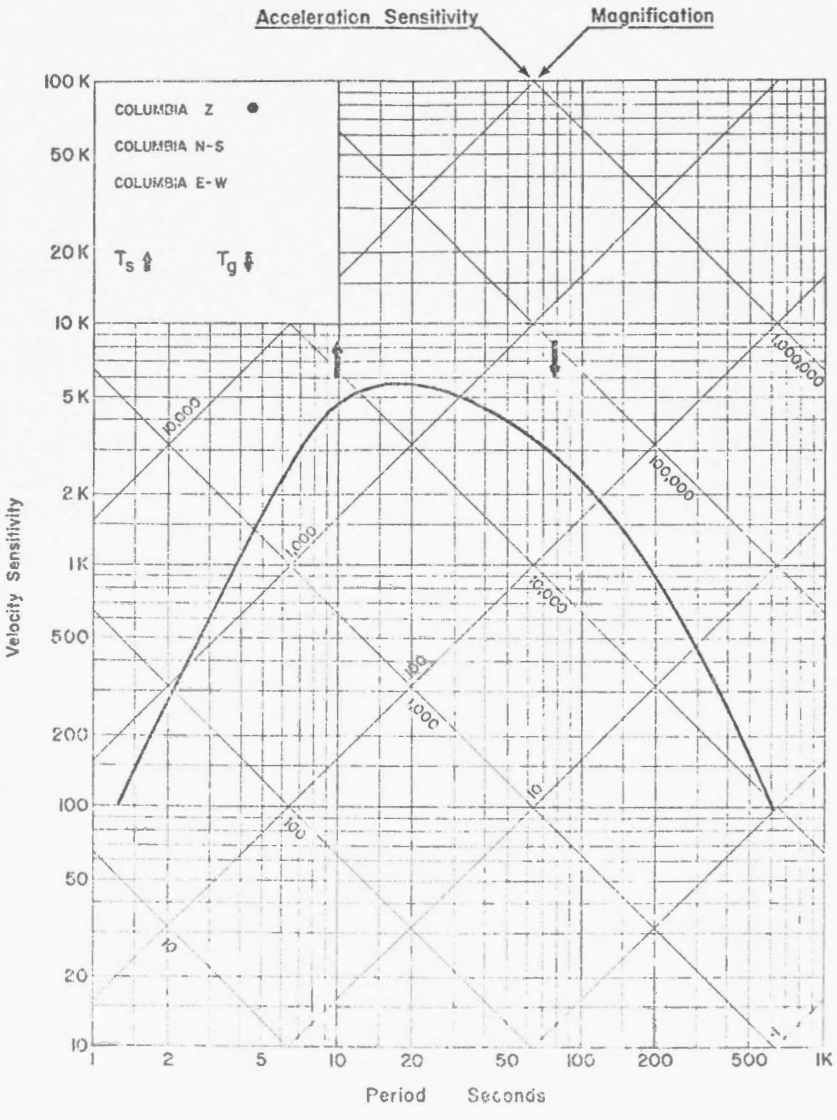
WILLMORE N-S

WILLMORE E-W ● Nov. 28, 1972

STATION: FROBISHER, N.W.T. (FRB) (FINAL)

ϕ= 63°44.8'N λ= 68°32.8'W Altitude 18 M

Foundation: Precambrian metamorphic rock



Dates of Calibration: Valid from Dec. 7, 1972, to June 25, 1973 (Calculated in Ottawa)

COLUMBIA Z

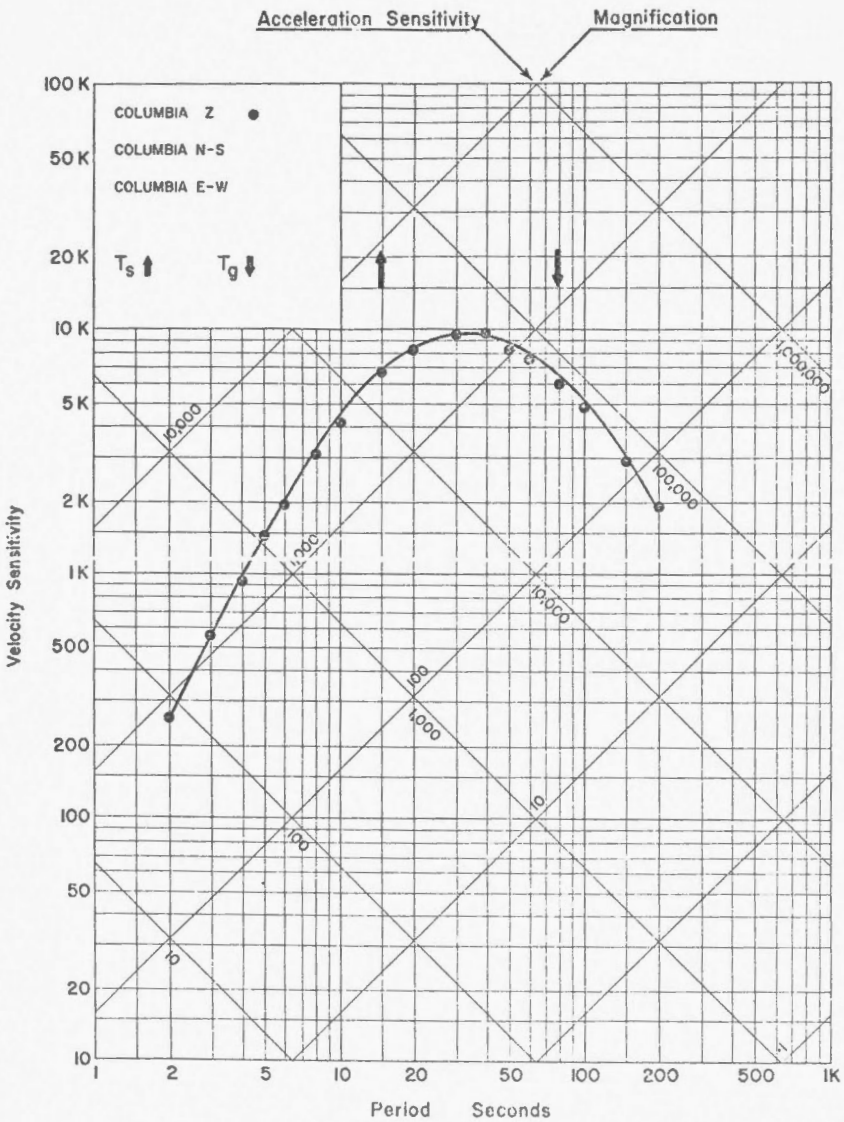
COLUMBIA N-S

COLUMBIA E-W

STATION: FROBISHER, N.W.T. (FRB) (FINAL)

$\phi = 63^{o}44.8'N$ $\lambda = 68^{o}32.8'W$ Altitude 18 M

Foundation: Precambrian metamorphic rock



Dates of Calibration:

COLUMBIA Z • Nov. 29, 1972 (Valid again from June 26, 1973 onward. See Bulletin notes.)

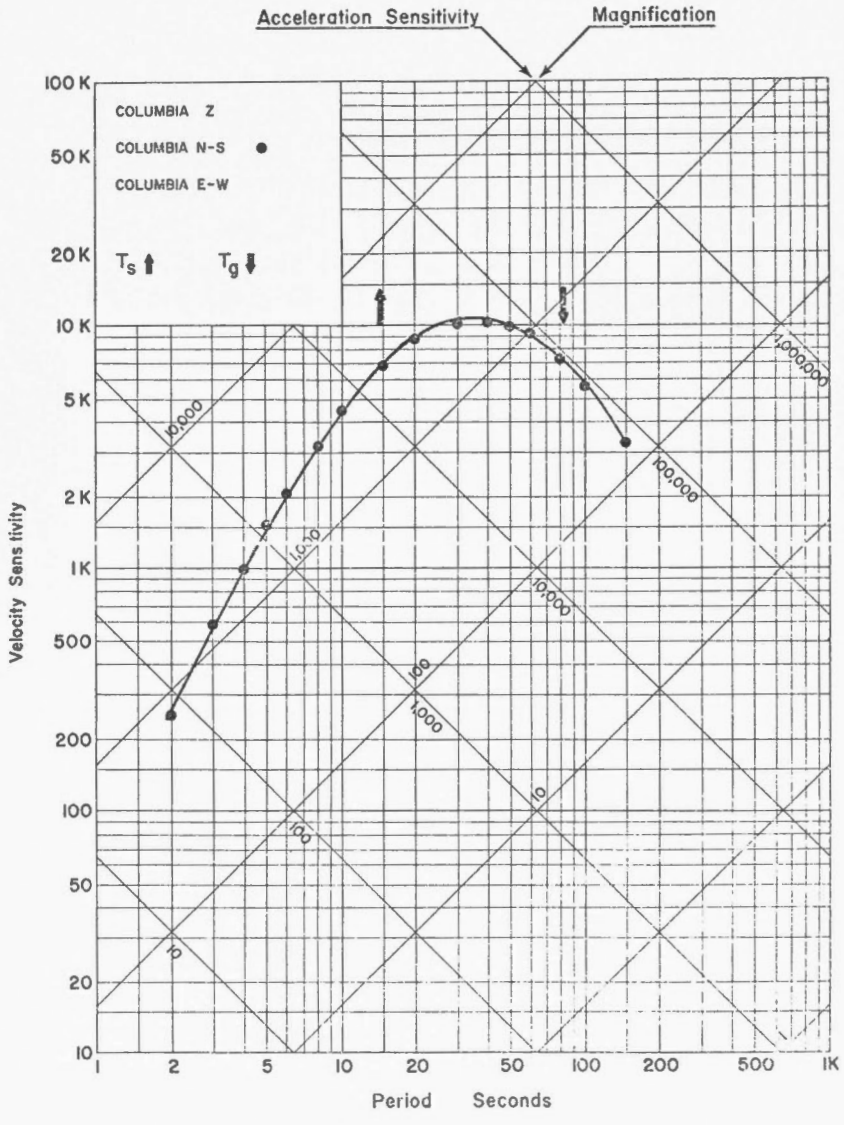
COLUMBIA N-S

COLUMBIA E-W

STATION: FROBISHER, N.W.T. (FRB) (FINAL)

$\phi = 63^{o}44.8'N$ $\lambda = 68^{o}32.8'W$ Altitude 18 M

Foundation: Precambrian metamorphic rock



Dates of Calibration:

COLUMBIA Z

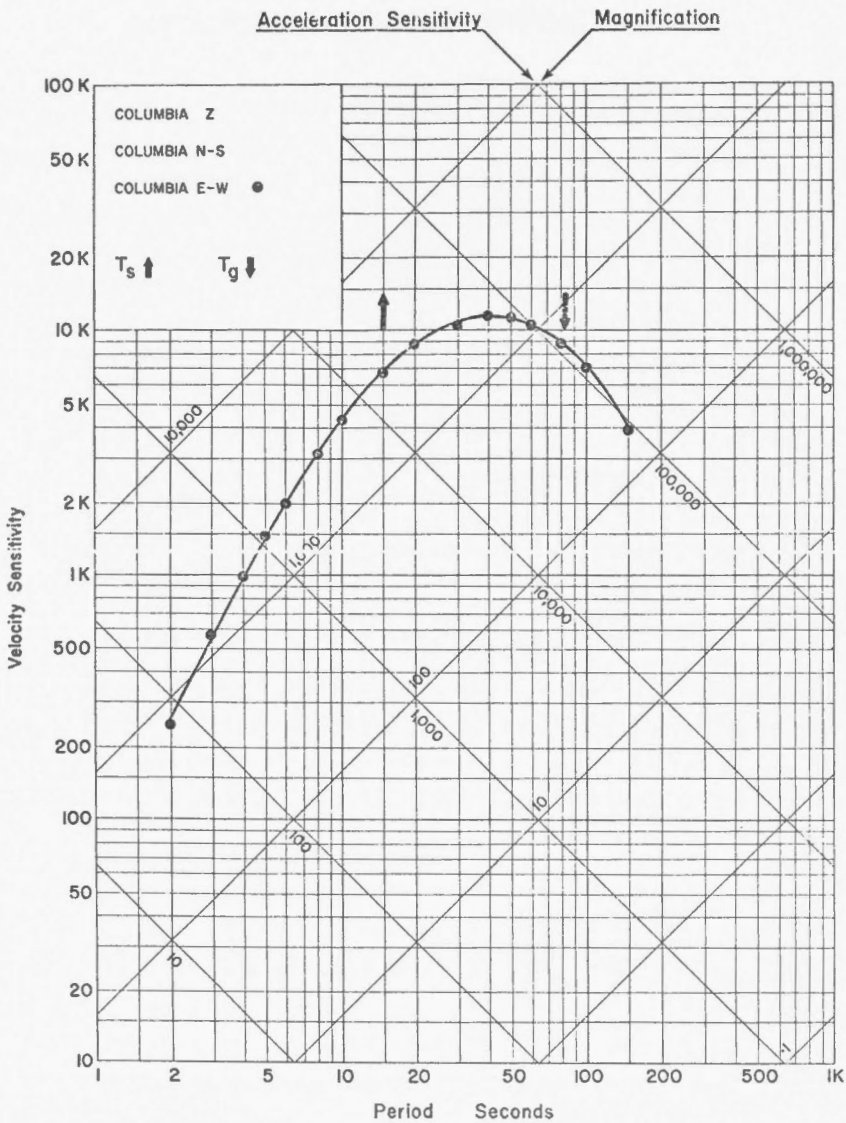
COLUMBIA N-S ● Nov. 29, 1972

COLUMBIA E-W

STATION: FROBISHER, N.W.T. (FRB) (FINAL)

$\phi = 63^{o}44.8'N$ $\lambda = 68^{o}32.8'W$ Altitude 18 M

Foundation: Precambrian metamorphic rock



Dates of Calibration:

COLUMBIA Z

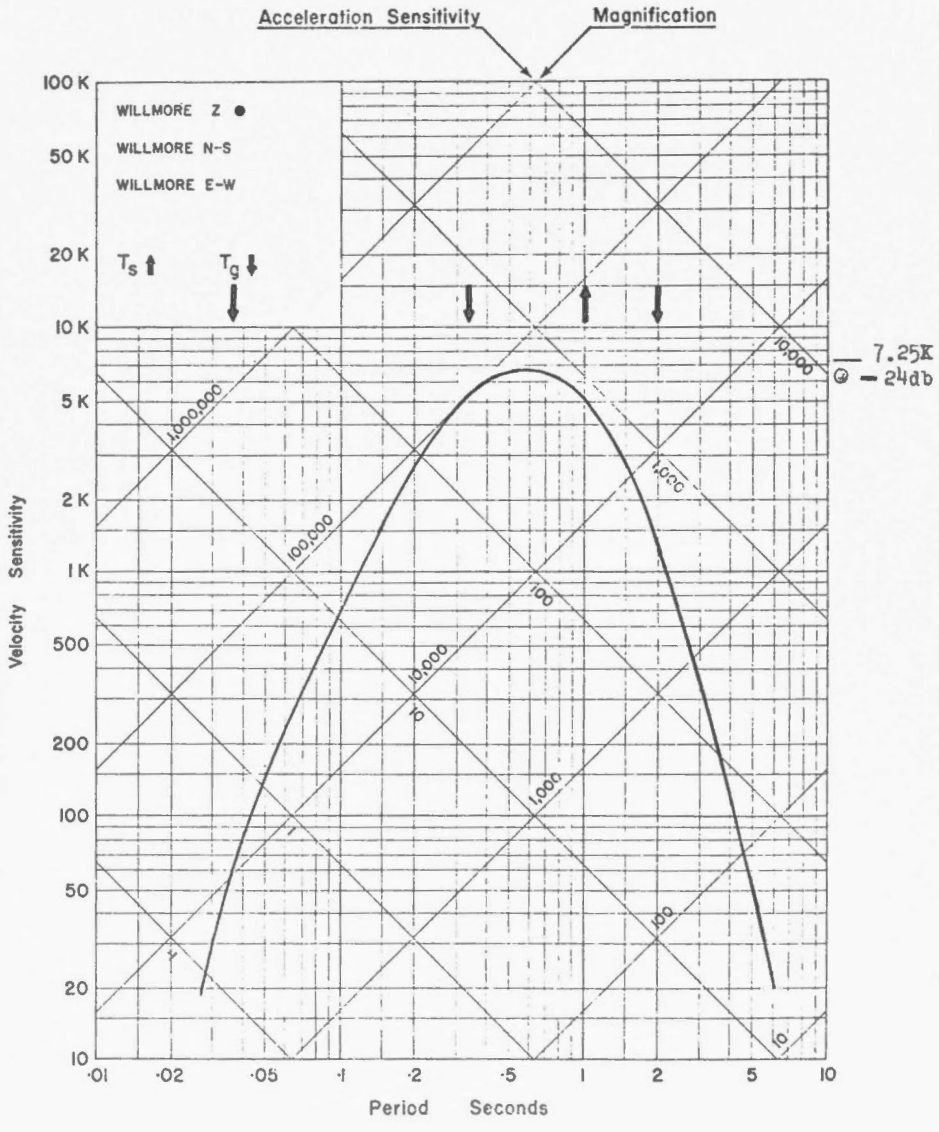
COLUMBIA N-S

COLUMBIA E-W • Nov. 30, 1972

STATION: HALIFAX, N.S. (HAL)

ϕ= 44°38'N λ= 63°36'W Altitude 56M

Foundation: Carbonaceous Slate



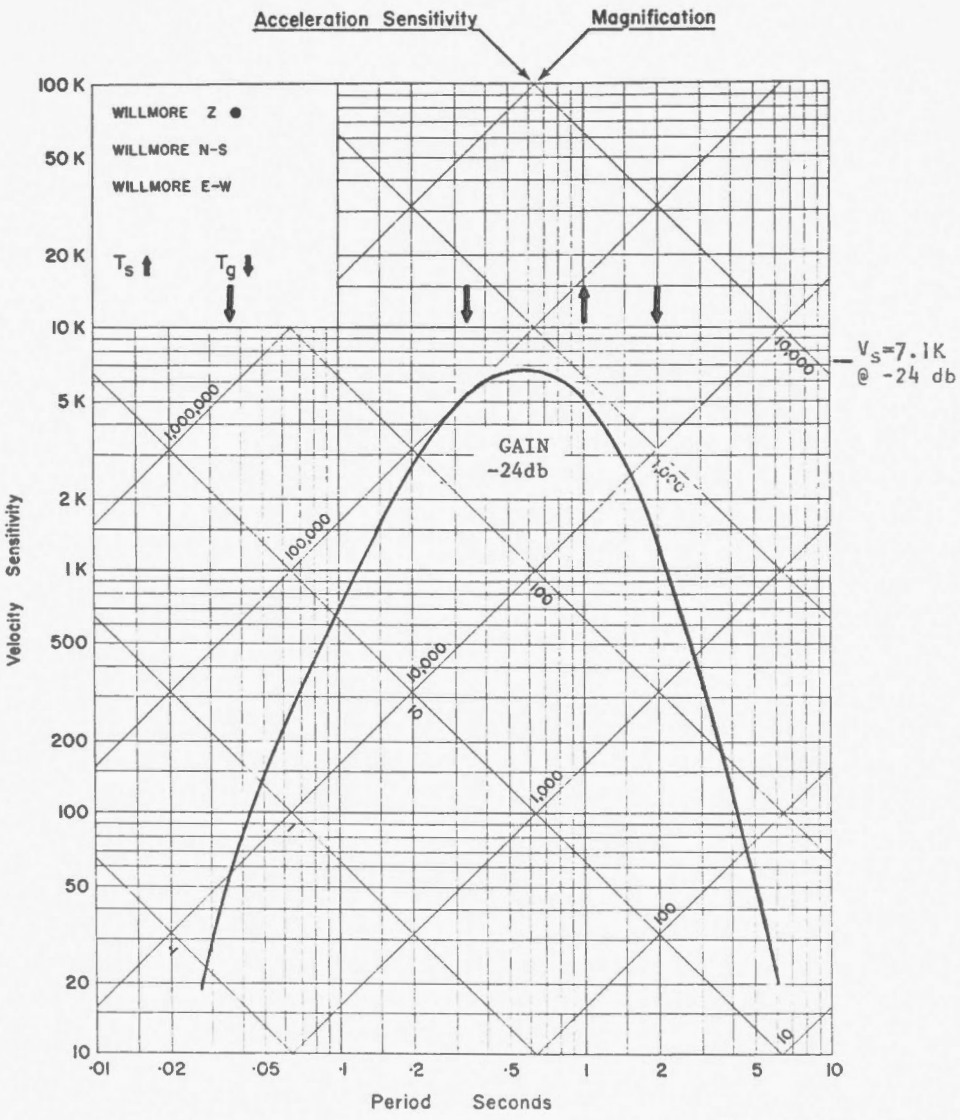
Dates of Calibration:

WILLMORE Z ● April 1, 1971 - Operating with Teledyne
WILLMORE N-S EA 310 amplifier into Helicorder.
WILLMORE E-W Corner frequencies indicated by "Tg" arrows.

STATION: HALIFAX, N.S. (HAL)

ϕ= 44°38'N λ= 63°36'W Altitude 56M

Foundation: Carbonaceous Slate



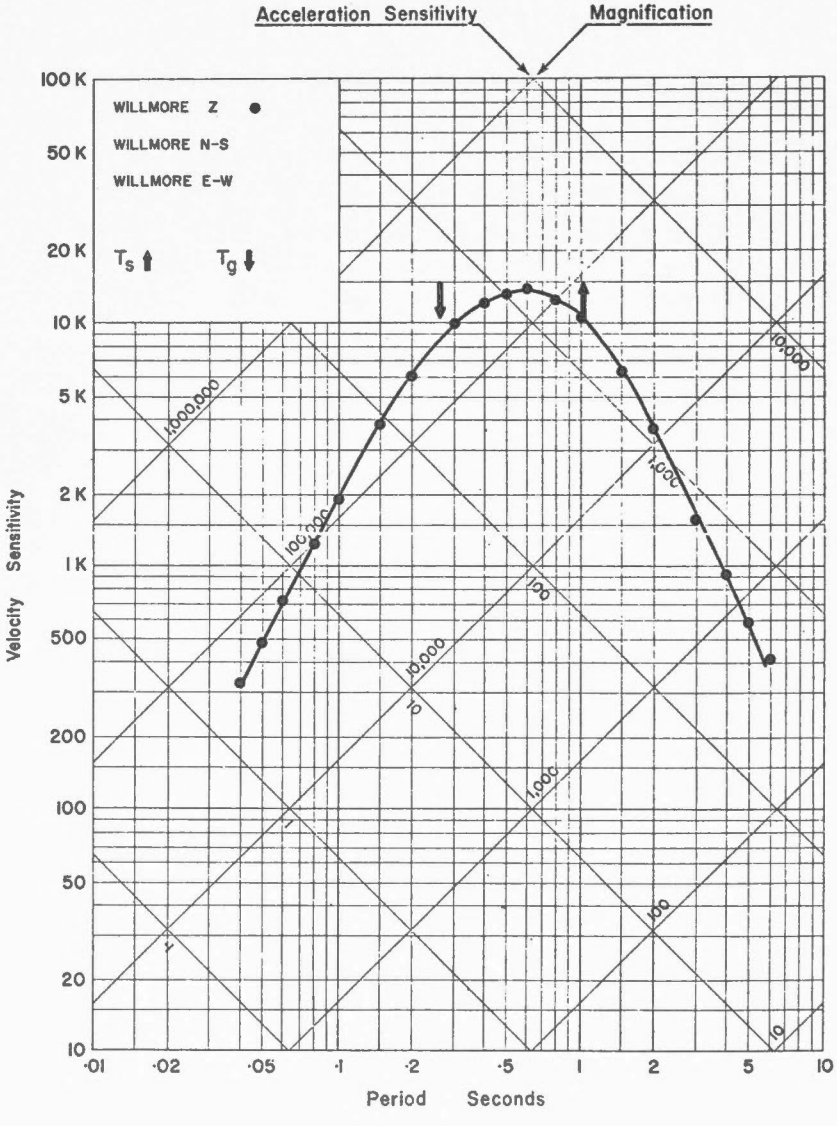
Dates of Calibration: March 9, 1973

SEISMOMETER: Willmore MKII G_L=1.96 v.s/cm
PREAMPLIFIER: Teledyne EA310 operated @ 30 db sep.
Filter Band Pass 0.5-3 Hz
HELICORDER: Model RV301 0-30 Hz
Corner frequencies indicated by "T_g" arrows.

STATION: INUVIK, N.W.T. (FINAL) (INK)

ϕ= 68°17.5'N λ= 133°30'W Altitude 40 M (approx.)

Foundation: Palaeozoic, Sediments Cambrian Limestone



Dates of Calibration:

WILLMORE Z ● June 2, 1972

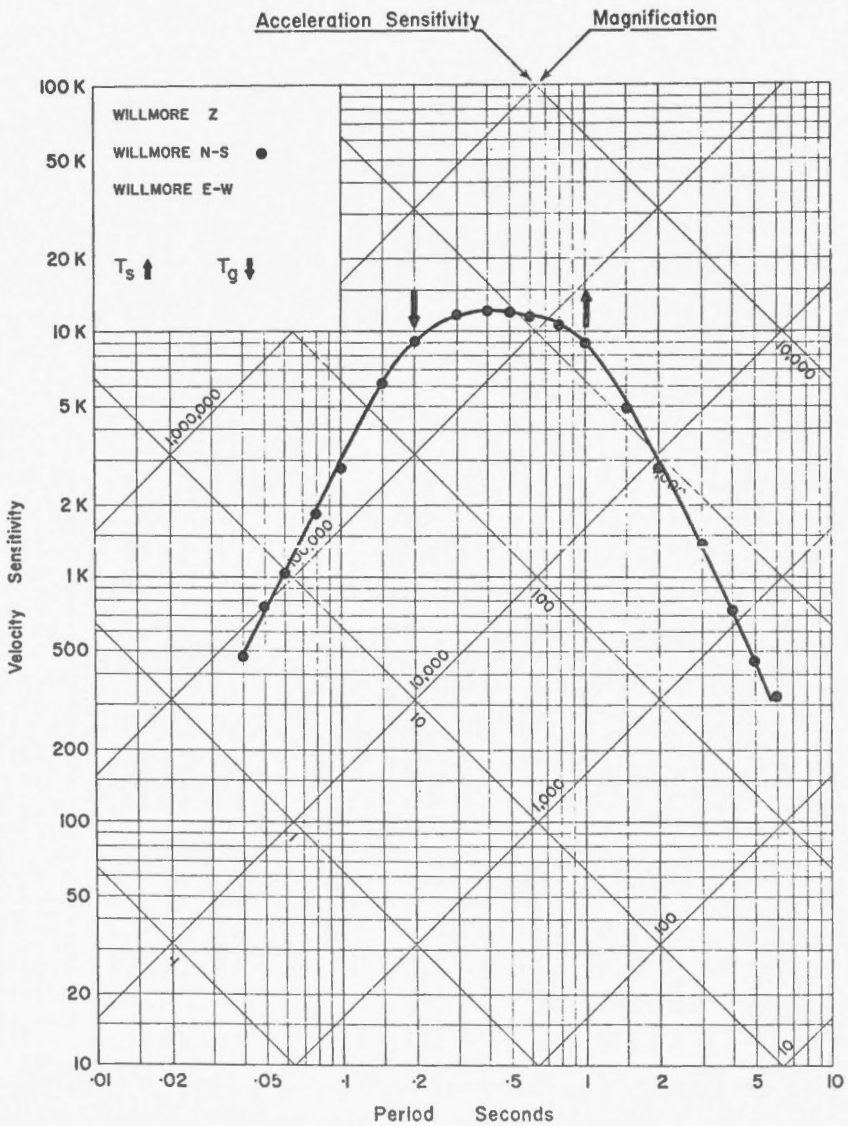
WILLMORE N-S

WILLMORE E-W

STATION: INUVIK, N.W.T. (FINAL) (INK)

ϕ= 68°17.5'N λ= 133°30'W Altitude 40 M (approx.)

Foundation: Palaeozoic, Sediments Cambrian Limestone



Dates of Calibration:

WILLMORE Z

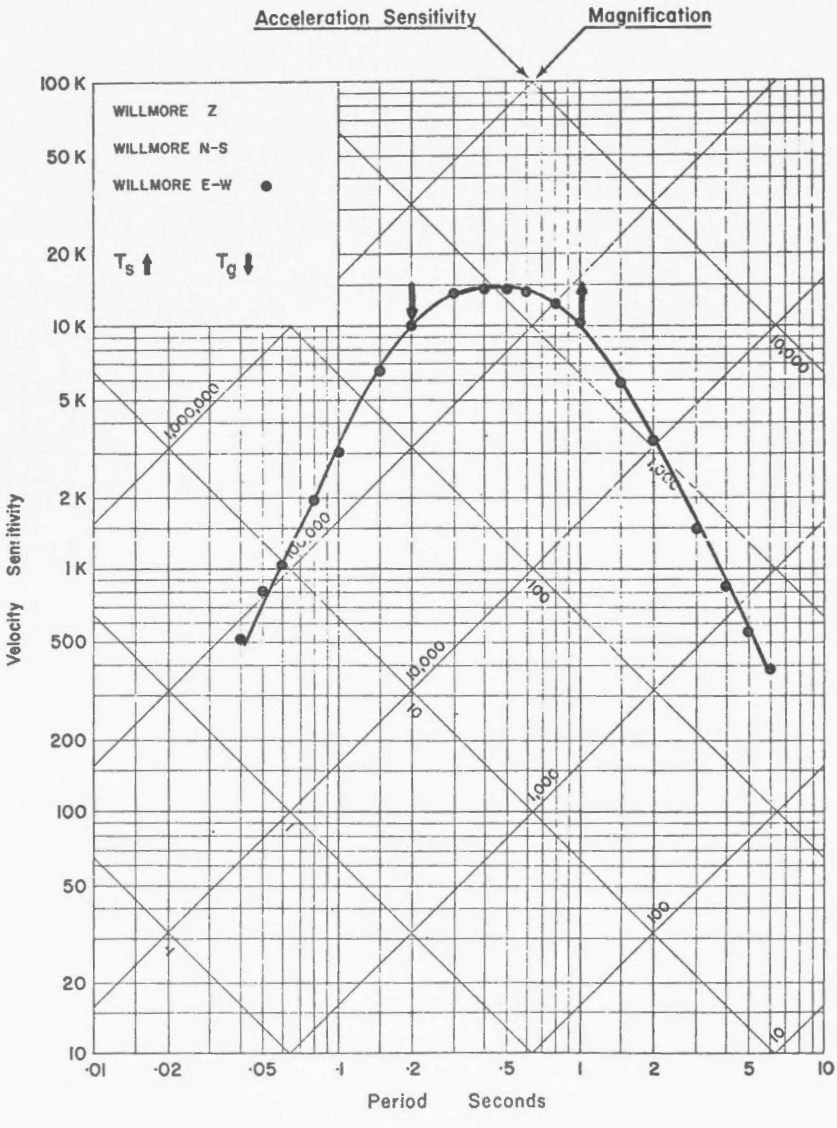
WILLMORE N-S ● June 1, 1972

WILLMORE E-W

STATION: INUVIK, N.W.T. (FINAL) (INK)

ϕ=68°17.5'N λ=133°30'W Altitude 40 M (approx.)

Foundation: Palaeozoic, Sediments Cambrian Limestone



Dates of Calibration:

WILLMORE Z

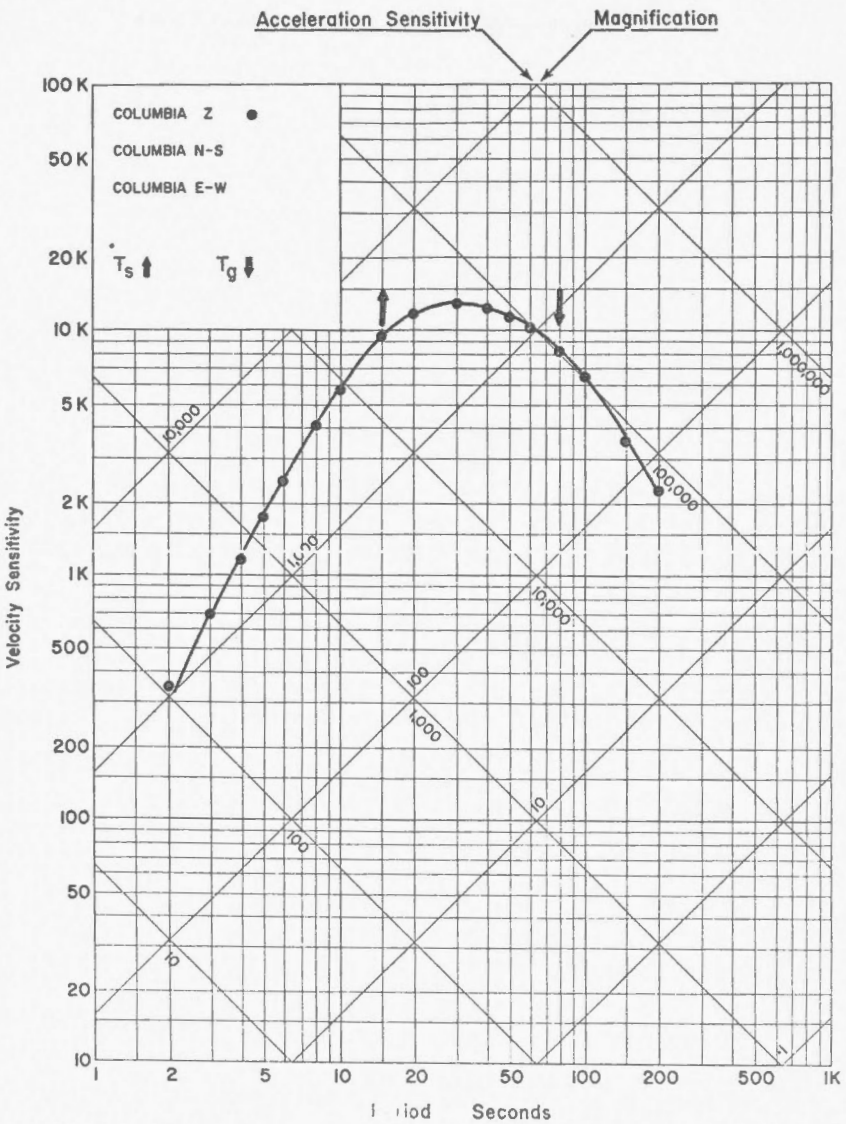
WILLMORE N-S

WILLMORE E-W ● May 31, 1972

STATION: INUVIK, N.W.T. (FINAL) (INK)

$\phi = 68^{\circ}17.5'N$ $\lambda = 133^{\circ}30'W$ Altitude 40 M (approx.)

Foundation: Palaeozoic, Sediments Cambrian Limestone



Dates of Calibration:

COLUMBIA Z • May 31, 1972

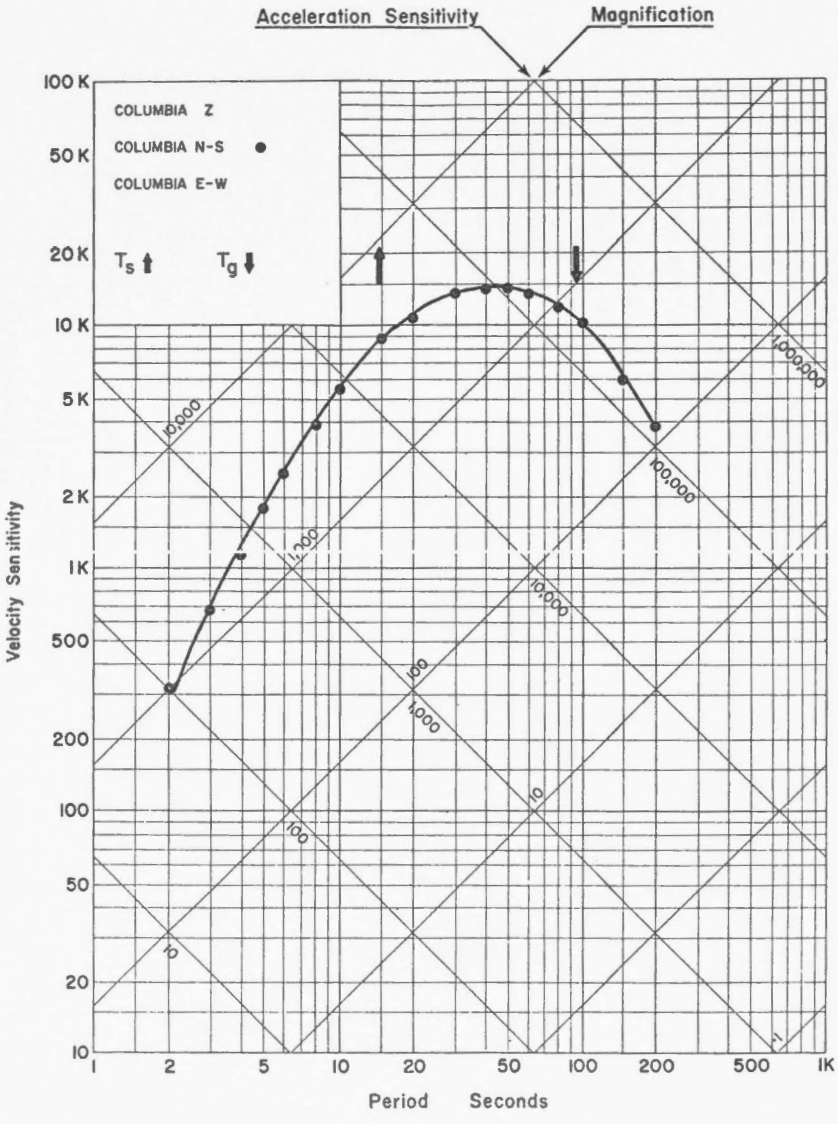
COLUMBIA N-S

COLUMBIA E-W

STATION: INUVIK, N.W.T. (FINAL) (INK)

ϕ= 68°17.5'N λ= 133°30'W Altitude 40 M (approx.)

Foundation: Palaeozoic, Sediments Cambrian Limestone



Dates of Calibration:

COLUMBIA Z

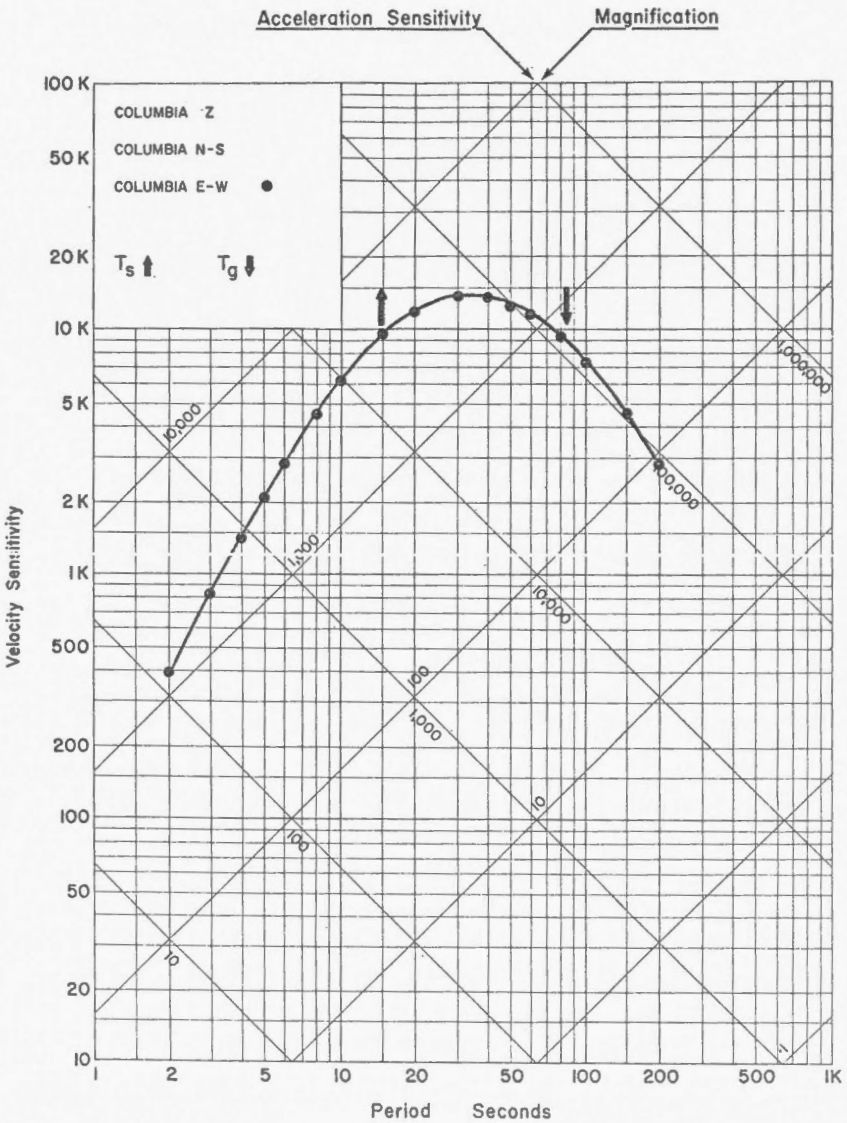
COLUMBIA N-S ● May 31, 1972

COLUMBIA E-W

STATION: INUVIK, N.W.T. (FINAL) (INK)

$\phi = 68^{\circ}17.5'N$ $\lambda = 133^{\circ}30'W$ Altitude 40 M (approx.)

Foundation: Palaeozoic, Sediments Cambrian Limestone



Dates of Calibration:

COLUMBIA Z

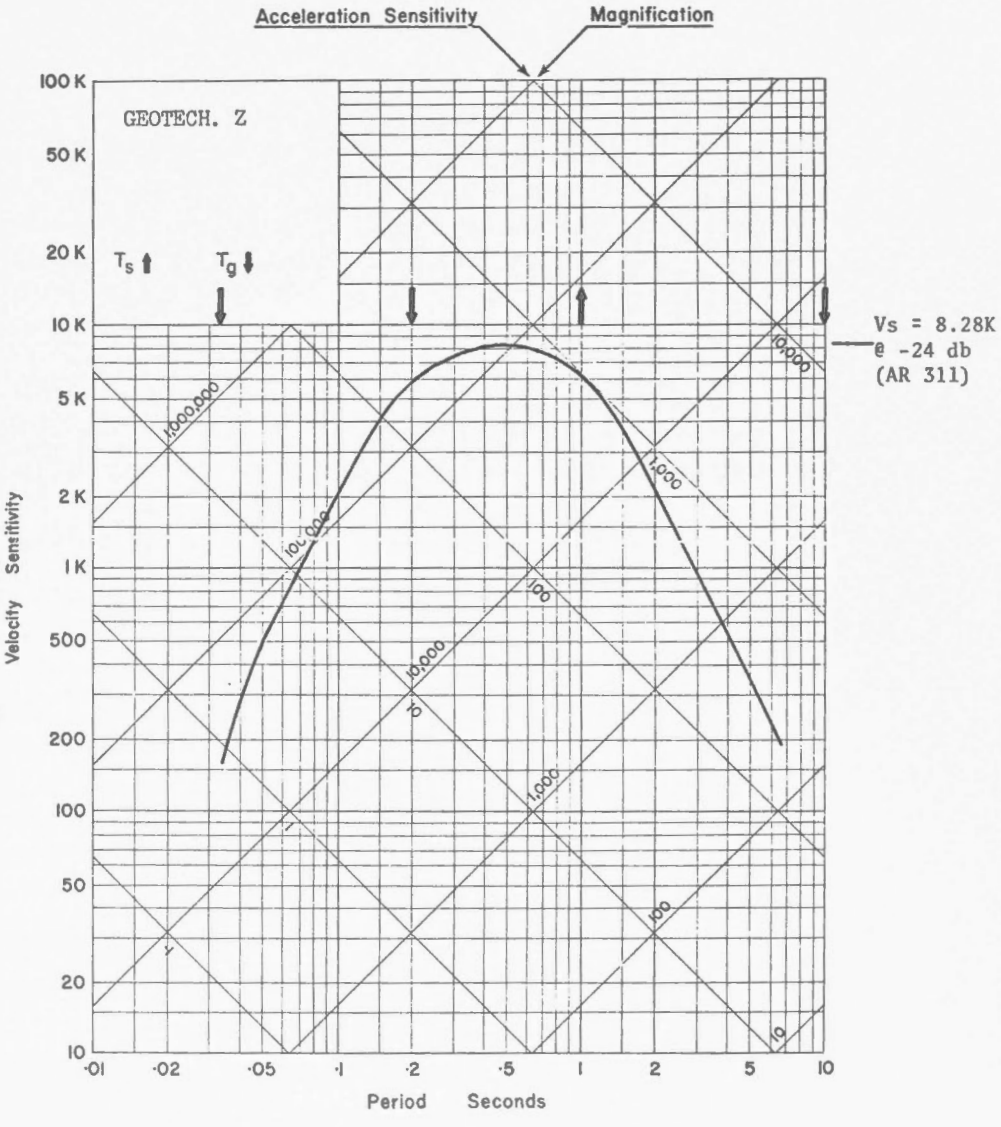
COLUMBIA N-S

COLUMBIA E-W ● May 31, 1972

STATION: LA POCATIERE, QUEBEC (POC)

ϕ= 47°21'52"N λ= 70°02'27"W Altitude 61 M

Foundation: Quartzite



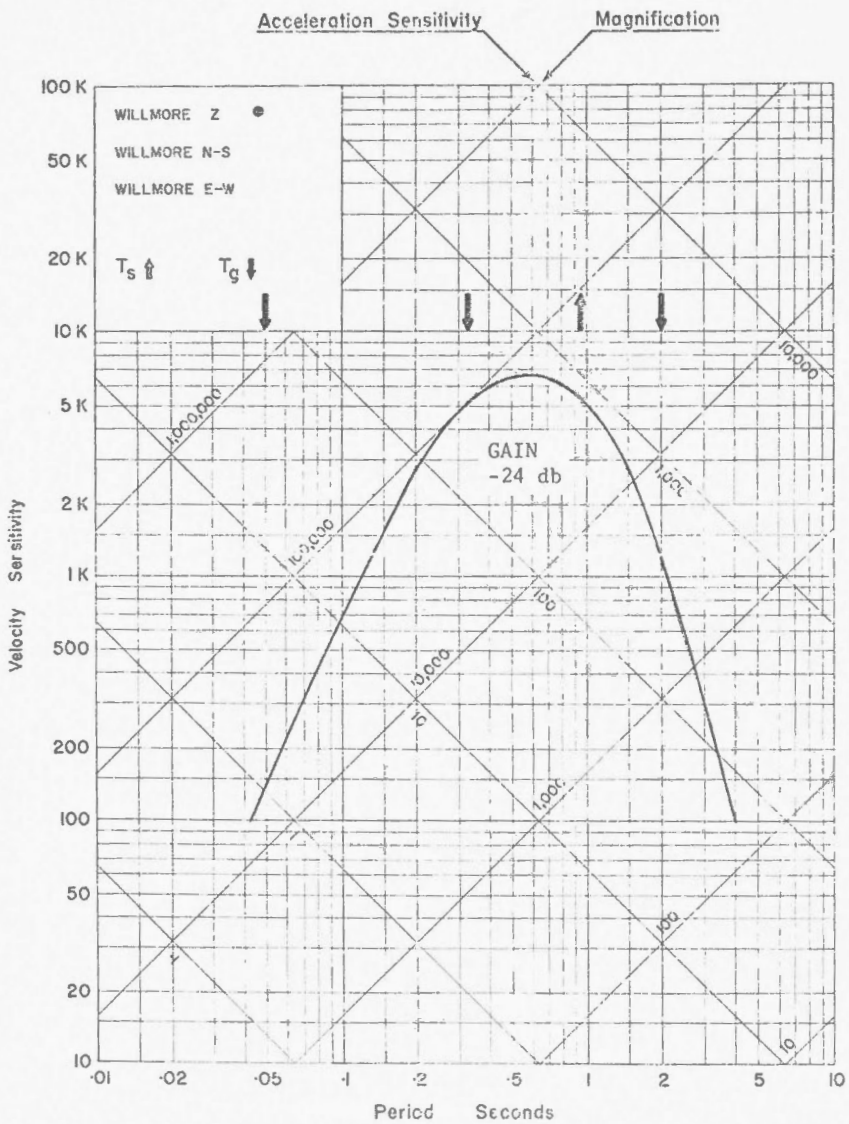
Dates of Calibration: October 1972

SEISMOMETER: Geotech S13 G_L = 2.62 V.S./C M.
PREAMPLIFIER: AS330 operated at 30-30 db (SEP.-ATT.)
Filter Bandpass 0.1-5 Hz
AMPLIFIER: AR 311 - 1 C M./Volt @ 24 db
HELICORDER: RV 301 - 0-30 Hz

STATION: MICA CREEK, B.C. (MCC)

ϕ = 52°03'06"N λ = 118°35'07"W Altitude 578M

Foundation:



Dates of Calibration: June 18, 1971

WILLMORE Z ● Operating with Teledyne EA-310 amplifier into Helicorder. Corner frequencies indicated by T_g arrows.

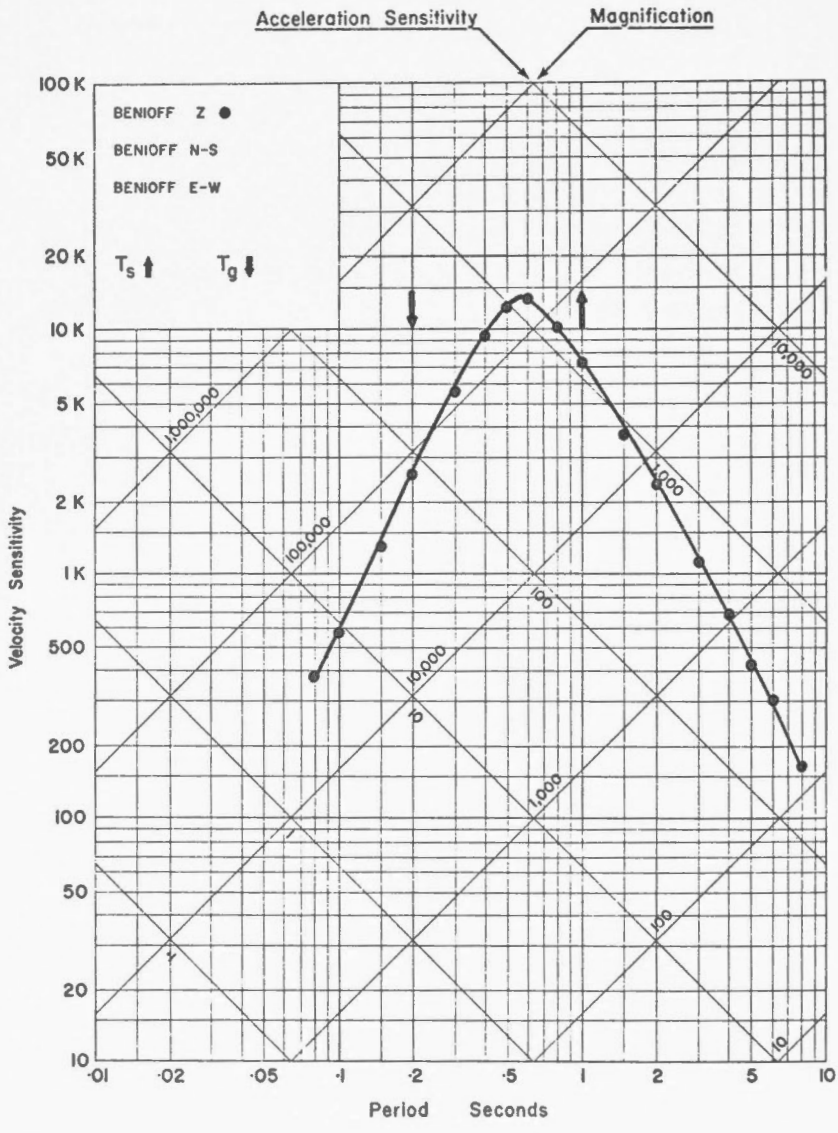
WILLMORE N-S

WILLMORE E-W

STATION: MONTREAL, QUE. (MNT)

ϕ= 45°30'09"N λ= 73°37'23"W Altitude 112 M

Foundation: Ordovician Limestone (Trenton)



Dates of Calibration:

BENIOFF Z ● February 6, 1971

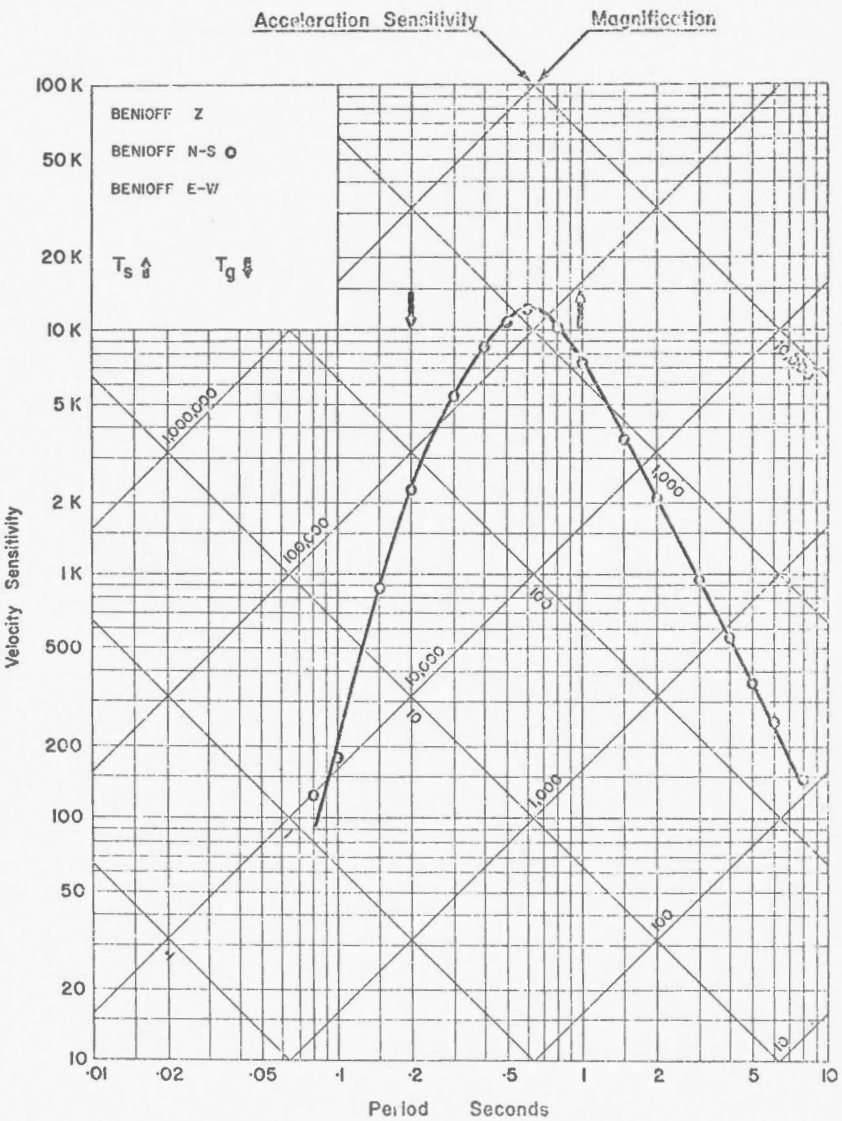
BENIOFF N-S

BENIOFF E-W

STATION: MONTREAL, QUE. (MNT)

ϕ= 45°30'09"N λ= 73°37'23"W Altitude 112 M

Foundation: Ordovician Limestone (Trenton)



Dates of Calibration:

BENIOFF Z

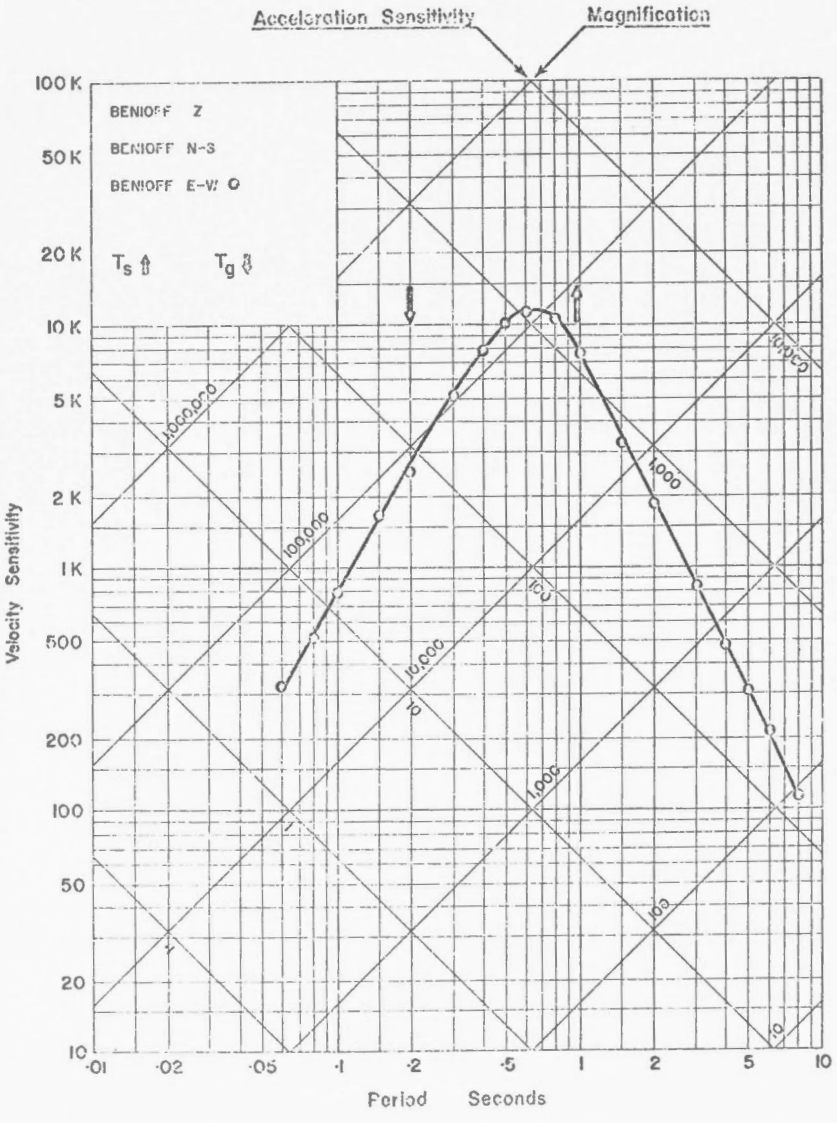
BENIOFF N-S O November 26, 1969

BENIOFF E-W

STATION: MONTREAL, QUE. (MNT)

ϕ= 45°30'09"N λ= 73°37'23"W Altitude 112 M

Foundation: Ordovician Limestone (Trenton)



Dates of Calibration:

BENIOFF Z

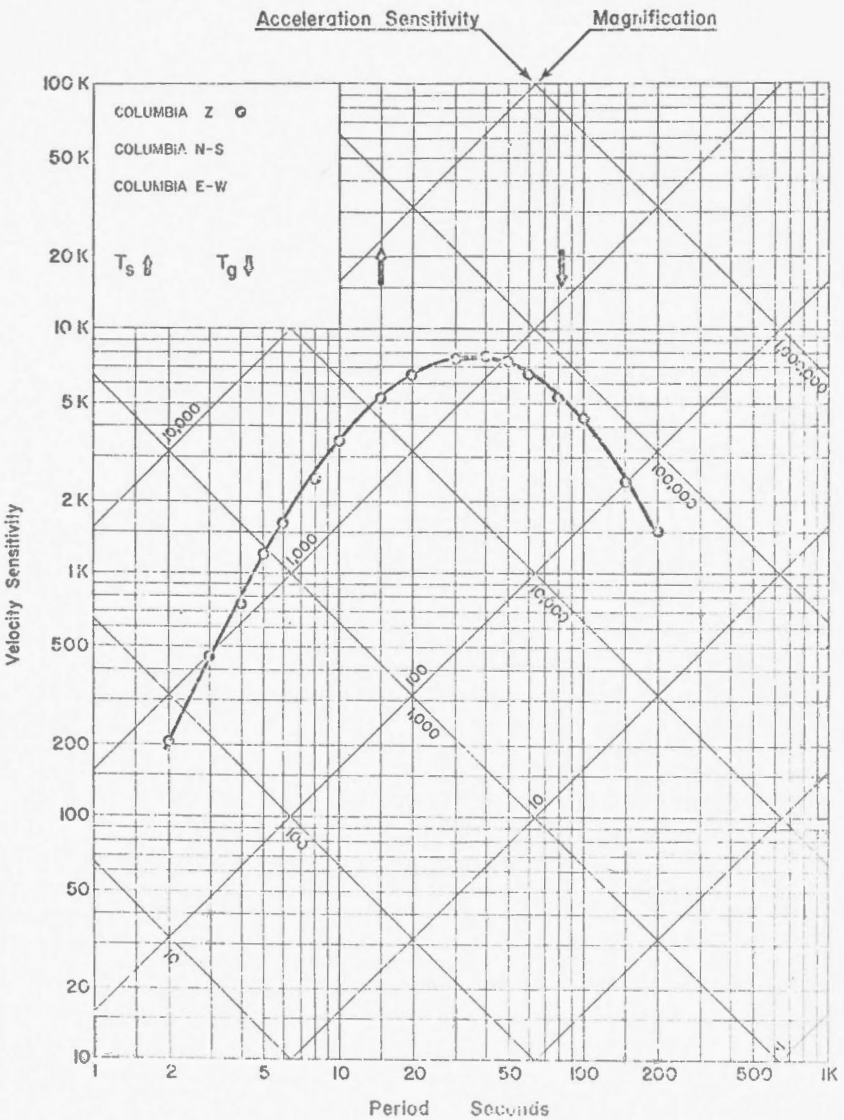
BENIOFF N-S

BENIOFF E-W O November 26, 1969

STATION: MONTREAL, QUE. (MNT)

ϕ= 45°30'09"N λ= 73°37'23"W Altitude 112 M

Foundation: Ordovician Limestone (Trenton)



Dates of Calibration:

COLUMBIA Z December 1, 1969

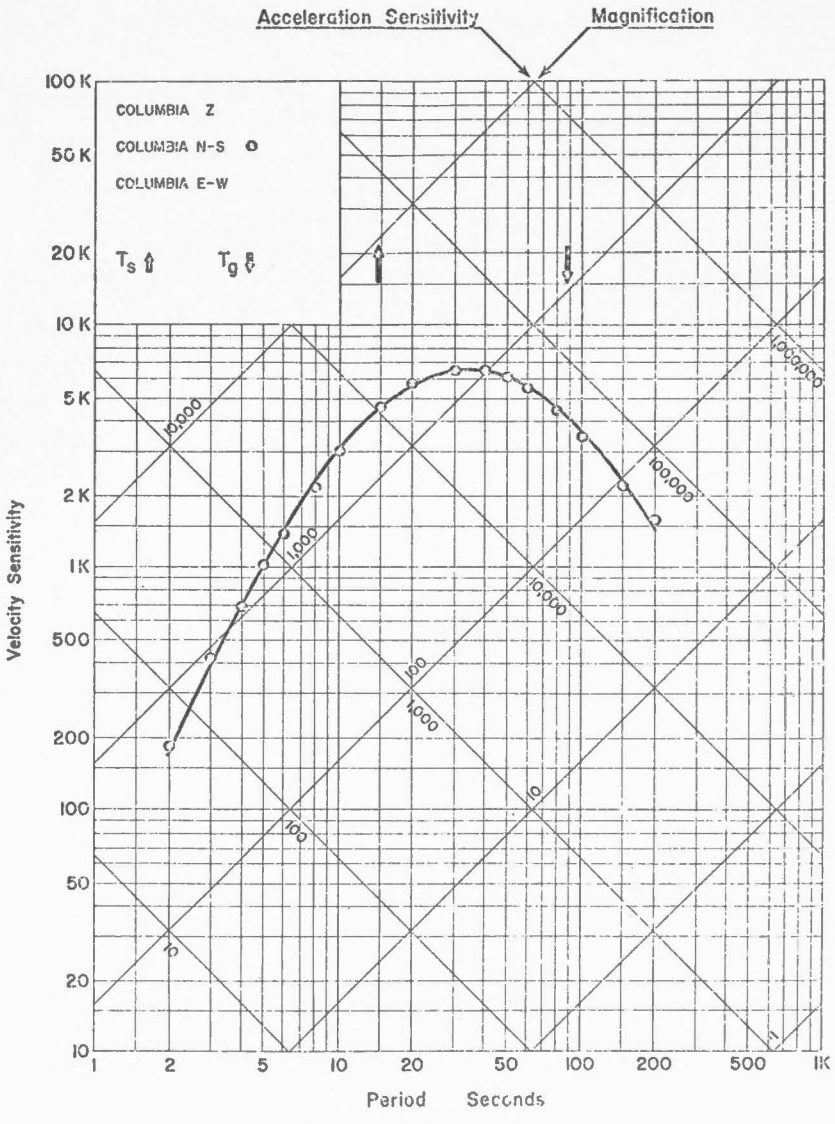
COLUMBIA N-S

COLUMBIA E-W

STATION: MONTREAL, QUE. (MNT)

ϕ= 45°30'09"N λ= 73°37'23"W Altitude 112 M

Foundation: Ordovician Limestone (Trenton)



Dates of Calibration:

COLUMBIA Z

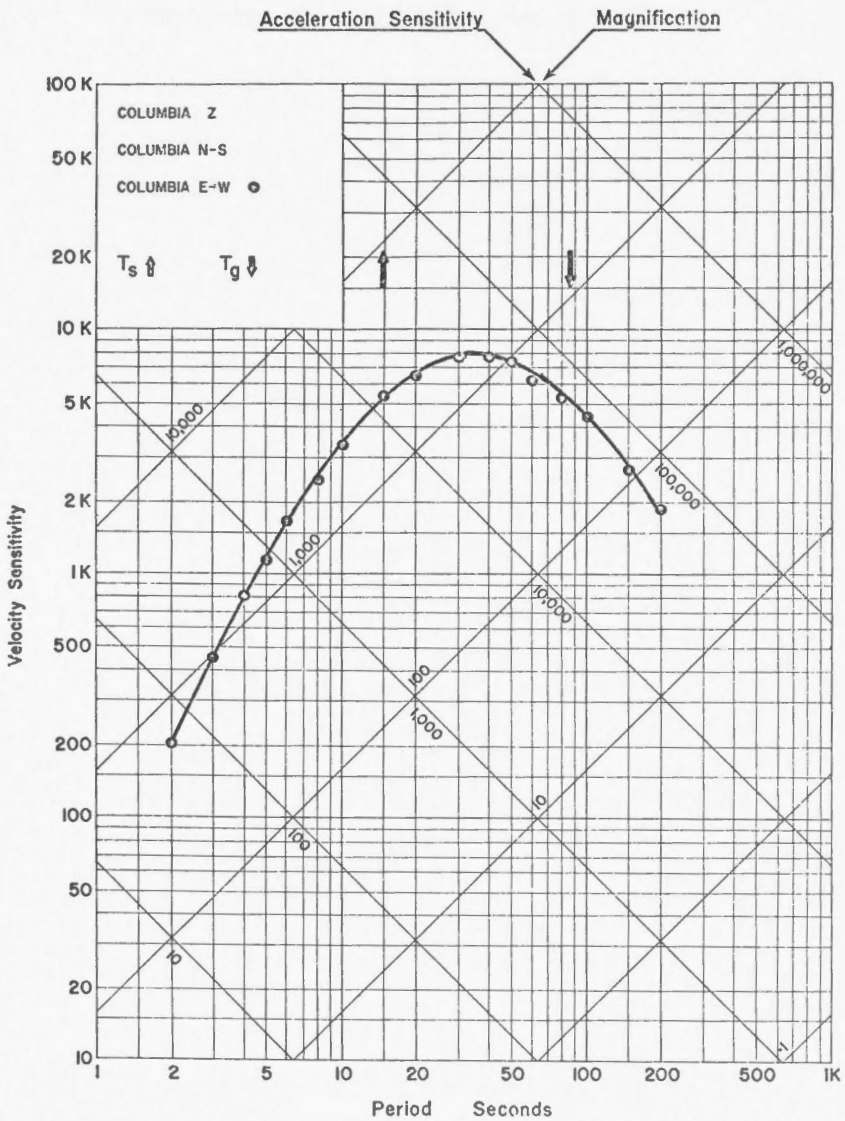
COLUMBIA N-S o December 1, 1969

COLUMBIA E-W

STATION: MONTREAL, QUE. (MNT)

ϕ= 45°30'09"N λ= 73°37'23"W Altitude 112 M

Foundation: Ordovician Limestone (Trenton)



Dates of Calibration:

COLUMBIA Z

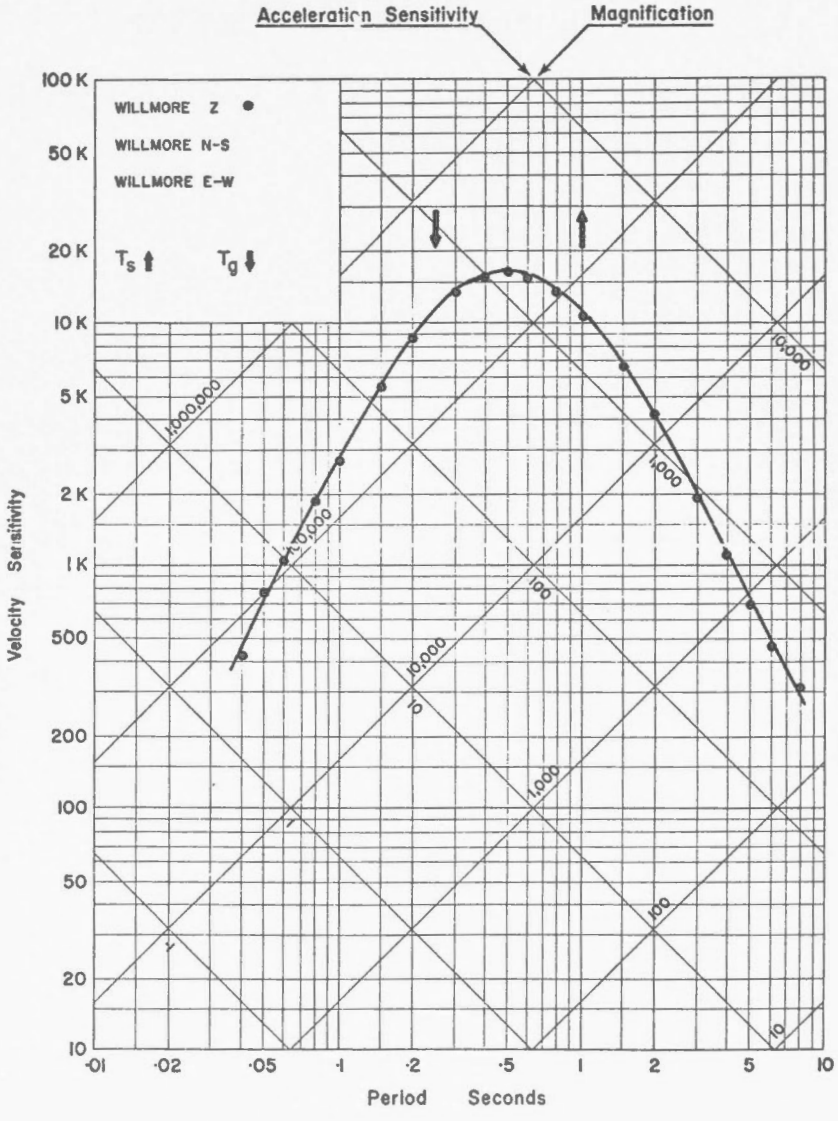
COLUMBIA N-S

COLUMBIA E-W December 1, 1969

STATION: MOULD BAY, N.W.T. (MBC)

ϕ= 76°14.5'N λ= 119°21.6' W Altitude 15 M

Foundation: Regolith and solifluxion deposits overlying Devonian sandstone (permafrost)



Dates of Calibration:

WILLMORE Z ● May 2, 1968

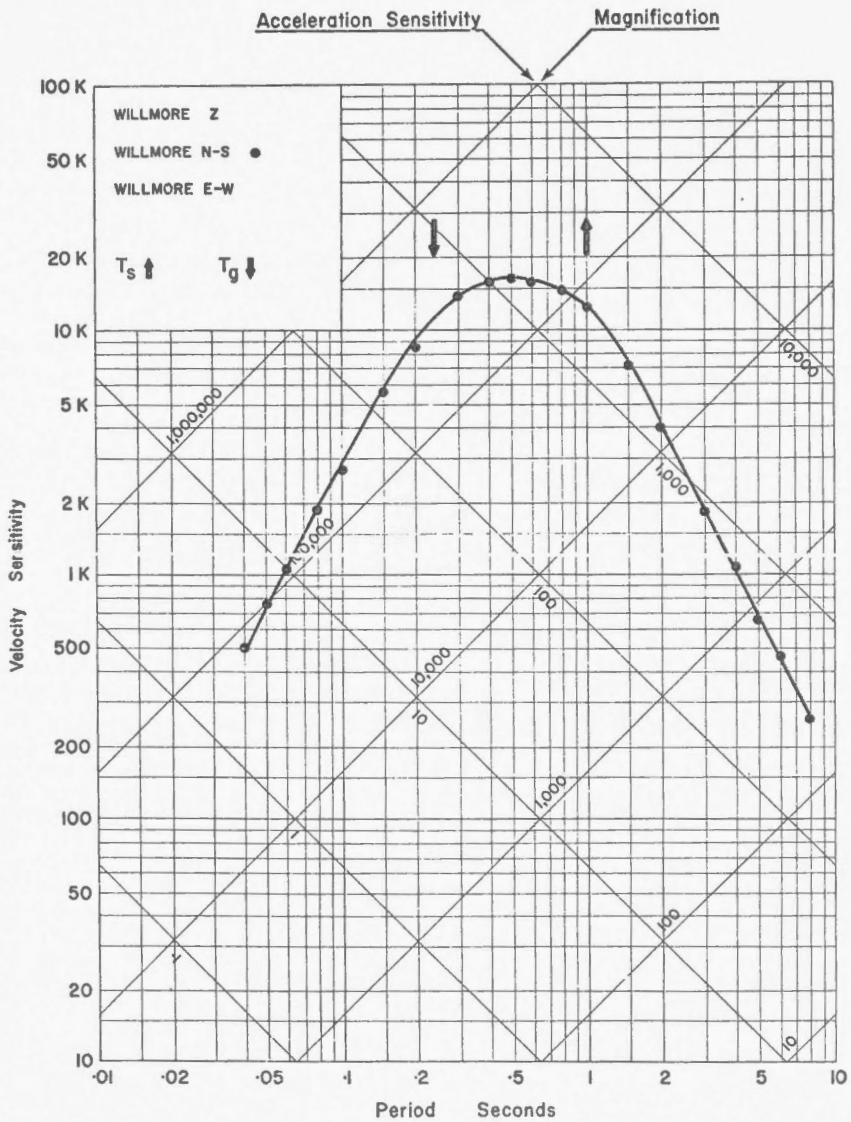
WILLMORE N-S

WILLMORE E-W

STATION: MOULD BAY , N.W.T. (MBC)

ϕ= 76°14.5'N λ= 119°21.6'W Altitude 15 M

Foundation: Regolith and solifluxion deposits overlying Devonian sandstone (permafrost)



Dates of Calibration:

WILLMORE Z

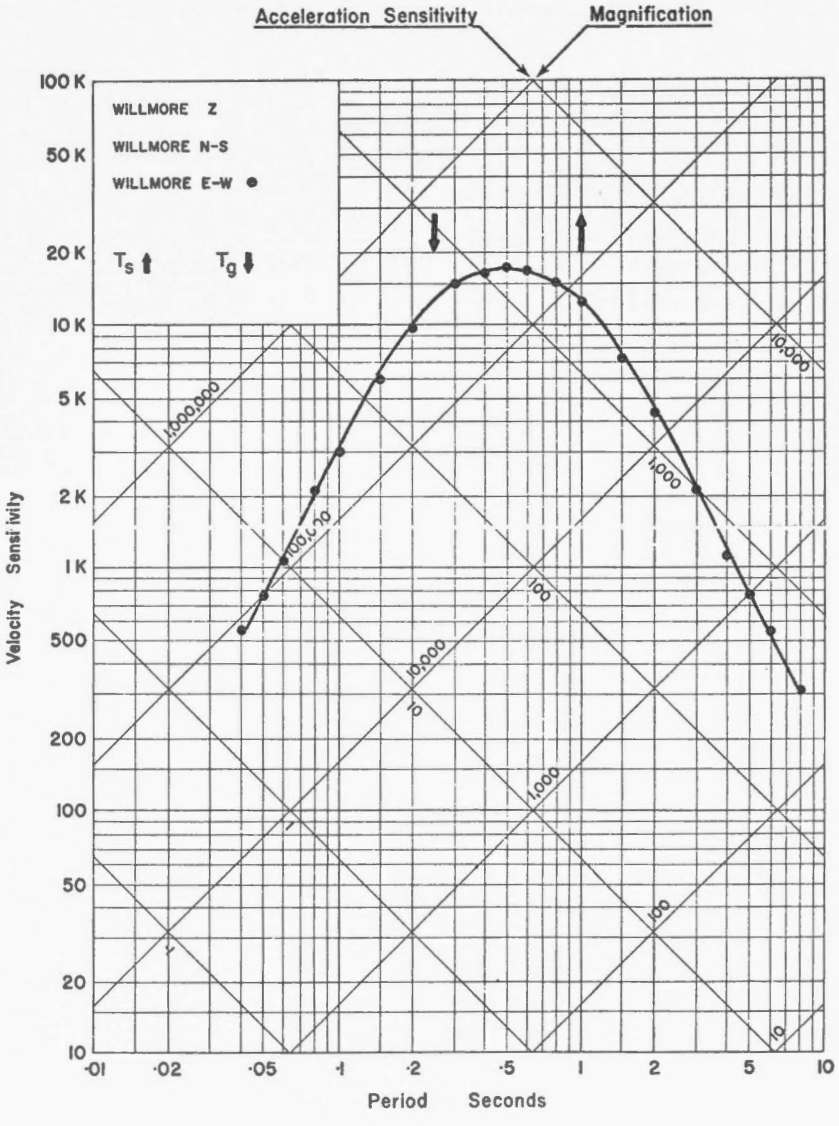
WILLMORE N-S • May 2, 1968

WILLMORE E-W

STATION: MOULD BAY, N.W.T. (MBC)

$\phi = 76^{o}14.5'N$ $\lambda = 119^{o}21.6'W$ Altitude 15 M

Foundation: Regolith and solifluxion deposits overlying Devonian sandstone (permafrost)



Dates of Calibration:

WILLMORE Z

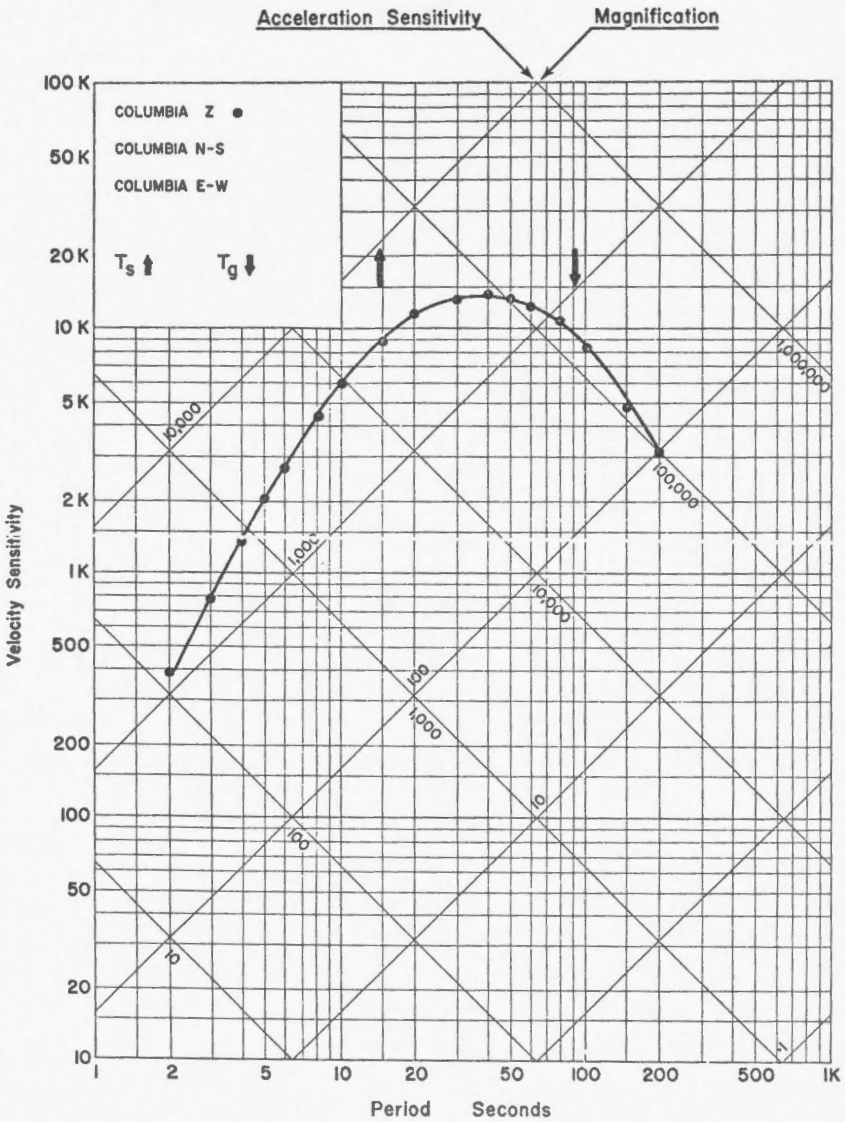
WILLMORE N-S

WILLMORE E-W • May 2, 1968

STATION: MOULD BAY, N.W.T. (MBC)

ϕ= 76°14.5'N λ= 119°21.6'W **Altitude** 15 M

Foundation: Regolith and solifluxion deposits overlying Devonian sandstone (permafrost)



Dates of Calibration:

COLUMBIA Z • May 3, 1968

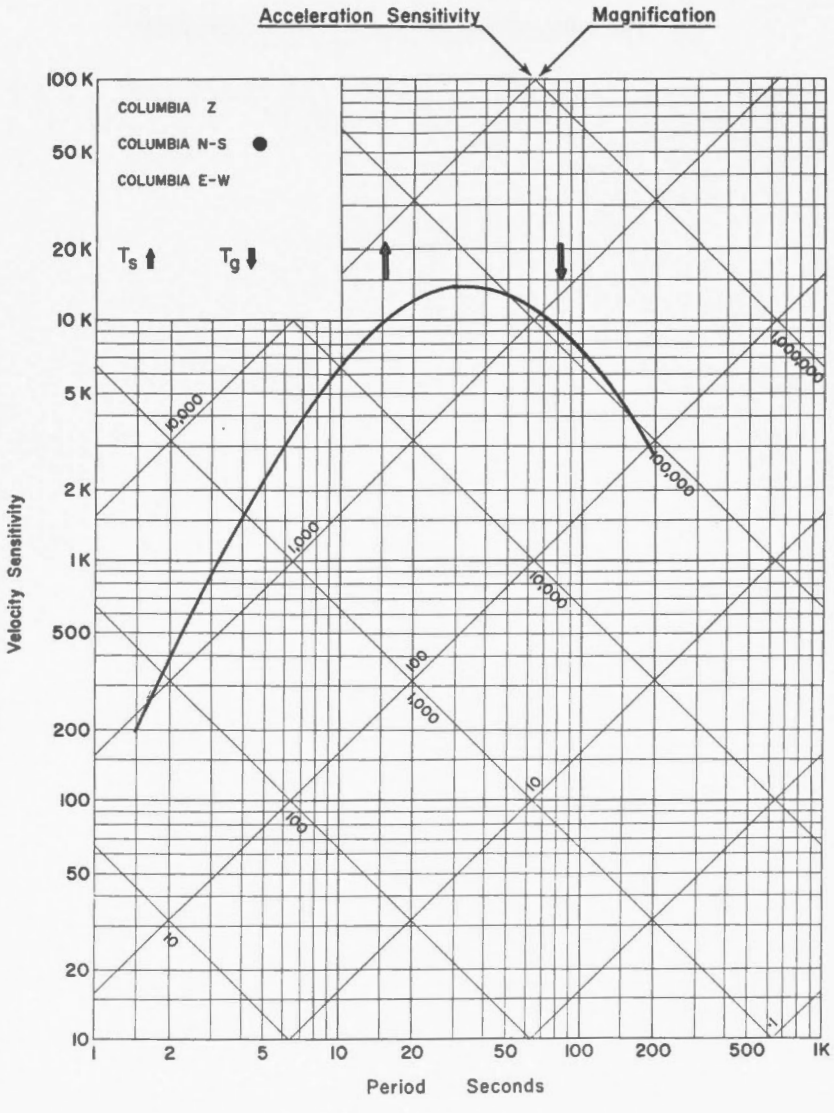
COLUMBIA N-S

COLUMBIA E-W

STATION: MOULD BAY, N.W.T. (MBC)

ϕ= 76°14.5'N λ= 119°21.6'W Altitude 15 M

Foundation: Regolith and solifluxion deposits overlying Devonian sandstone (permafrost)



Dates of Calibration:

COLUMBIA Z

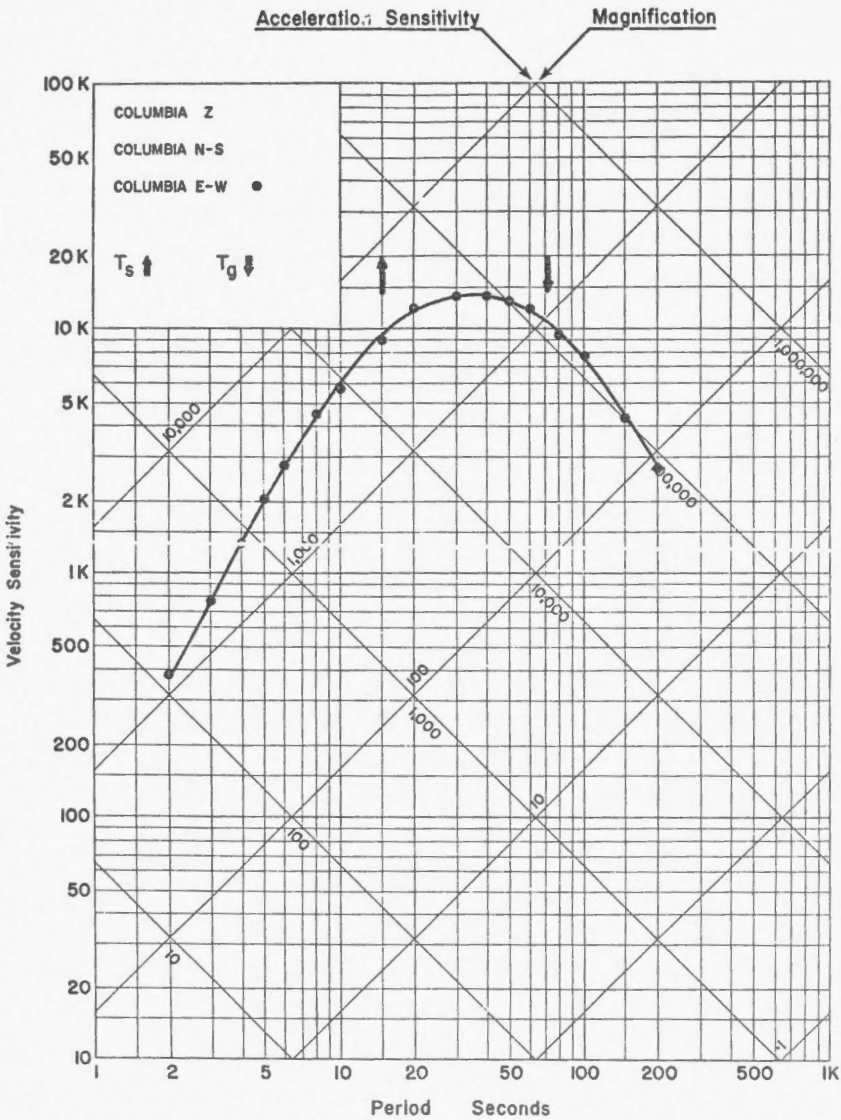
COLUMBIA N-S ● Feb. 22, 1970

COLUMBIA E-W

STATION: MOULD BAY, N.W.T. (MBC)

ϕ= 76°14.5'N λ= 119°21.6'W **Altitude** 15 M

Foundation: Regolith and solifluxion deposits overlying Devonian sandstone (permafrost)



Dates of Calibration:

COLUMBIA Z

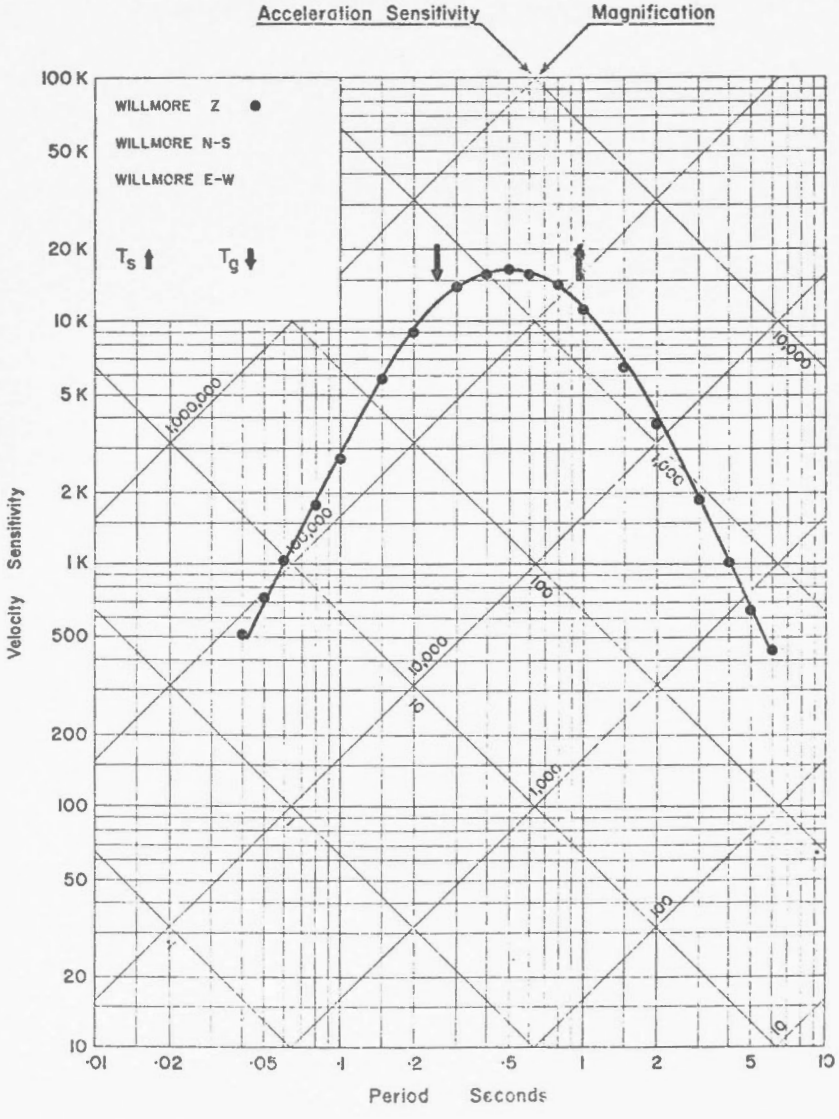
COLUMBIA N-S

COLUMBIA E-W • May 4, 1968

STATION: MOULD BAY, N.W.T. (MBC)
(As found & left)

ϕ= 76°14.5'N λ= 119°21.6'W Altitude 15M

Foundation: Regolith and solifluxion deposits overlying Devonian sandstone (permafrost)



Dates of Calibration

WILLMORE Z • May 5, 1973

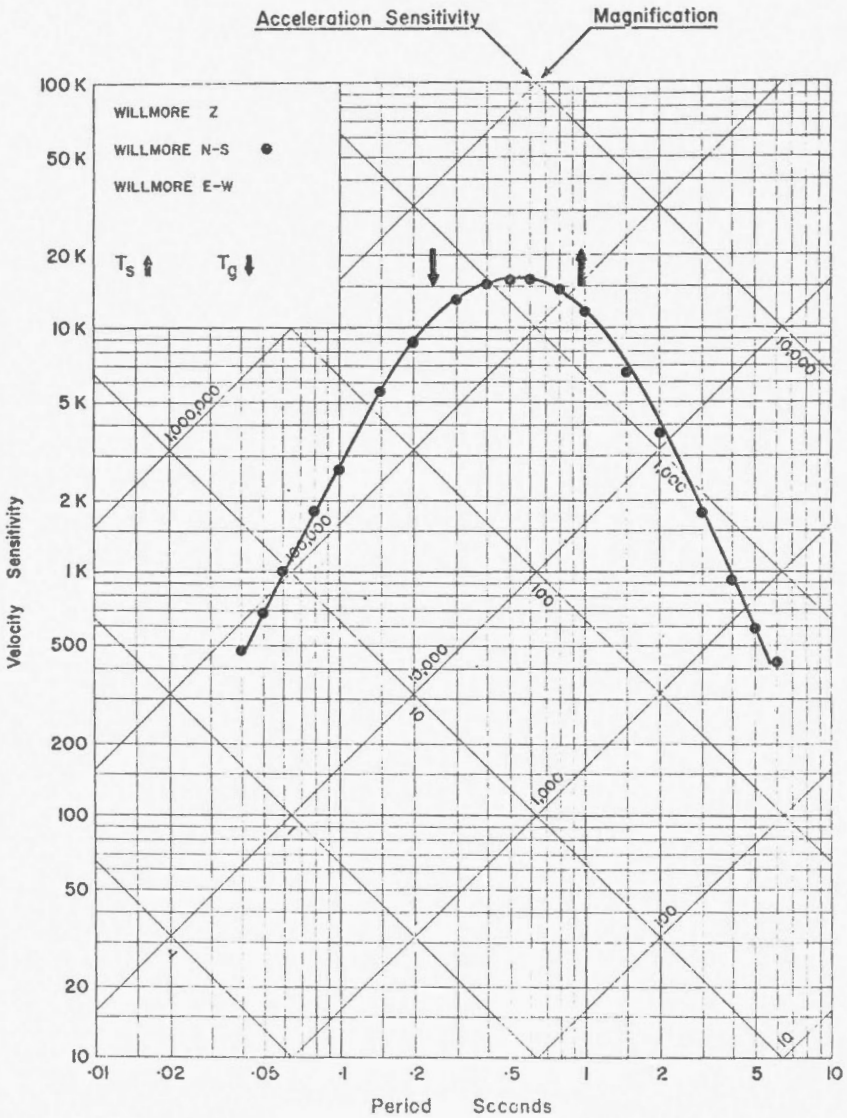
WILLMORE N-S

WILLMORE E-W

STATION: MOULD BAY, N.W.T. (MBC)
(As found & left)

ϕ= 76°14.5'N λ= 119°21.6'W Altitude 15 M

Foundation: Regolith and solifluxion deposits overlying Devonian sandstone (permafrost)



Dates of Calibration

WILLMORE Z

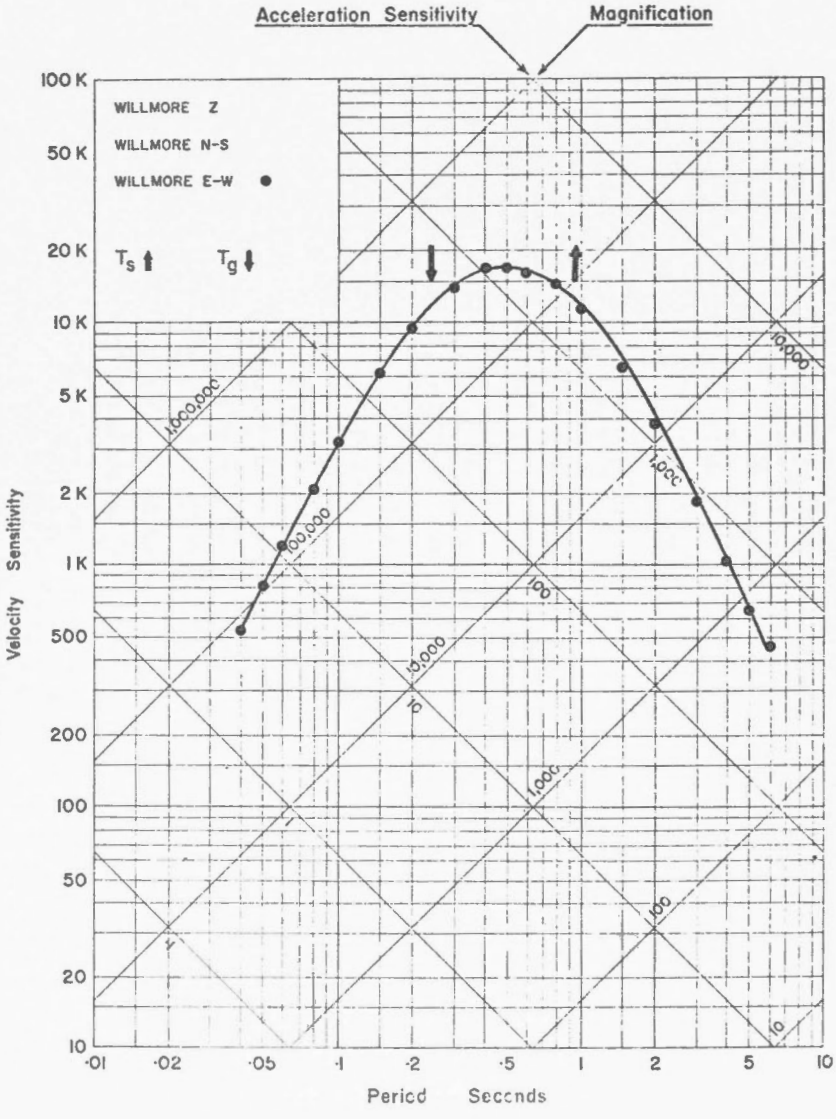
WILLMORE N-S ● May 5, 1973

WILLMORE E-W

STATION: MOULD BAY, N.W.T. (MBC)
(As found & left)

ϕ= 76°14.5'N λ= 119°21.6'W Altitude 15 M

Foundation: Regolith and solifluxion deposits overlying Devonian sandstone (permafrost)



Dates of Calibration:

WILLMORE Z

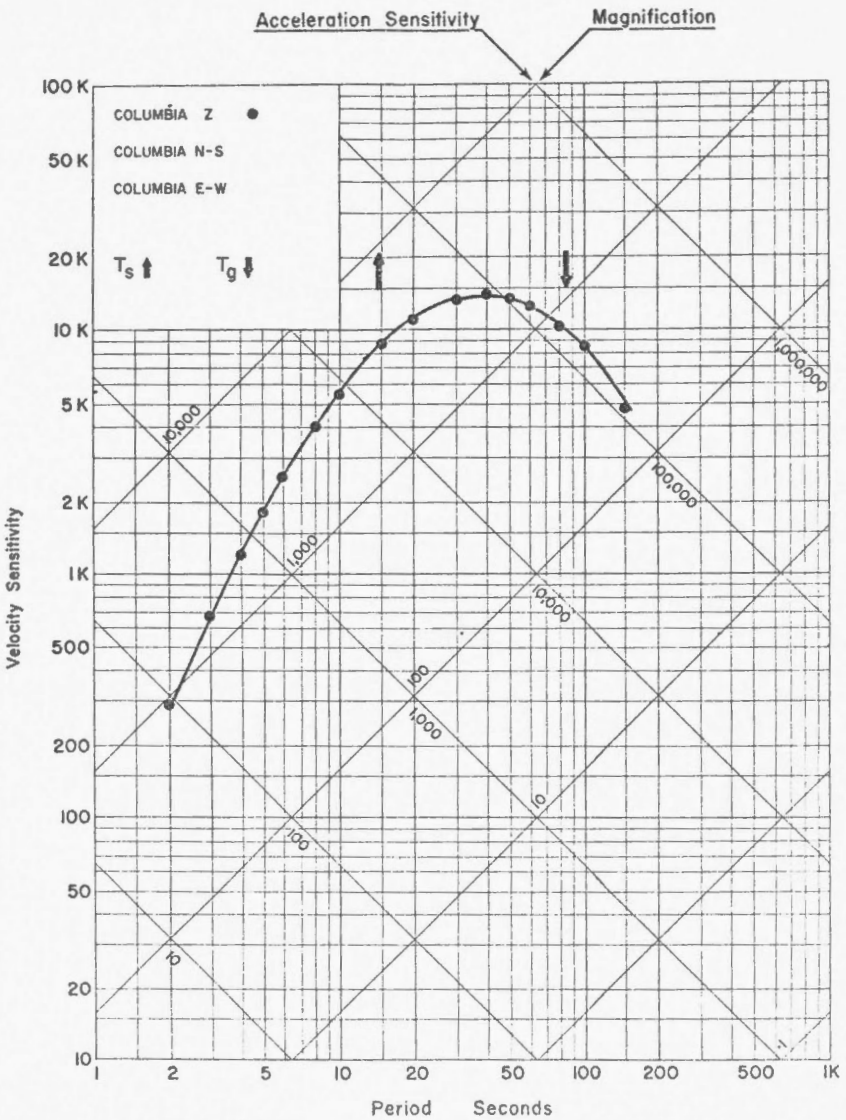
WILLMORE N-S

WILLMORE E-W • May 6, 1973

STATION: MOULD BAY, N.W.T. (MBC)
(As found & left)

ϕ= 76°14.5'N λ= 119°21.6'W Altitude 15 M

Foundation: Regolith and solifluxion deposits overlying Devonian sandstone (permafrost)



Dates of Calibration:

COLUMBIA Z • May 5, 1973

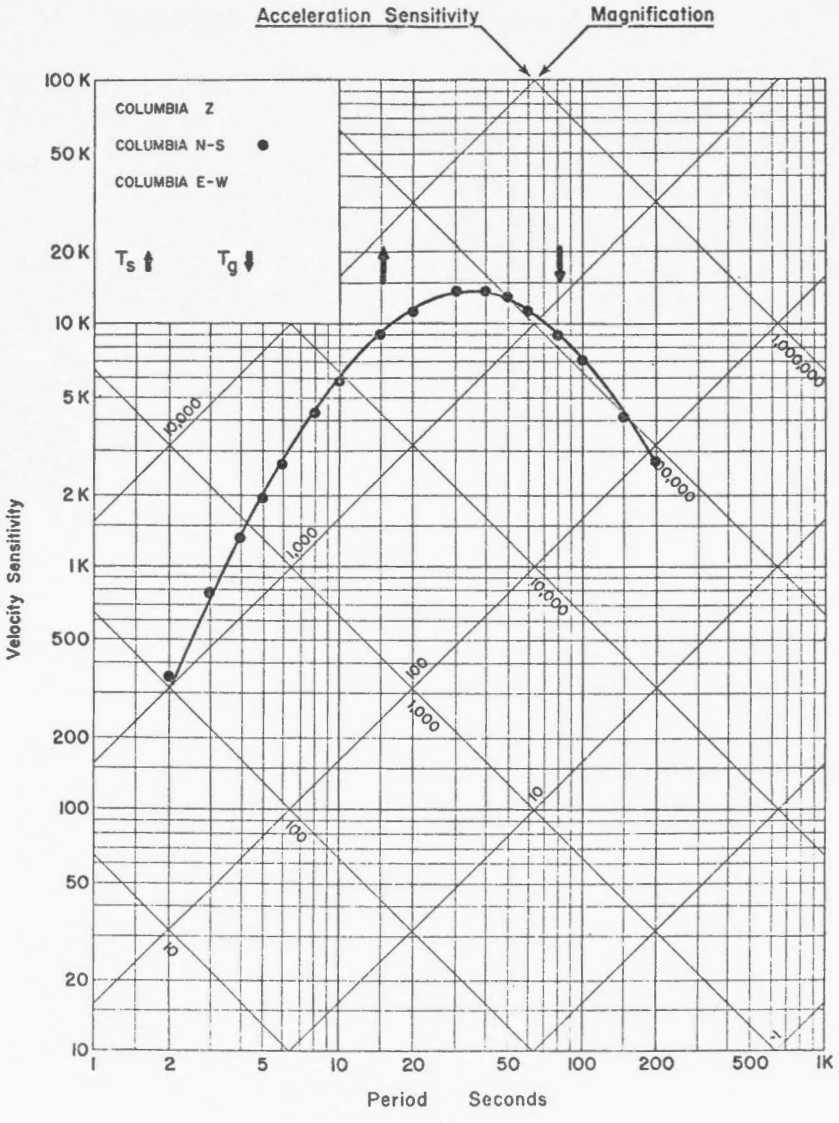
COLUMBIA N-S

COLUMBIA E-W

STATION: MOULD BAY, N.W.T. (MBC)
(As found & left)

ϕ= 76°14.5'N λ= 119°21.6'W Altitude 15 M

Foundation: Regolith and solifluxion deposits overlying Devonian sandstone (permafrost)



Dates of Calibration:

COLUMBIA Z

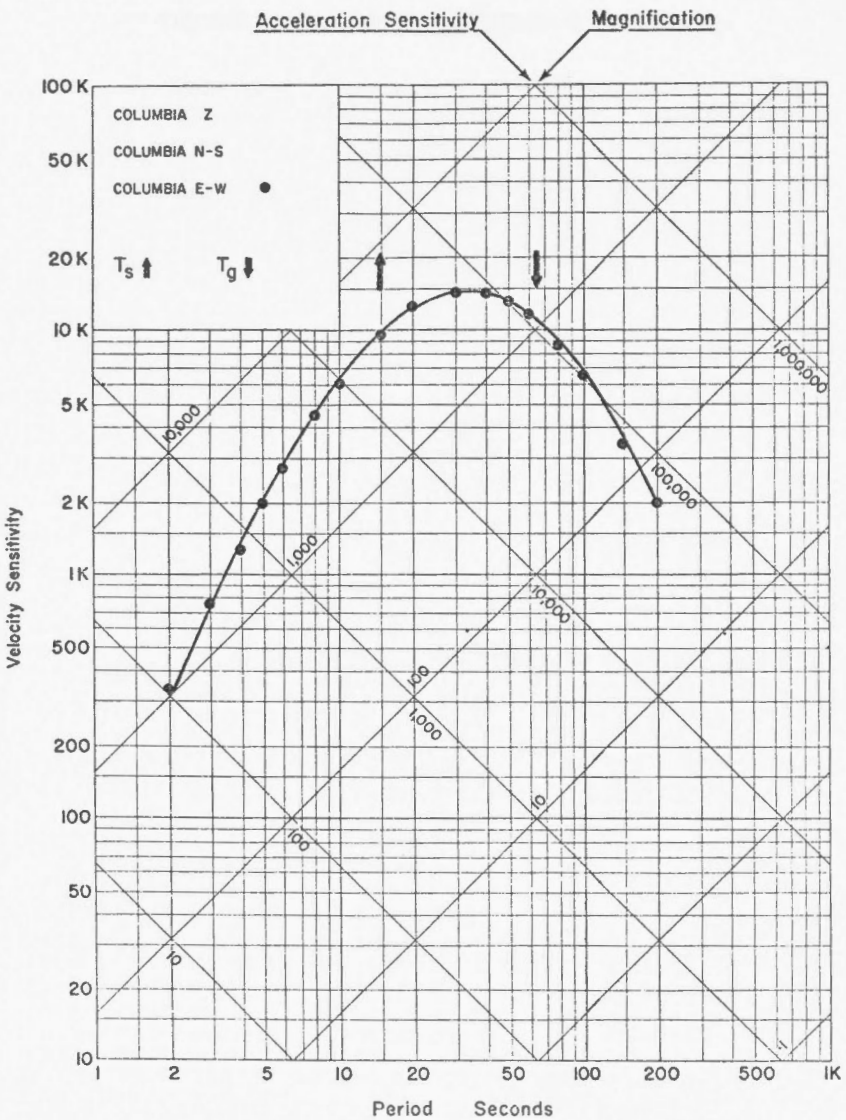
COLUMBIA N-S • May 5, 1973

COLUMBIA E-W

STATION: MOULD BAY, N.W.T. (MBC)
(As found & left)

ϕ= 76°14.5'N λ= 119°21.6'W Altitude 15 M

Foundation: Regolith and solifluxion deposits overlying Devonian sandstone (permafrost)



Dates of Calibration:

COLUMBIA Z

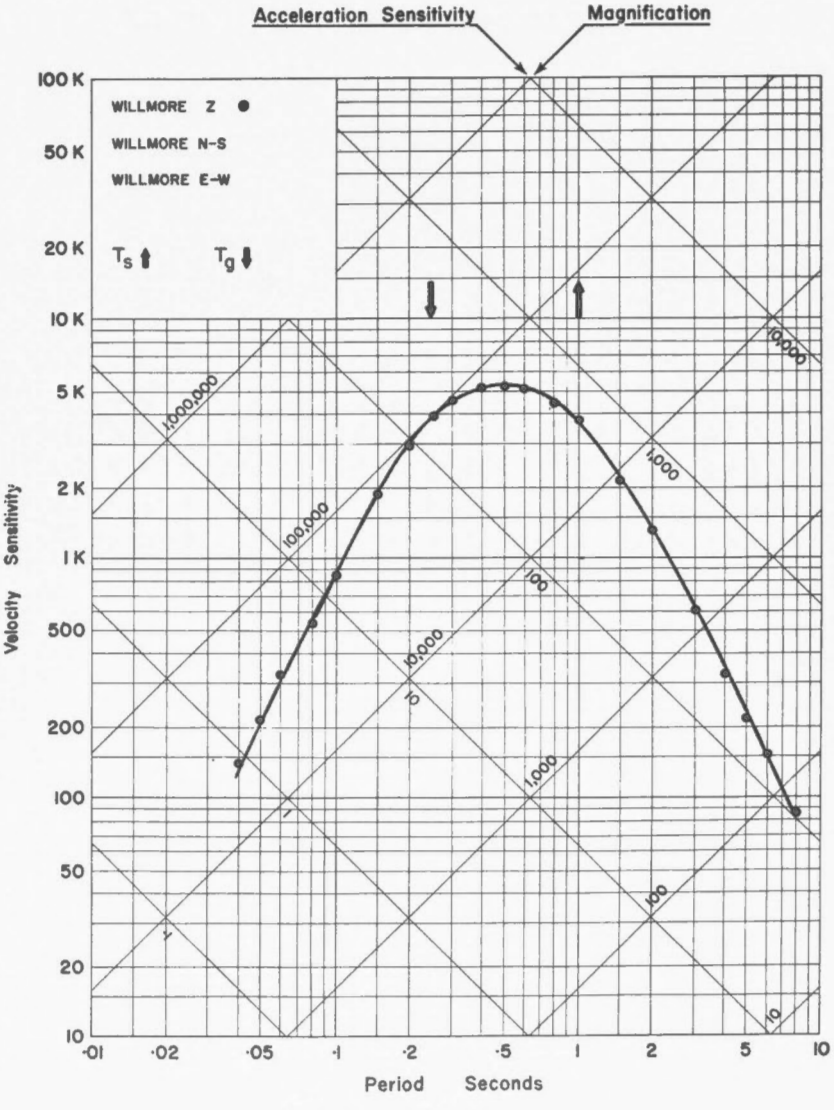
COLUMBIA N-S

COLUMBIA E-W • May 5, 1973

STATION: OTTAWA , ONT. (OTT)

ϕ= 45°23'38"N λ= 75°42'57"W Altitude 83M

Foundation: Boulder clay on limestone



Dates of Calibration:

WILLMORE Z ● March 24 - 1969

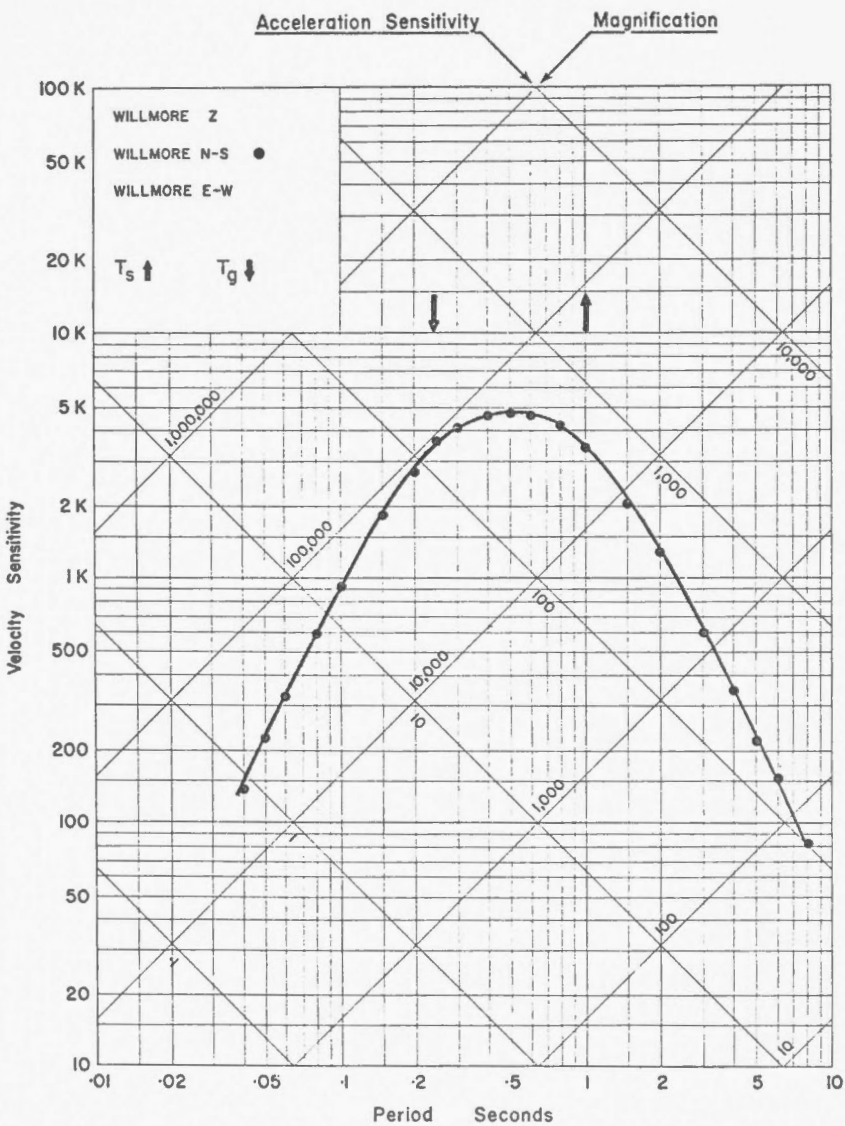
WILLMORE N-S

WILLMORE E-W

STATION: OTTAWA, ONT. (OTT)

ϕ= 45°23'38"N λ= 75°42'57"W Altitude 83M

Foundation: Boulder clay on limestone



Dates of Calibration:

WILLMORE Z

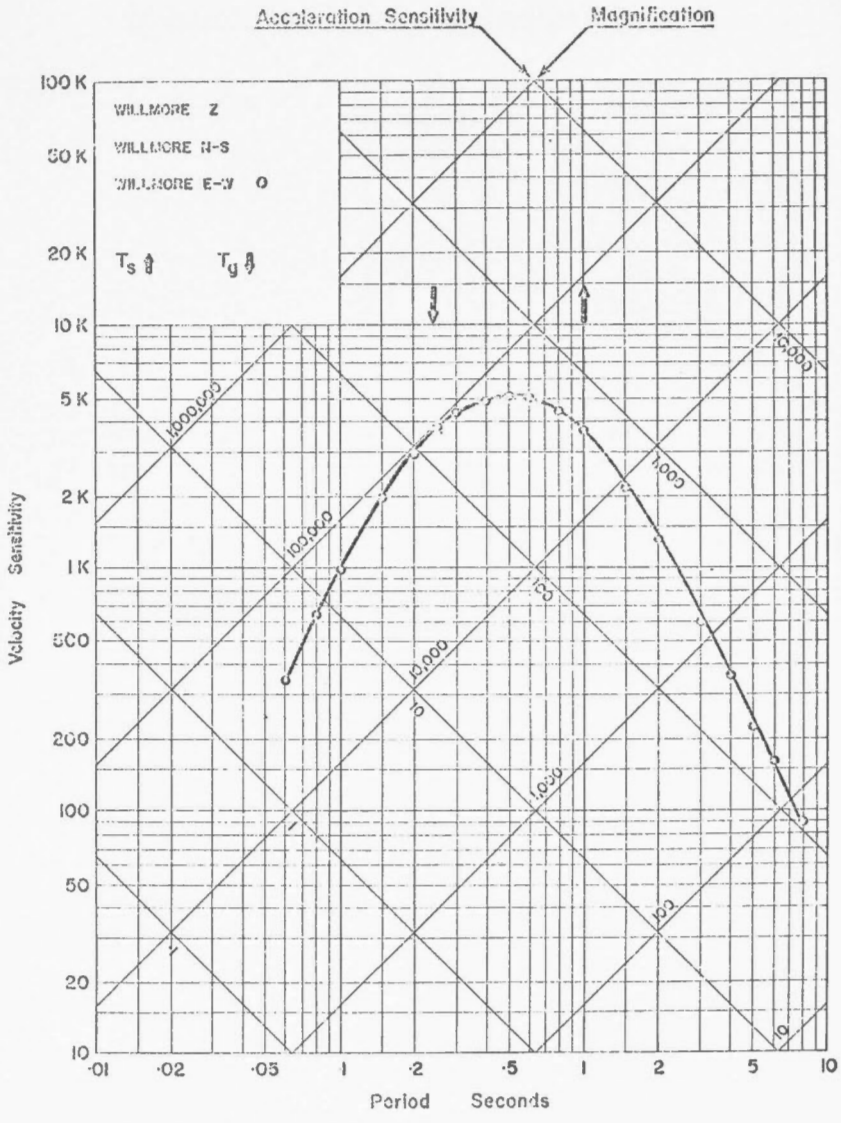
WILLMORE N-S ● March 25 - 1969

WILLMORE E-W

STATION: OTTAWA, ONT. (OTT)

ϕ= 45° 23'38"N λ= 75°42'57"W Altitude 83M

Foundation: Boulder clay on limestone



Dates of Calibration:

WILLMORE Z

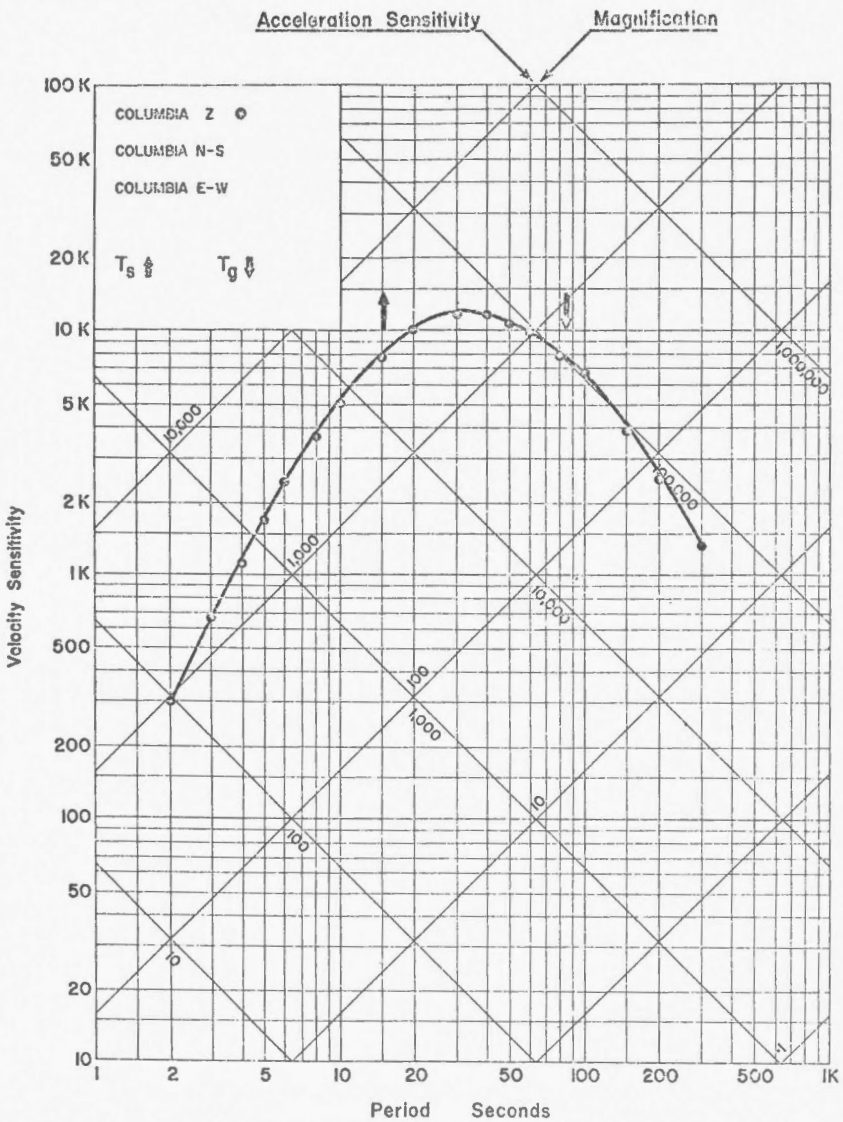
WILLMORE N-S

WILLMORE E-W O March 25 - 1969

STATION: OTTAWA, ONT. (OTT)

ϕ= 45°23'38"N λ= 75°42'57"W Altitude 83M

Foundation: BOULDER CLAY ON LIMESTONE



Dates of Calibration:

COLUMBIA Z ⊙ JULY 9, 1969

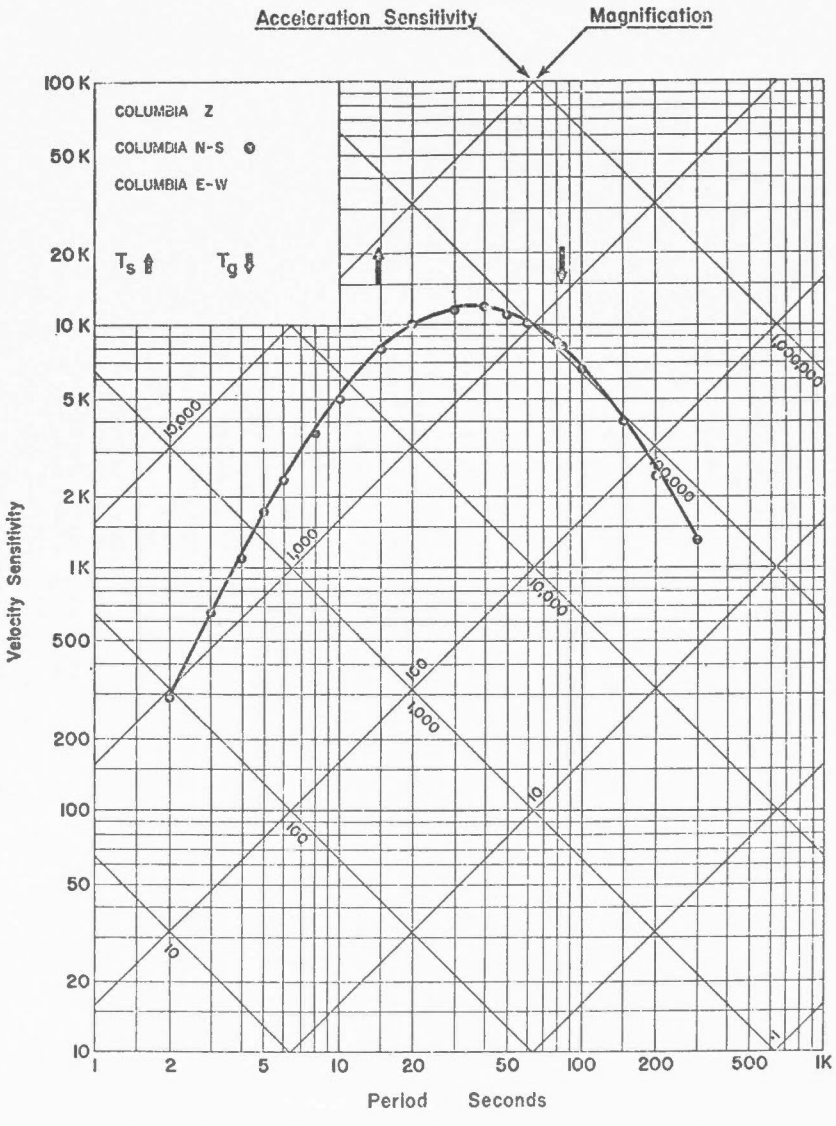
COLUMBIA N-S

COLUMBIA E-W

STATION: OTTAWA, ONT. (OTT)

ϕ= 45°23'38"N λ= 75°42'57"W Altitude 83M

Foundation: Boulder clay on limestone



Dates of Calibration:

COLUMBIA Z

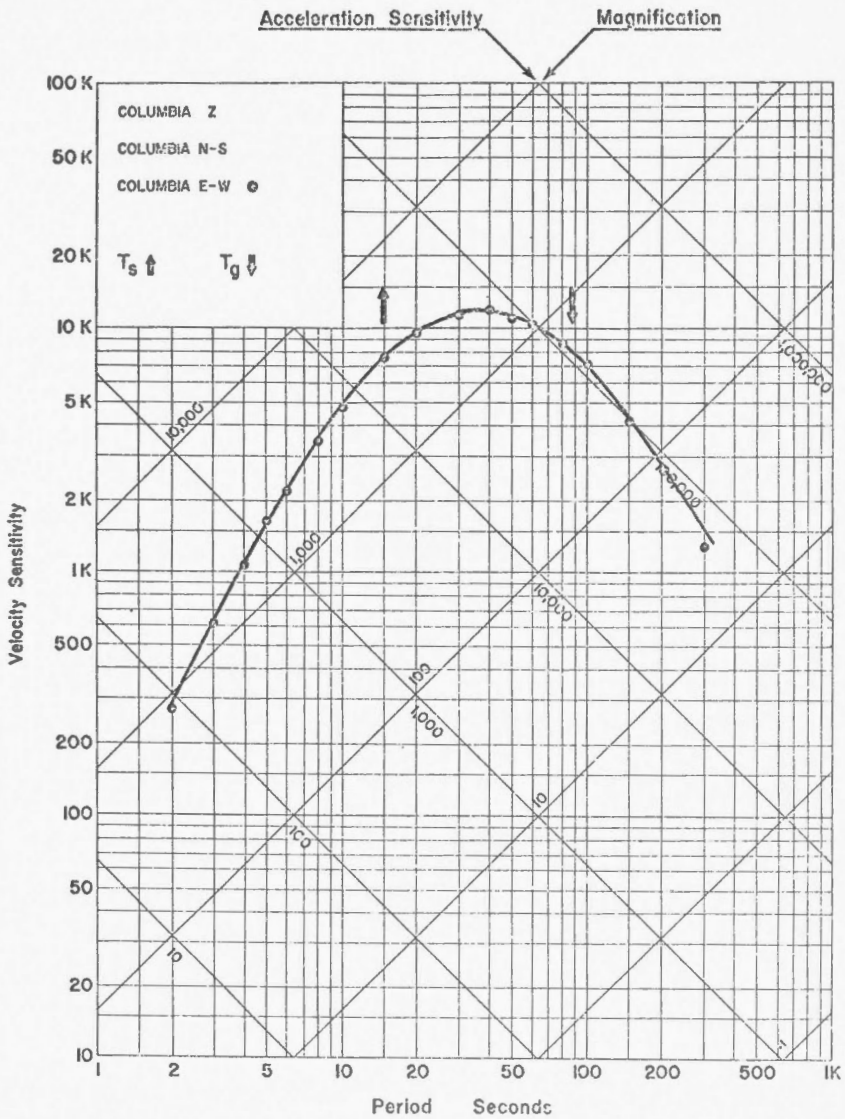
COLUMBIA N-S © July 15 -1969

COLUMBIA E-W

STATION: OTTAWA, ONT. (OTT)

ϕ= 45°23'38"N λ= 75°42'57"W Altitude 83M

Foundation: Boulder clay in limestone



Dates of Calibration:

COLUMBIA Z

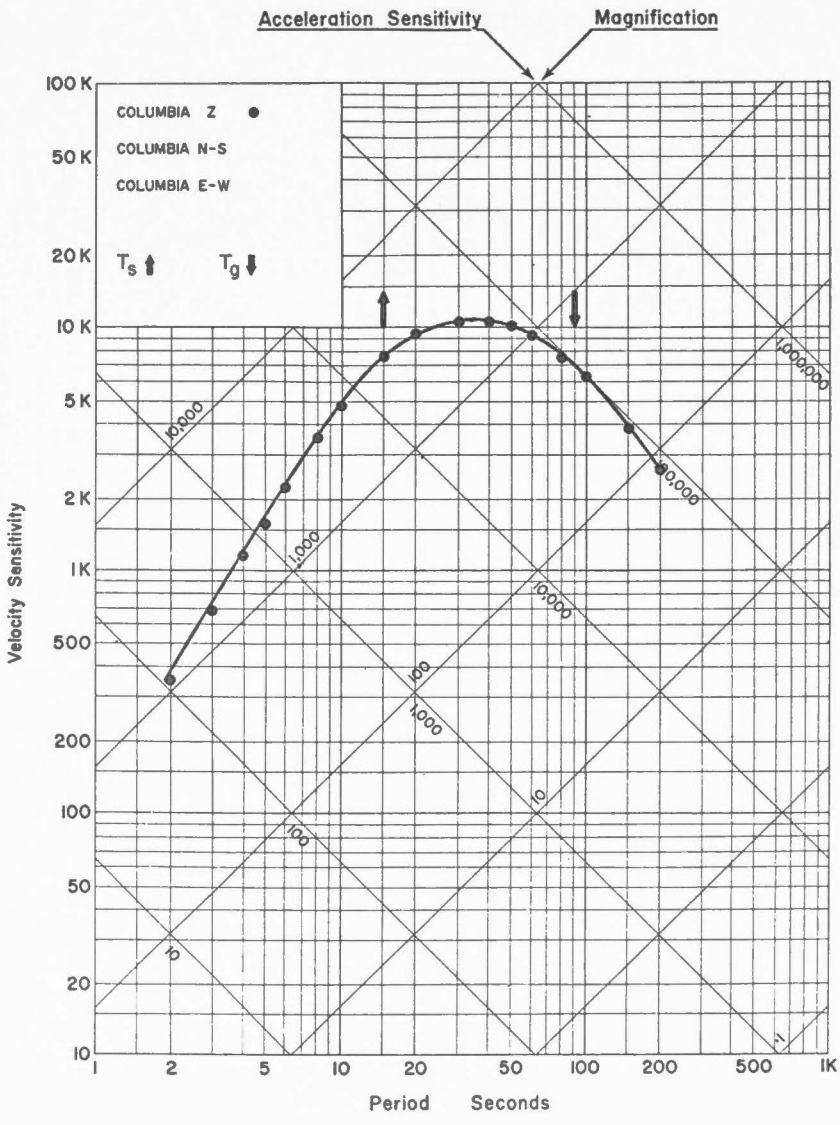
COLUMBIA N-S

COLUMBIA E-W July 17 -1969

STATION: OTTAWA, Ont. (OTT)
(as found)

$\phi = 45^{o}23'38"N$ $\lambda = 75^{o}42'57"W$ Altitude 83 M

Foundation: Boulder Clay on Limestone



Dates of Calibration:

COLUMBIA Z • Feb. 8, 1973

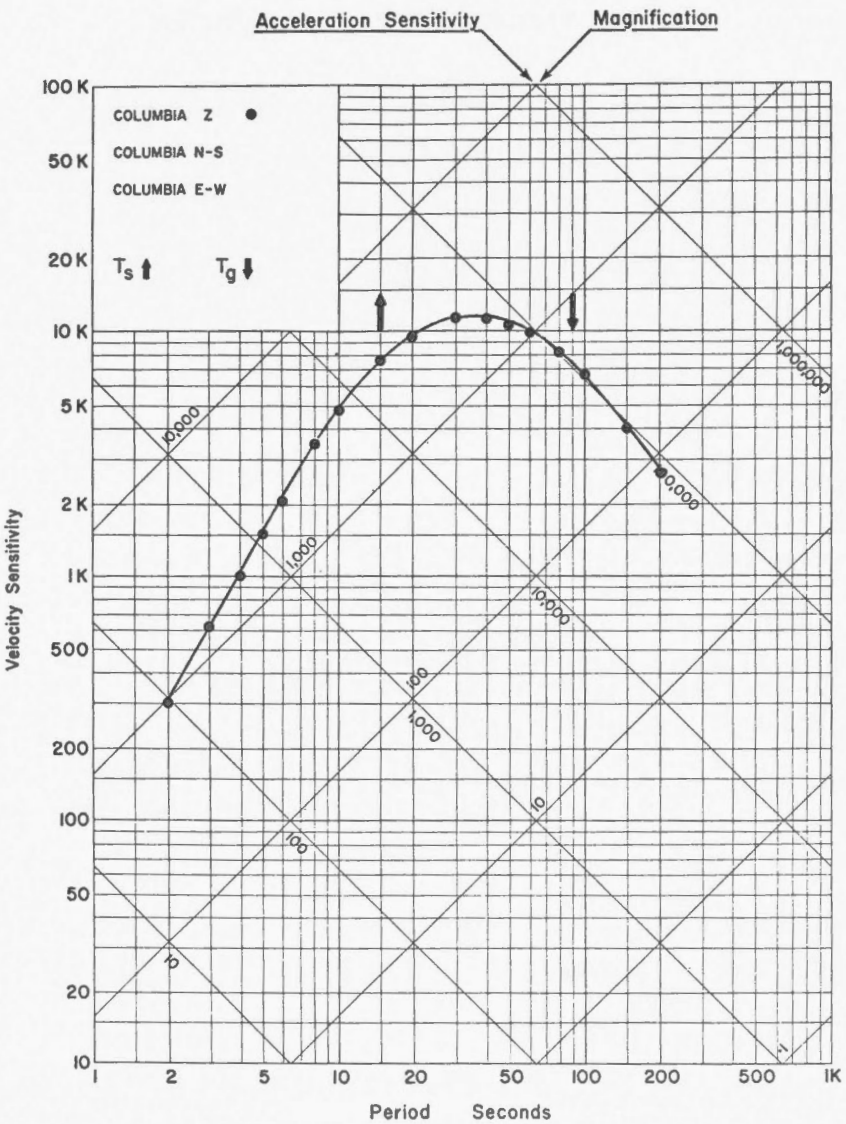
COLUMBIA N-S

COLUMBIA E-W

STATION: OTTAWA, ONT. (OTT)
(Final)

ϕ= 45°23'38"N λ= 75°42'57"W Altitude 83 M

Foundation: Boulder Clay on Limestone



Dates of Calibration:

COLUMBIA Z ● February 13, 1973

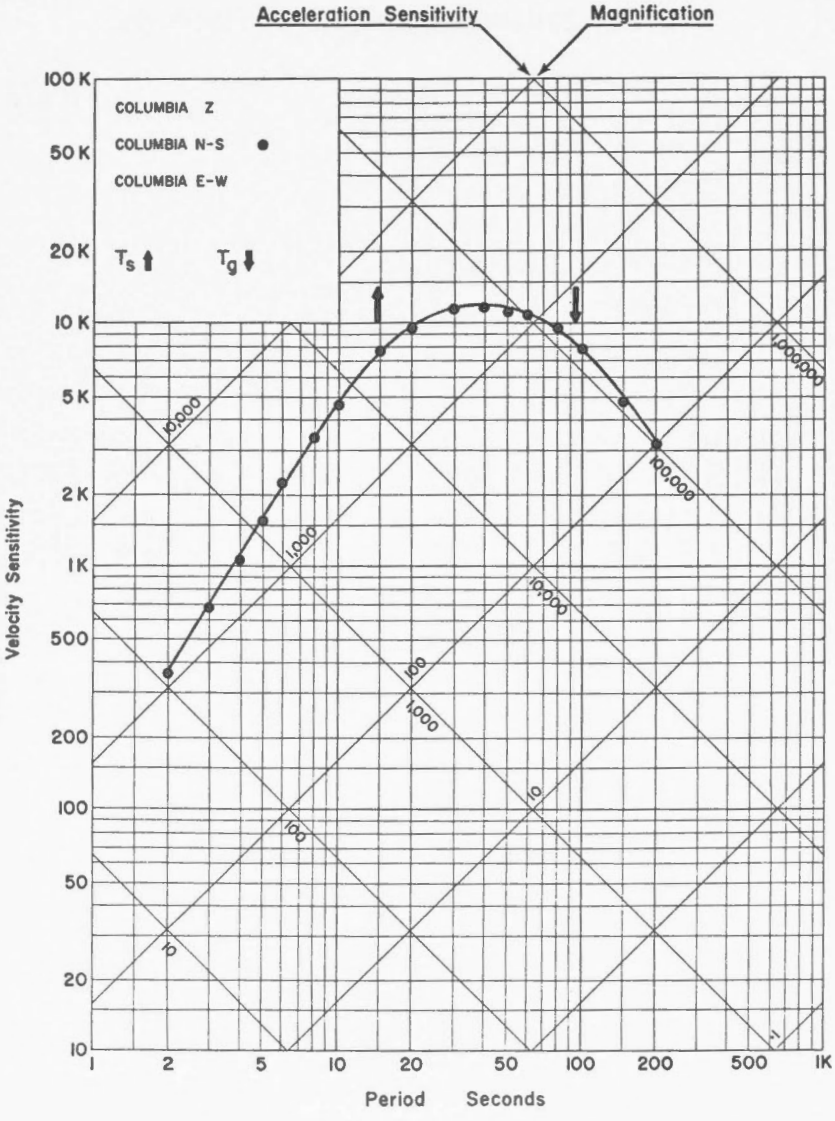
COLUMBIA N-S

COLUMBIA E-W

STATION: OTTAWA, ONT. (OTT)
(As Found & Left)

ϕ= 45°23'38"N λ= 75°42'57"W Altitude 83 M

Foundation: Boulder Clay on Limestone



Dates of Calibration:

COLUMBIA Z

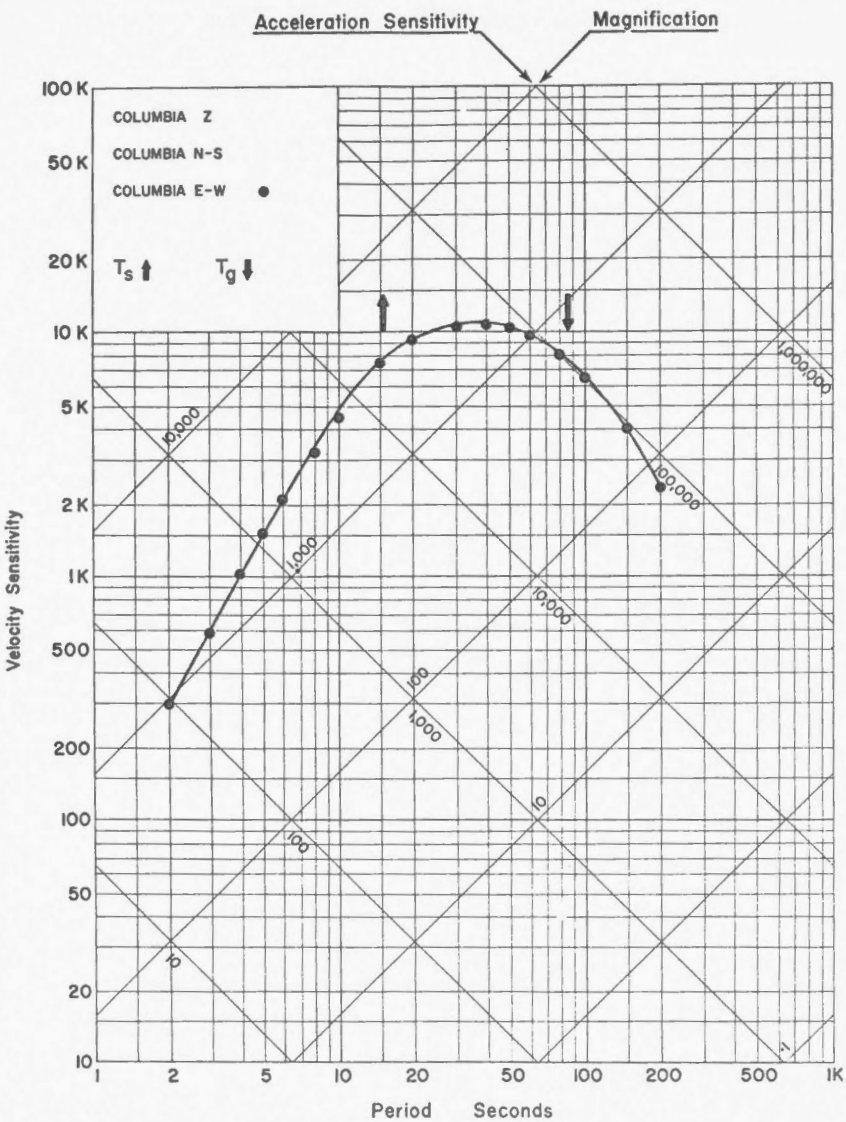
COLUMBIA N-S ● February 13, 1973

COLUMBIA E-W

STATION: OTTAWA, ONT. (OTT)
(As Found & Left)

$\phi = 45^{o}23'38''N$ $\lambda = 75^{o}42'57''W$ Altitude 83 M

Foundation: Boulder Clay on Limestone



Dates of Calibration:

COLUMBIA Z

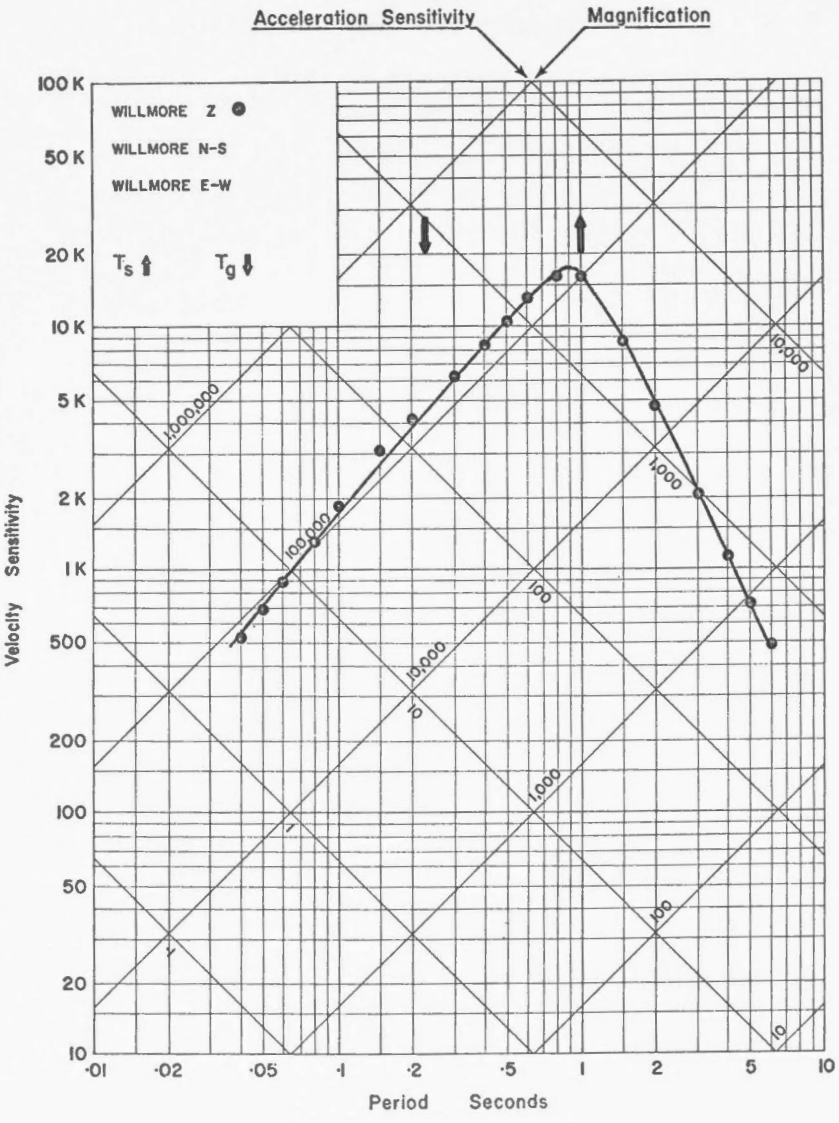
COLUMBIA N-S

COLUMBIA E-W • February 14, 1973

STATION: PENTICTON, B.C. (PNT)

ϕ= 49°19'N λ= 119°37'W Altitude 550 M

Foundation: Tertiary shale



Dates of Calibration:

WILLMORE Z May 29, 1970

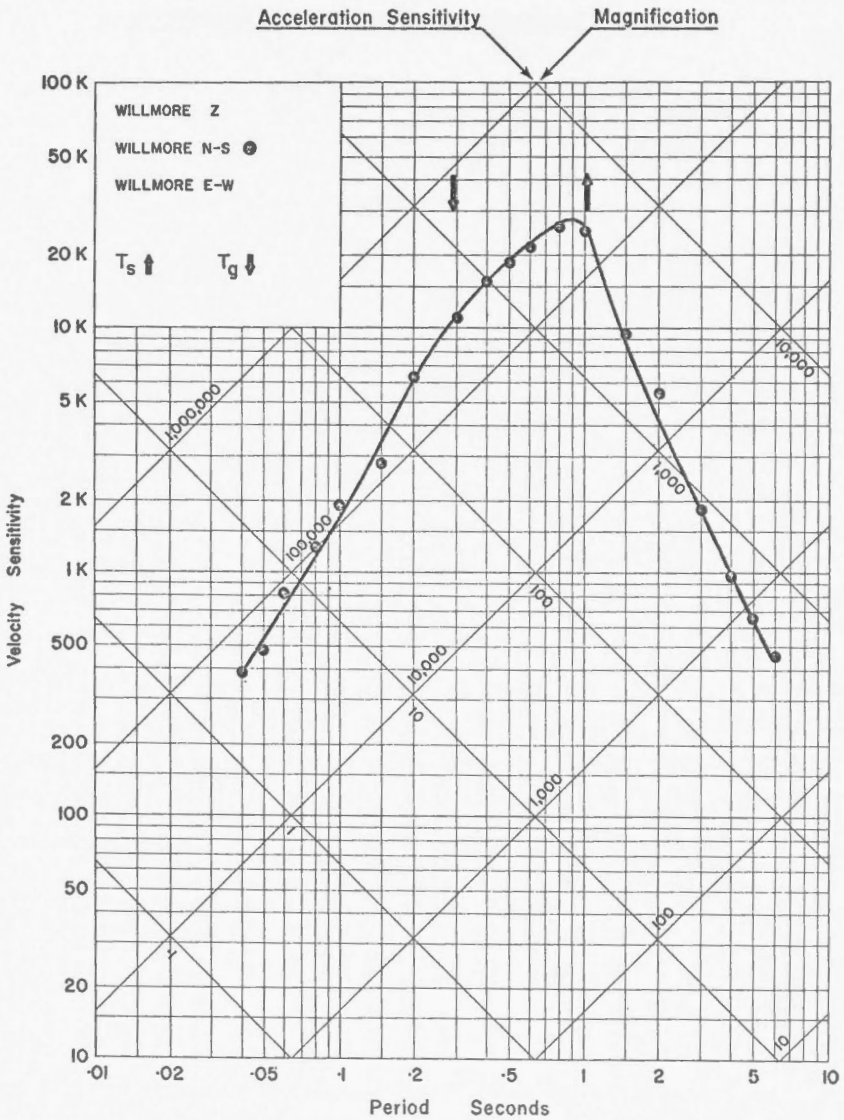
WILLMORE N-S

WILLMORE E-W

STATION: PENTICTON, B.C. (PNT)

ϕ= 49°19'N λ= 119°37'W Altitude 550 M

Foundation: Tertiary shale



Dates of Calibration:

WILLMORE Z

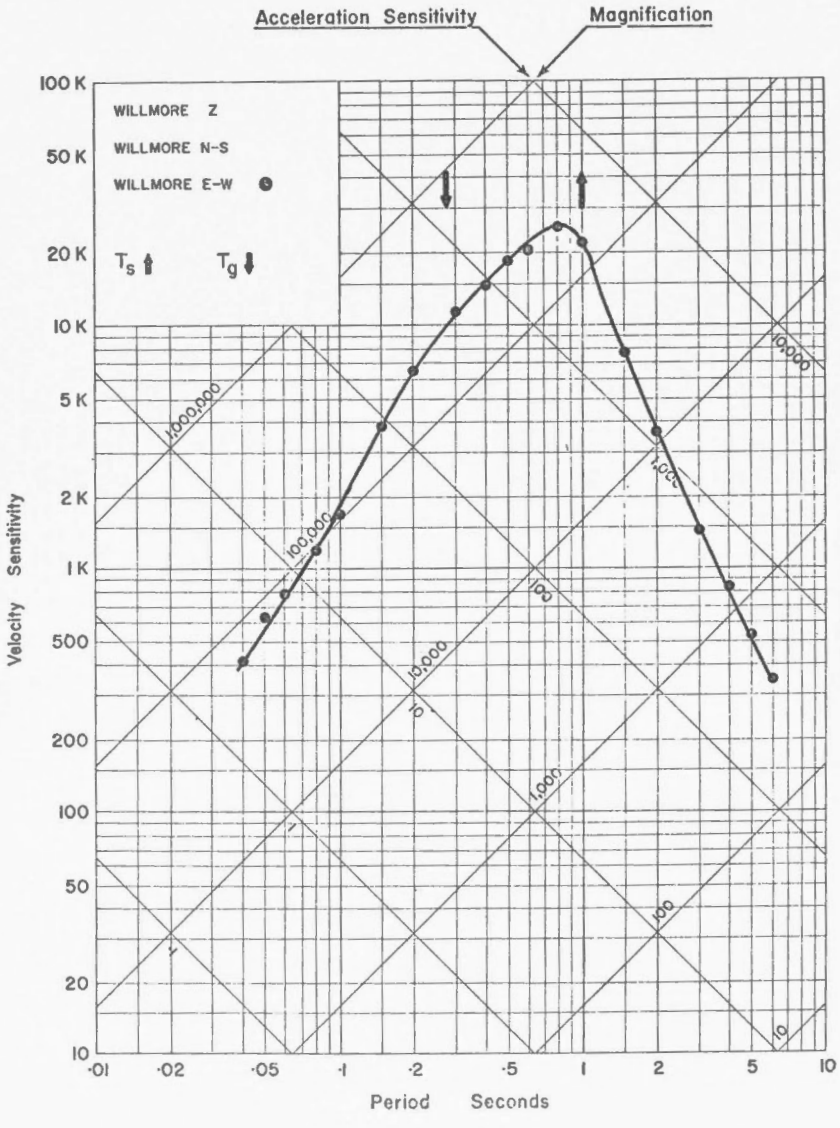
WILLMORE N-S May 29, 1970

WILLMORE E-W

STATION: PENTICTON, B.C. (PNT)

ϕ= 49°19'N λ= 119°37'W Altitude 550 M

Foundation: Tertiary shale



Dates of Calibration:

WILLMORE Z

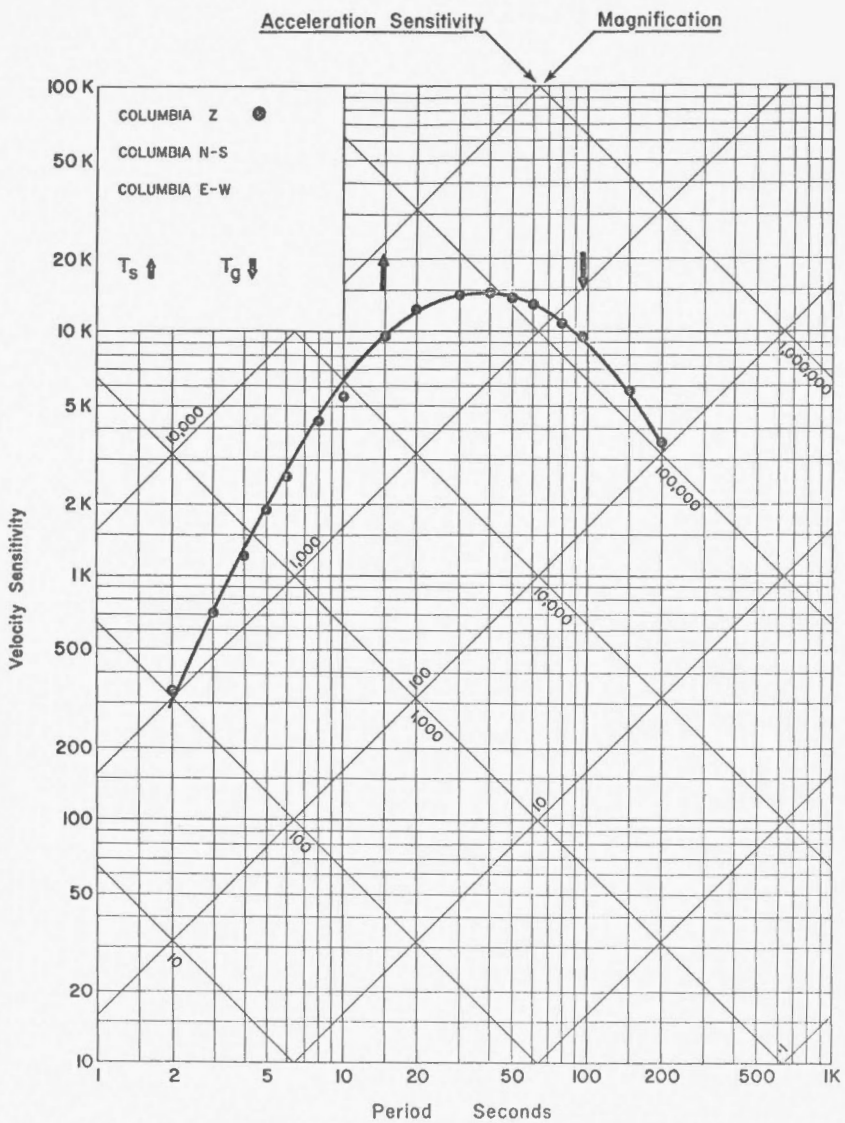
WILLMORE N-S

WILLMORE E-W ● May 29, 1970

STATION: PENTICTON, B.C. (PNT)

ϕ= 49°19'N λ= 119°37'W Altitude 550 M

Foundation: Tertiary shale



Dates of Calibration:

COLUMBIA Z May 29, 1970

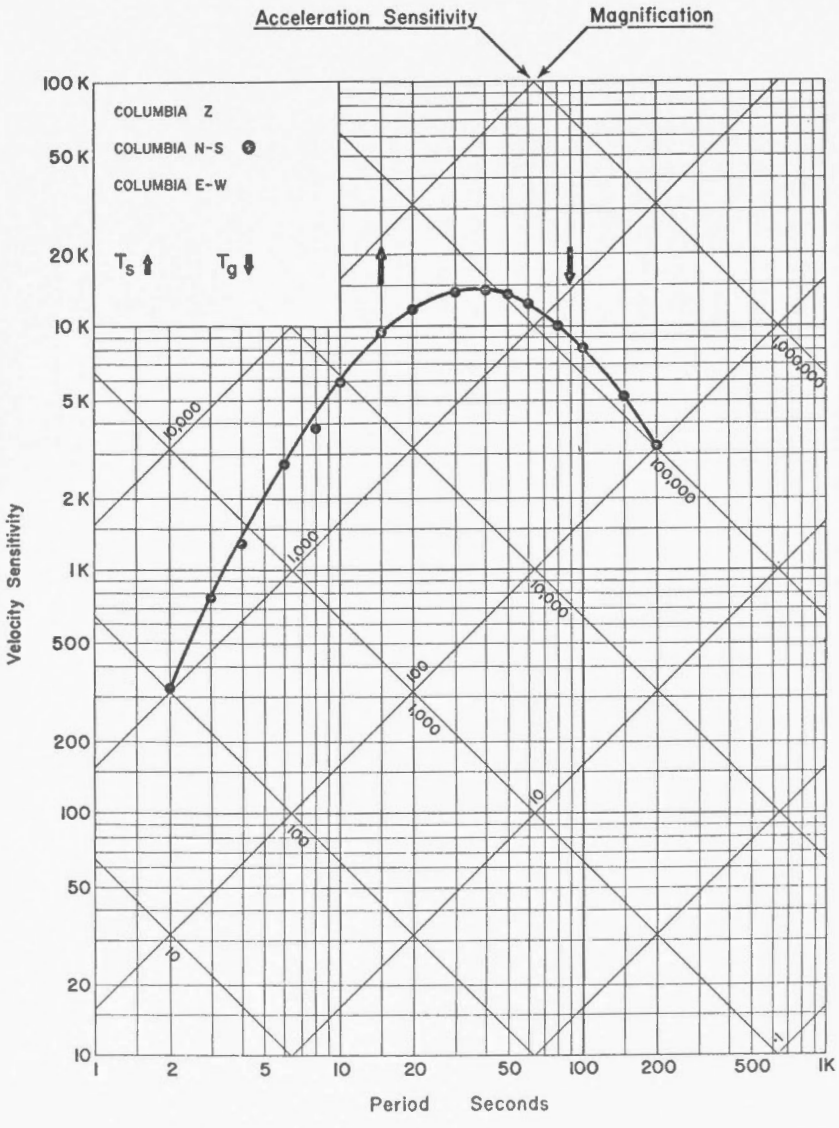
COLUMBIA N-S

COLUMBIA E-W

STATION: PENTICTON, B.C. (PNT)

ϕ= 49°19'N λ= 119°37'W Altitude 550M

Foundation: Tertiary shale



Dates of Calibration:

COLUMBIA Z

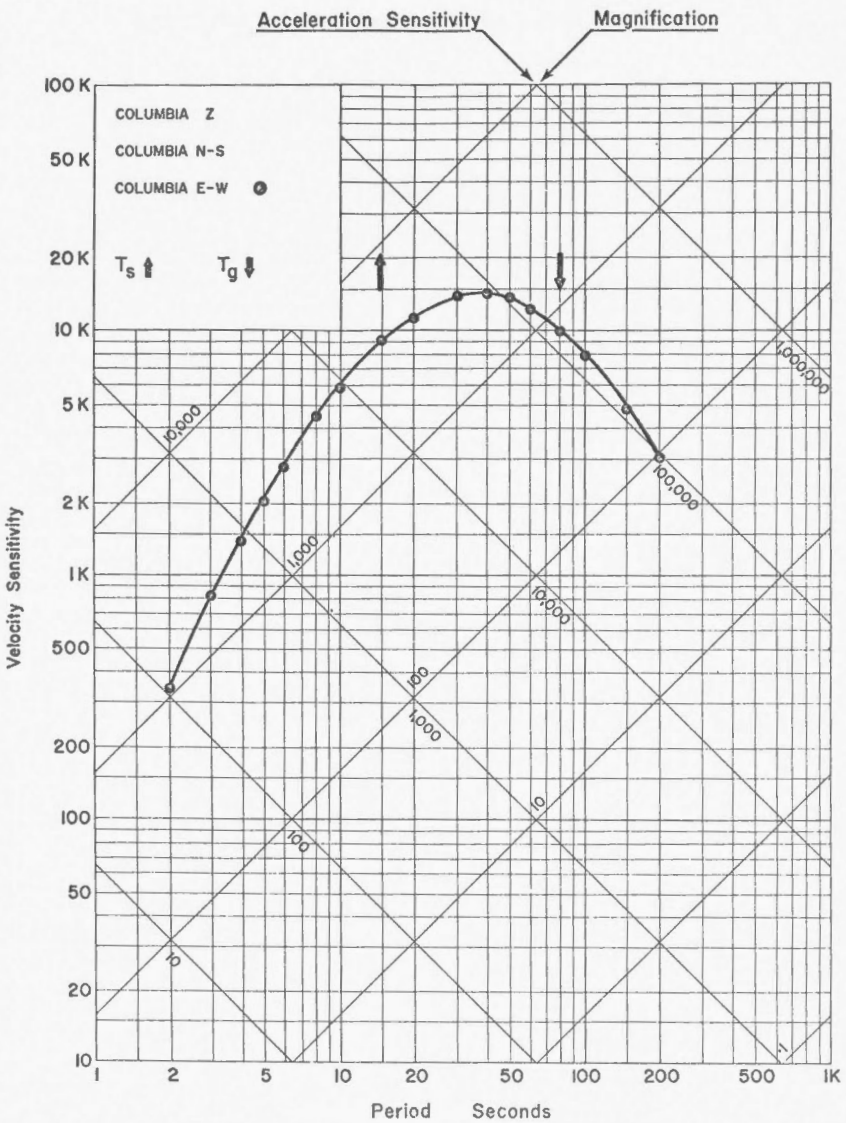
COLUMBIA N-S May 30, 1970

COLUMBIA E-W

STATION: PENTICTON, B.C. (PNT)

ϕ= 49°19'N λ= 119°37'W Altitude 550 M

Foundation: Tertiary shale



Dates of Calibration:

COLUMBIA Z

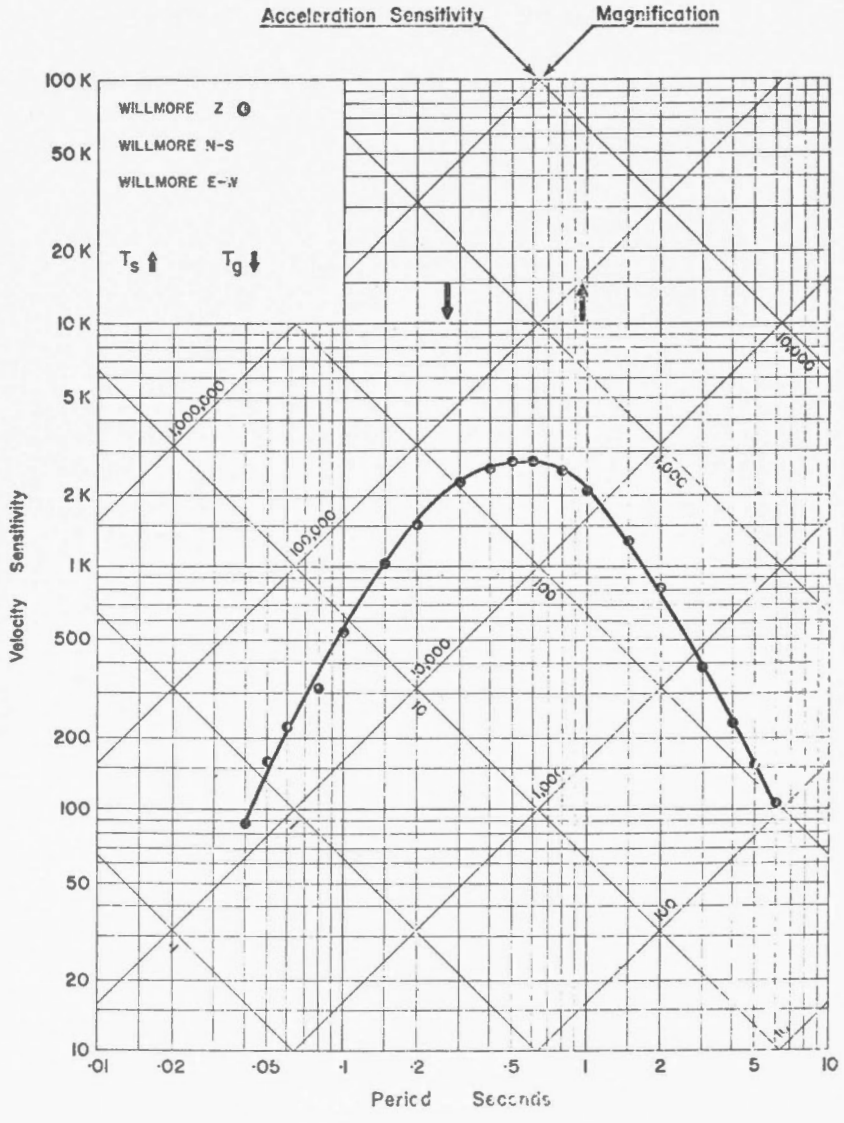
COLUMBIA N-S

COLUMBIA E-W ⊙ May 30, 1970

STATION: PORT HARDY, B.C. (PHC)

ϕ= 50°42.4'N λ= 127°25.9'W Altitude 33 M

Foundation: Mesozoic, Triassic sedimentary and volcanic rocks



Dates of Calibration:

WILLMORE Z Oct. 20, 1970

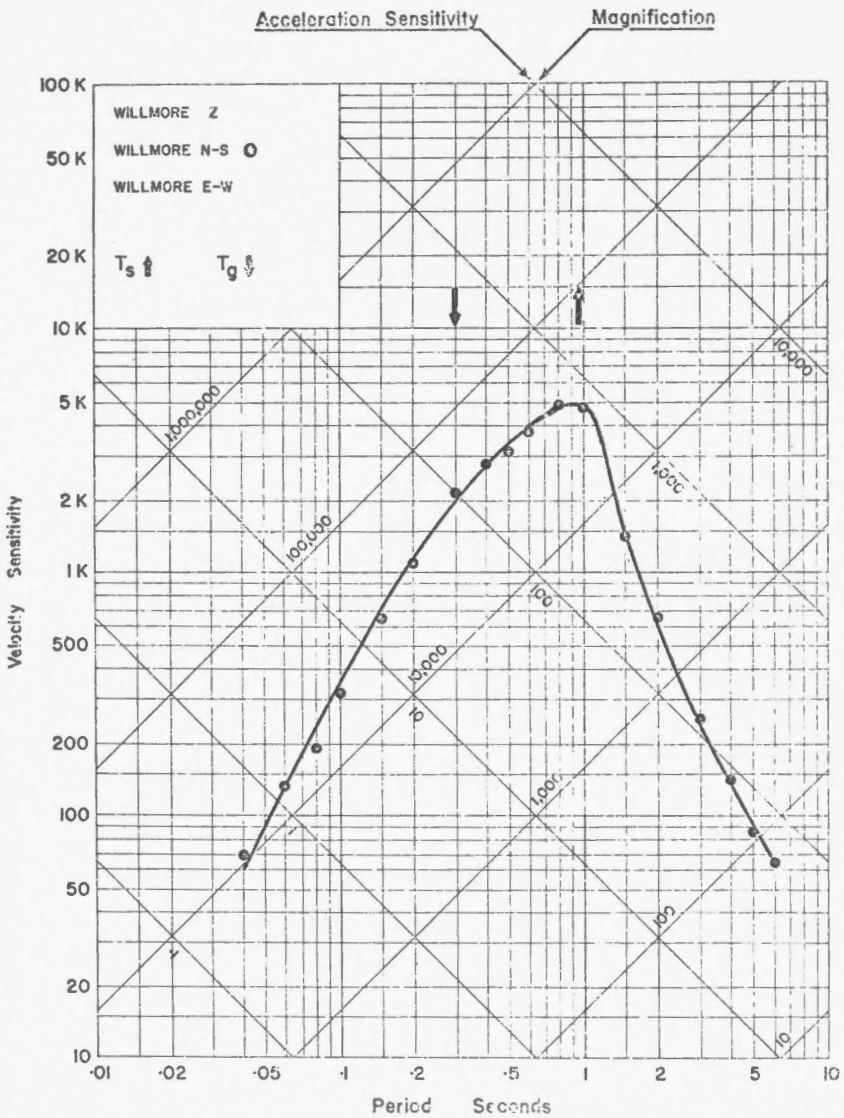
WILLMORE N-S

WILLMORE E-W

STATION: PORT HARDY, B.C. (PHC)

ϕ= 50°42.4'N λ= 127°25.9'W Altitude 33 M

Foundation: Mesozoic, Triassic sedimentary and volcanic rocks



Dates of Calibration:

WILLMORE Z

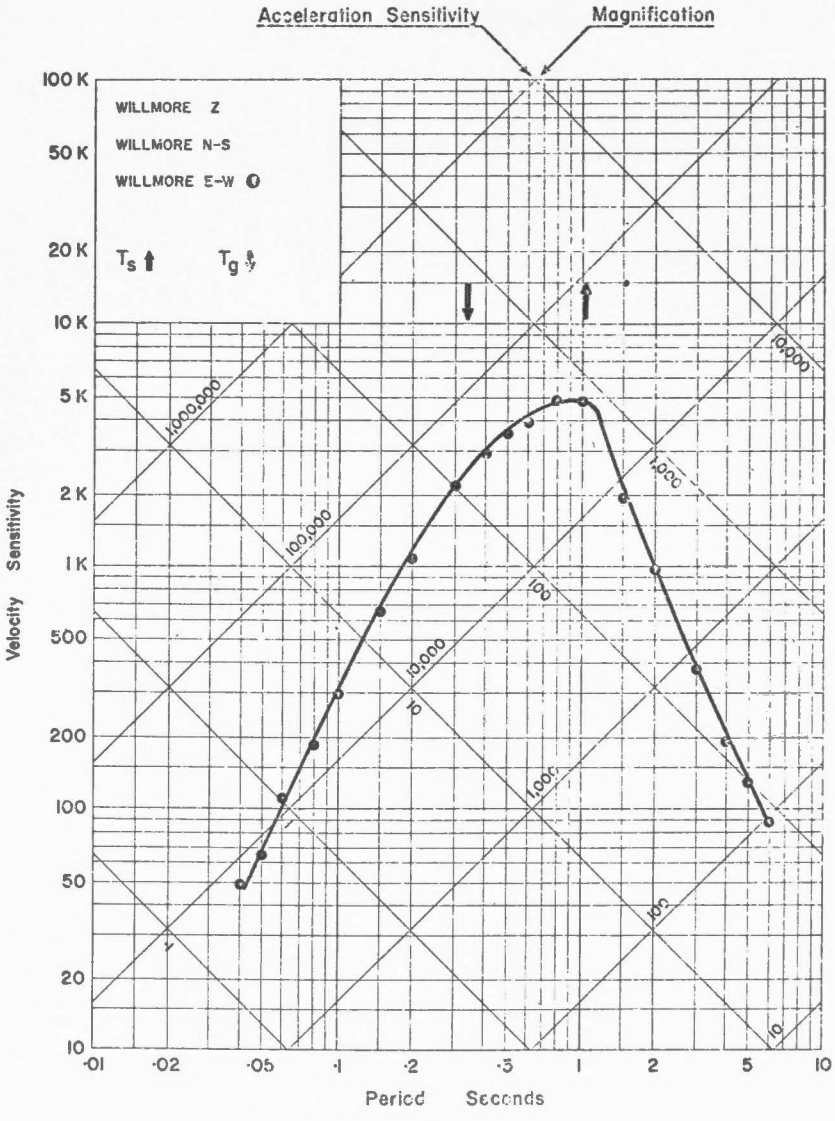
WILLMORE N-S O Oct. 20, 1970

WILLMORE E-W

STATION: PORT HARDY, B.C. (PHC)

ϕ= 50°42.4'N λ= 127°25.9'W Altitude 33 M

Foundation: Mesozoic, Triassic sedimentary and volcanic rocks



Dates of Calibration:

WILLMORE Z

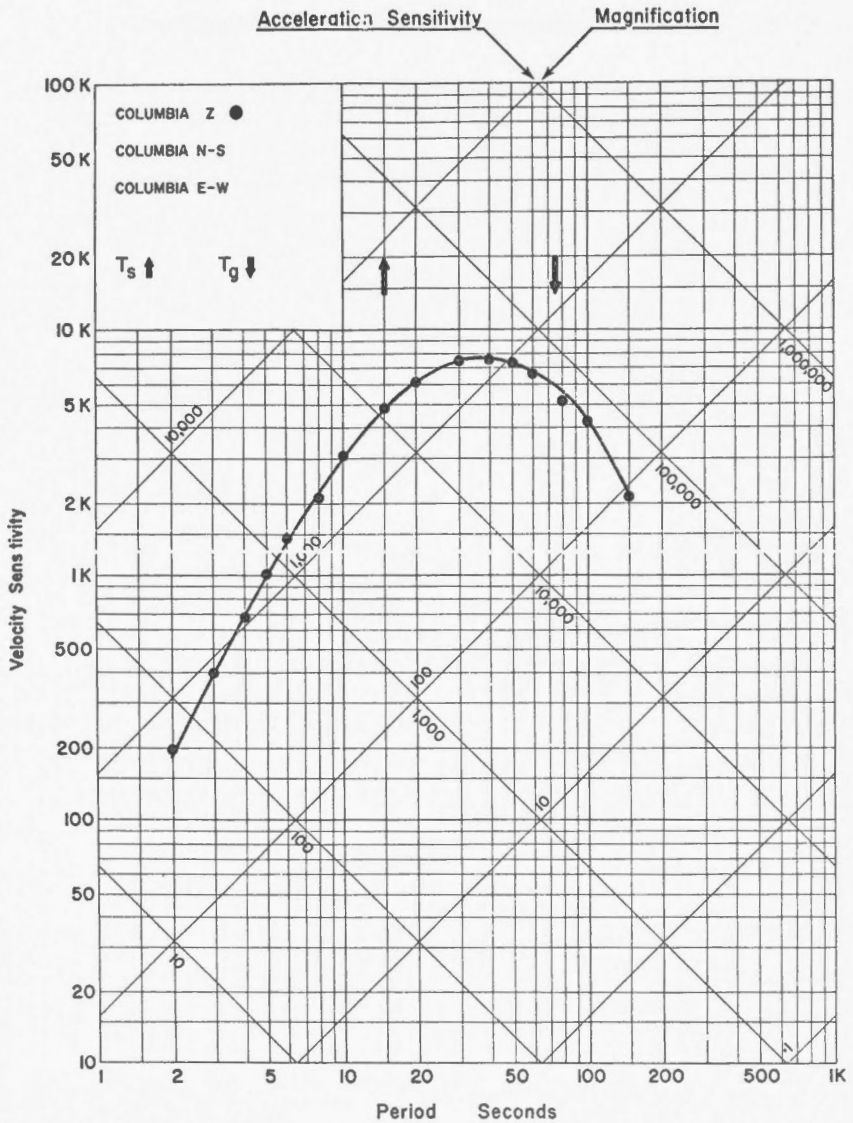
WILLMORE N-S

WILLMORE E-W Oct. 21, 1970

STATION: PORT HARDY, B.C. (PHC)

ϕ= 50°42.4'N λ= 127°25.9'W Altitude 33 M

Foundation: Mesozoic, Triassic sedimentary and Volcanic rocks



Dates of Calibration:

COLUMBIA Z ● Oct. 25, 1970

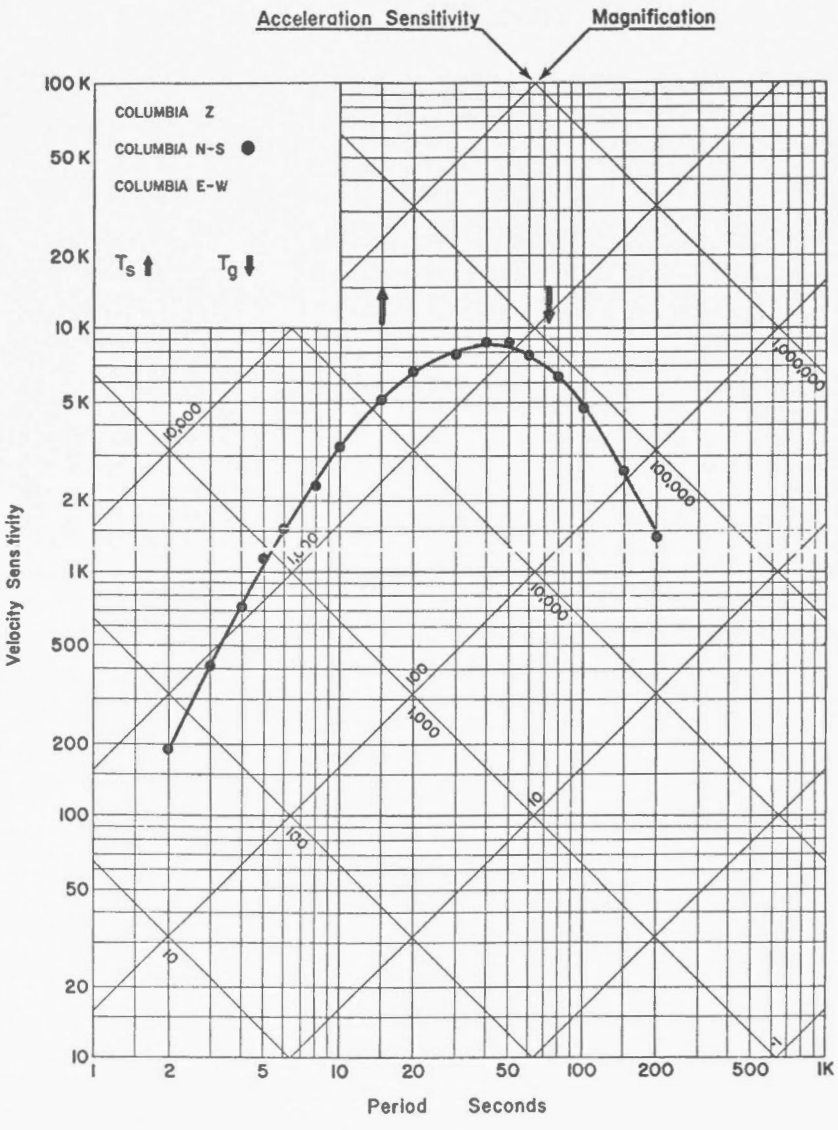
COLUMBIA N-S

COLUMBIA E-W

STATION: PORT HARDY, B.C. (PHC)

ϕ= 50°42.4'N λ= 127°25.9'W Altitude 33 M

Foundation: Mesozoic, Triassic sedimentary and volcanic rocks



Dates of Calibration:

COLUMBIA Z

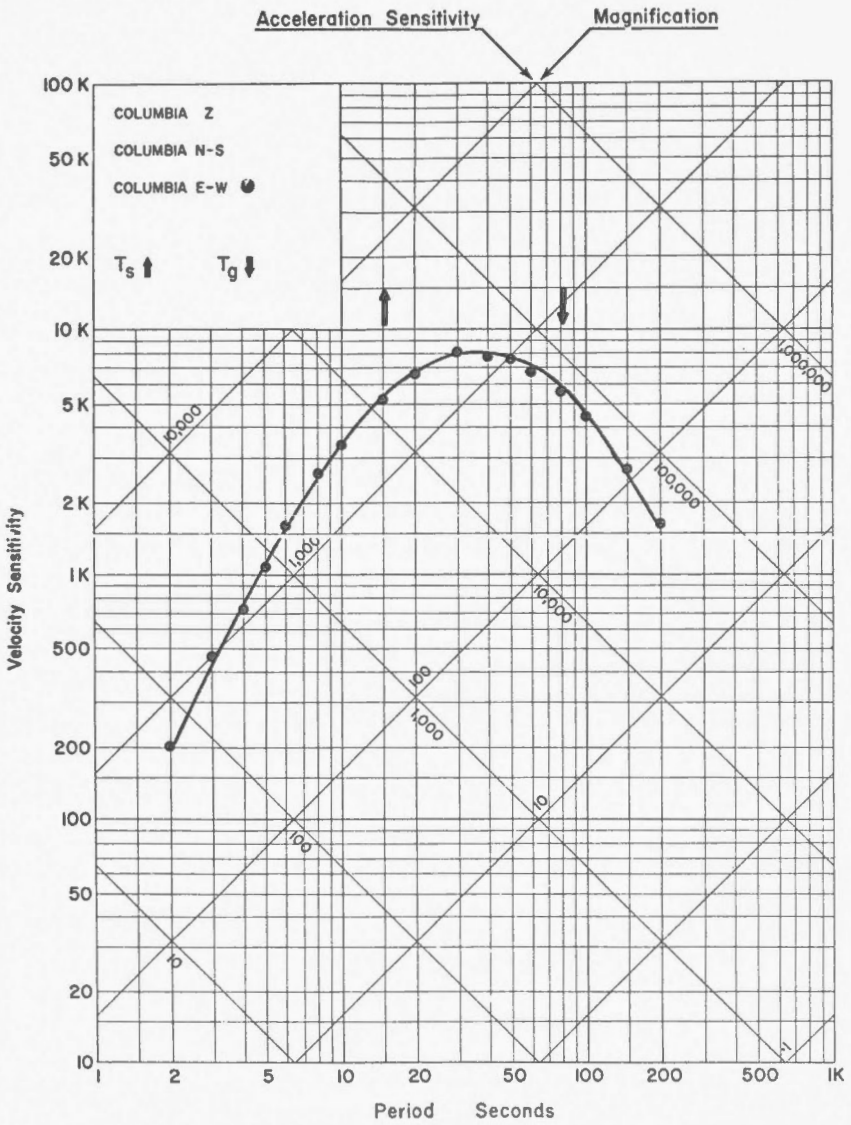
COLUMBIA N-S ● Oct. 24, 1970

COLUMBIA E-W

STATION: PORT HARDY, B.C. (PHC)

$\phi = 50^{o}42.4'N$ $\lambda = 127^{o}25.9'W$ Altitude 33 M

Foundation: Mesozoic, Triassic sedimentary and volcanic rocks



Dates of Calibration:

COLUMBIA Z

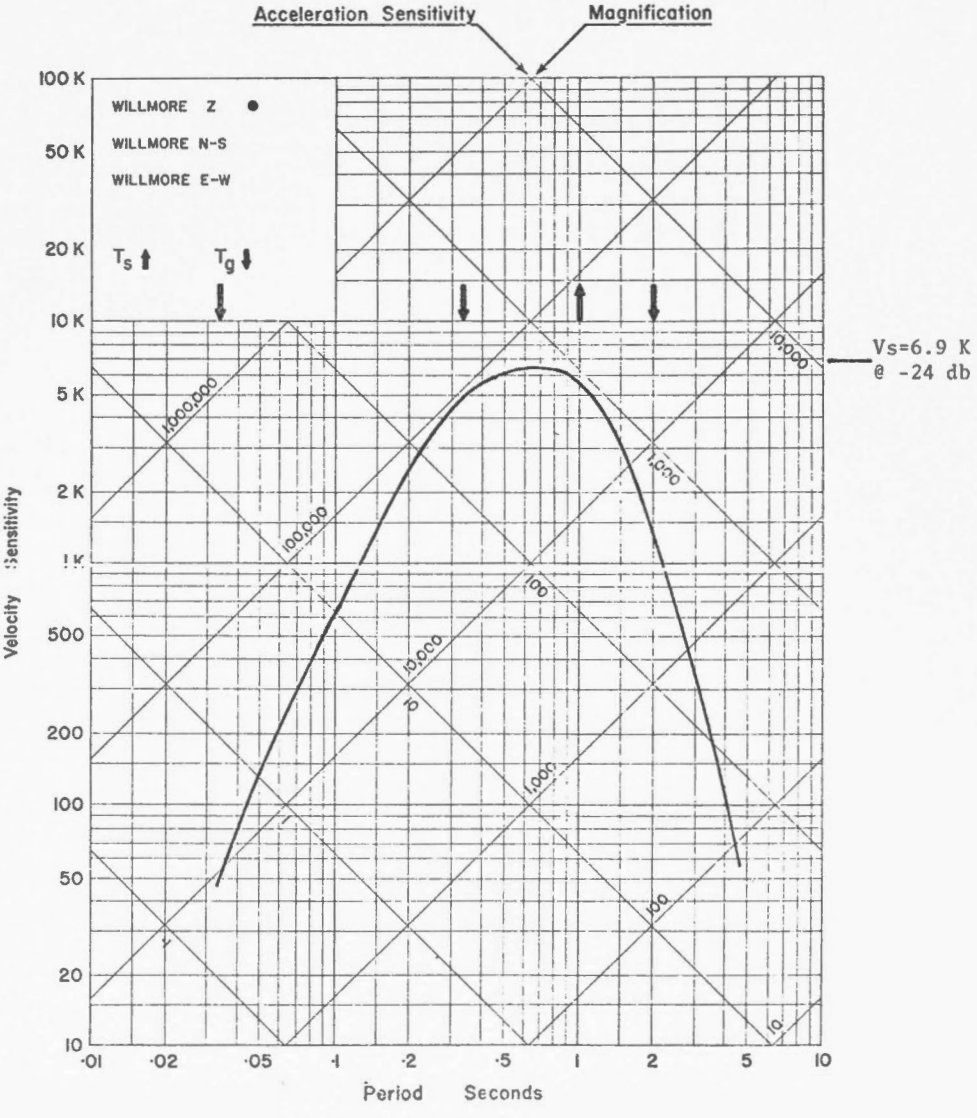
COLUMBIA N-S

COLUMBIA E-W ● Oct. 25, 1970

STATION: POSTE DE LA BALEINE, QUE. (PBQ)

ϕ= 55°16.6'N λ= 77°44.6'W Altitude 20 M

Foundation: Granite Gneiss



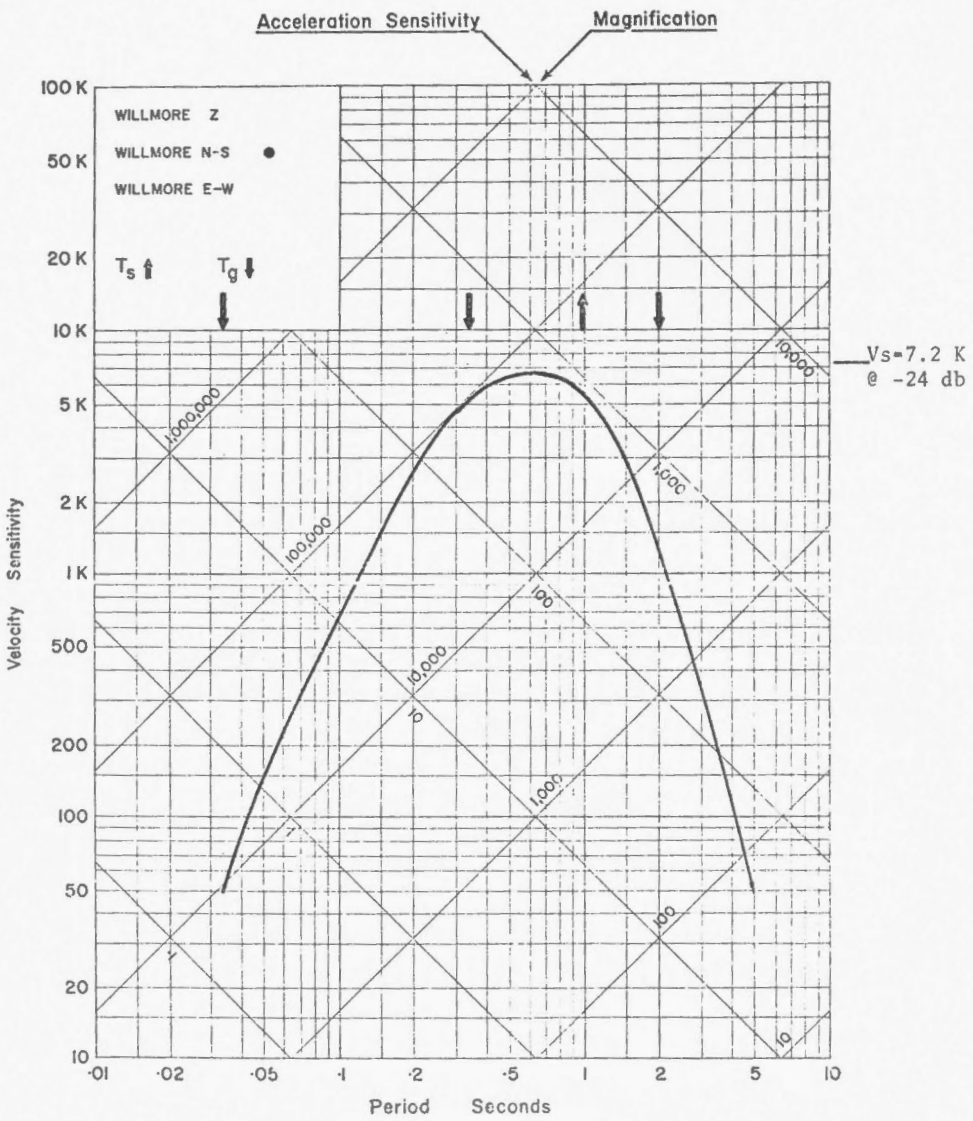
Dates of Calibration: 14 Sept. 1972

SEISMOMETER: Willmore Short Period Vertical
G_L = 1.1 v/cm/sec
AMPLIFIER: EA310 Filter Bandpass 0.5-3 Hz with 30 db sen. and max. gain of 100 k.
HELICORDER: RV301 Sensit. 1 cm/v
Response 0-30 Hz
Corner frequencies indicated by "T_g" arrows.

STATION: POSTE DE LA BALEINE, QUE. (PBQ)

ϕ= 55°16.6'N λ= 77°44.6'W Altitude 20 M

Foundation: Granite Gneiss .



Dates of Calibration: 14 Sept. 1972

SEISMOMETER: Willmore Short Period North-South
G_L = 1.15 v/cm/sec

AMPLIFIER: EA310 Filter Bandpass 0.5-3 Hz with 30 db sep. and max. gain of 100 k.

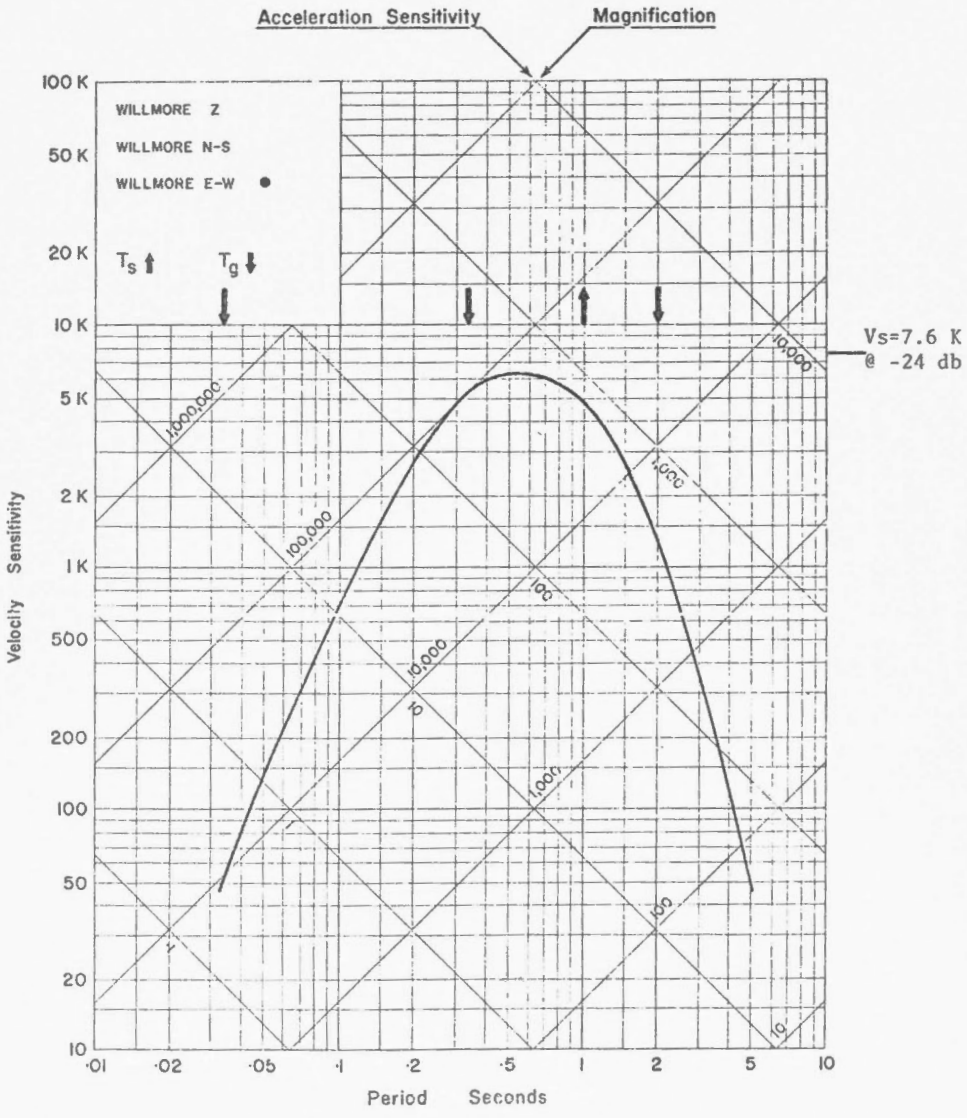
HELICORDER: RV301 Sensit. 1 cm/v

Corner frequencies indicated by "T_g" arrows.

STATION: POSTE DE LA BALEINE, QUE. (PBQ)

ϕ= 55°16.6'N λ= 77°44.6'W Altitude 20 M

Foundation: Granite Gneiss



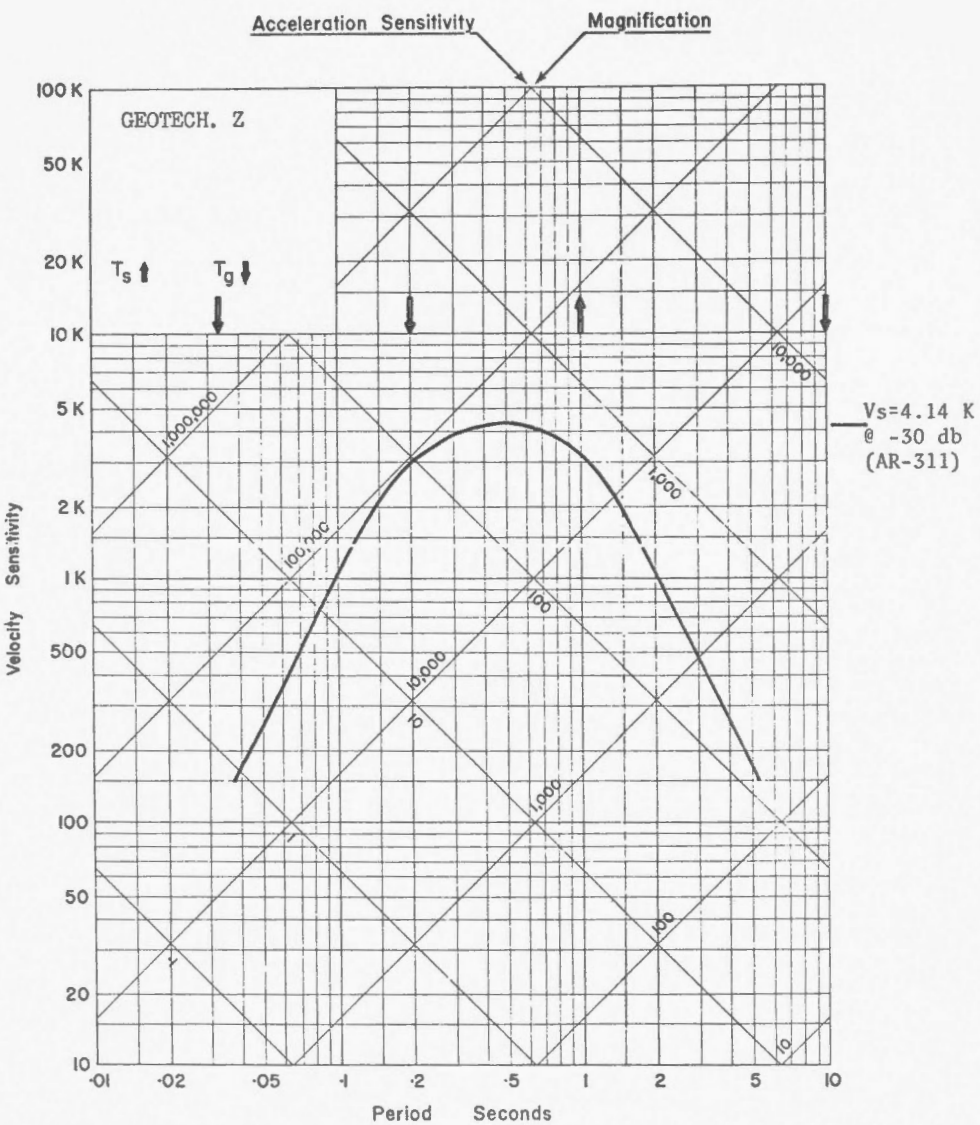
Dates of Calibration: 14 Sept. 1972

SEISMOMETER: Willmore Short Period East-West
G_L = 1.21 v/cm/sec
AMPLIFIER: EA310 Filter Bandpass 0.5-3 Hz with 30 db sep. and max. gain of 100 k.
HELICORDER: RV301 Sensit. 1 cm/v
Response 0-30 Hz
Corner frequencies indicated by "T_g" arrows.

STATION: QUEBEC, QUE. (QCQ)

ϕ= 46°46'44"N λ= 71°16'33"W Altitude 91 M

Foundation: Schist



Dates of Calibration: October 1972

SEISMOMETER: Geotech. S13 G_L = 2.62 V.S./C M.

PREAMPLIFIER: AS330 operated at 30-30 db (SEP.-ATT.)
Filter Bandpass 0.1 - 5 Hz

AMPLIFIER: AR 311 - 1 C M./Volt @ 24 db

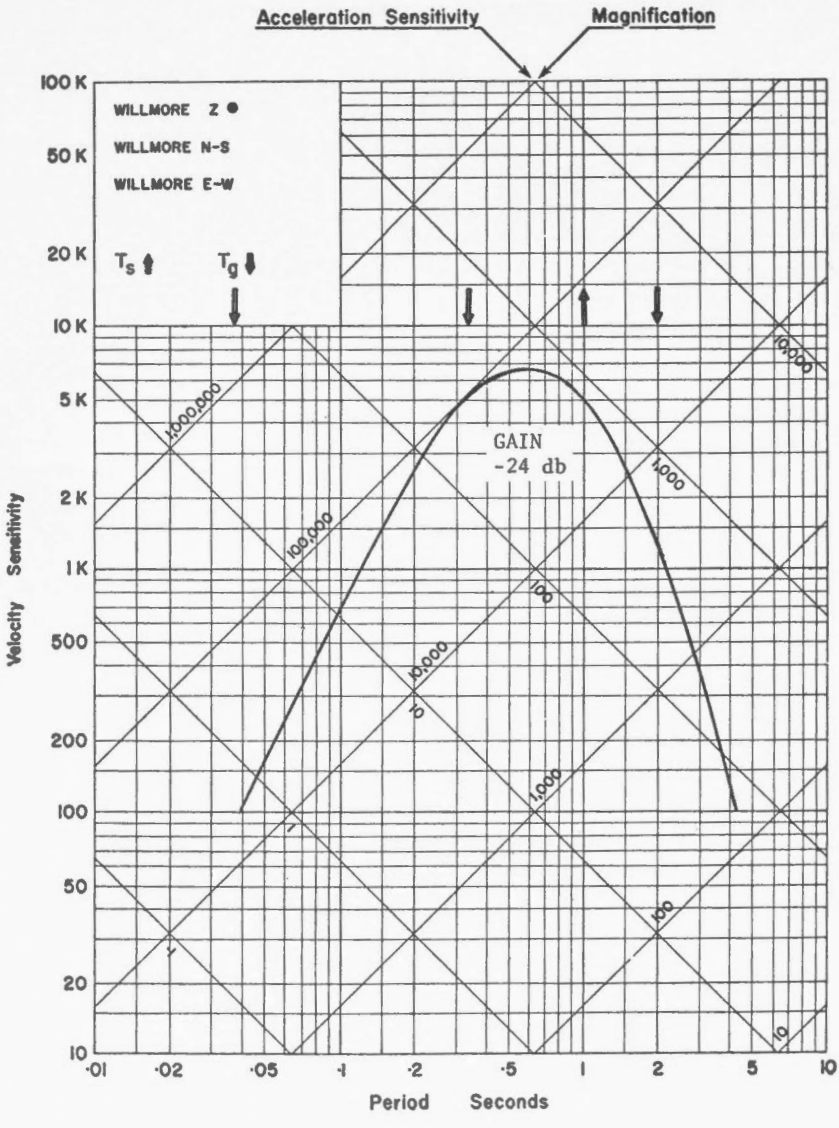
HELICORDER: RV 301 - 0-30 Hz

Corner frequencies indicated by "T_g" arrows.

STATION: QUEEN CHARLOTTE, B.C. (QCC)

ϕ= 53°15.3'N λ= 132°05.3'W **Altitude** 3 M

Foundation: Sedimentary Rocks



Dates of Calibration: Sept. 30, 1971

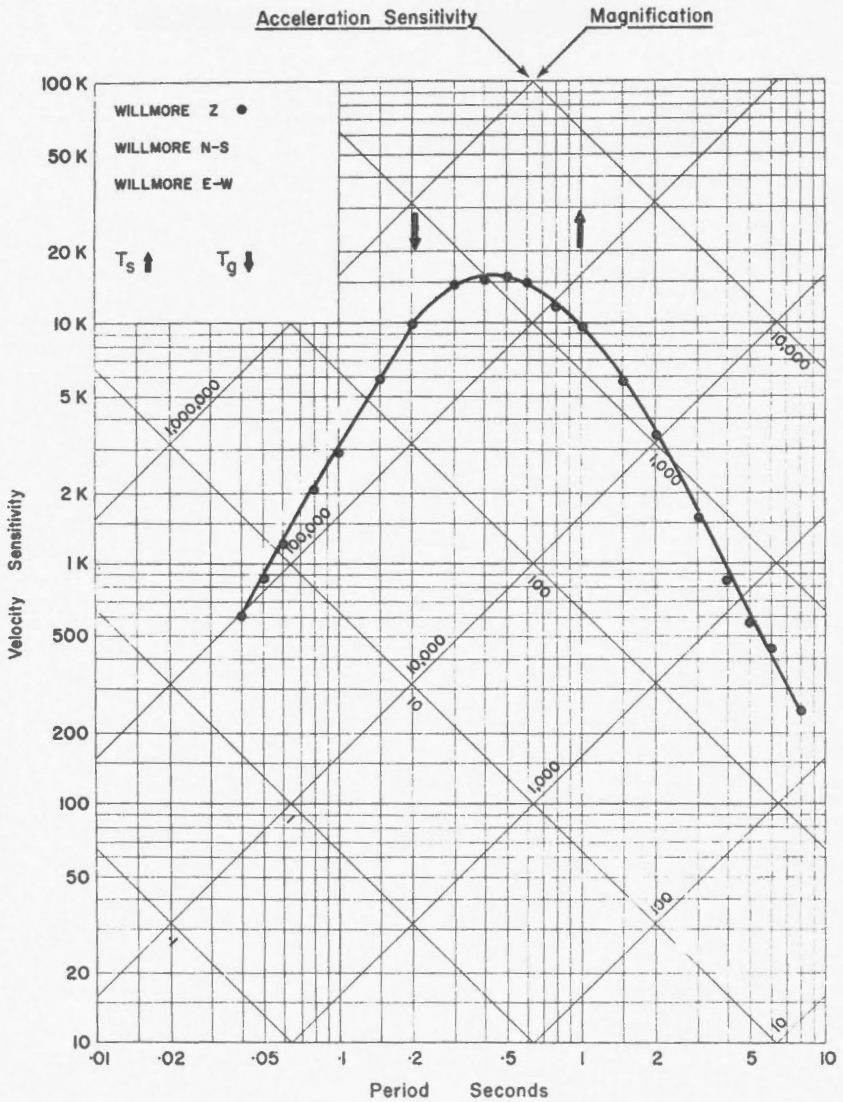
WILLMORE Z ●
WILLMORE N-S
WILLMORE E-W

Operating with a Teledyne EA310 amplifier into a helicorder. Corner frequencies indicated by "T_g" arrows.

STATION: RESOLUTE, N.W.T. (RES)

$\phi = 74^{\circ}41.2'$ N $\lambda = 94^{\circ}54.0'$W Altitude 15 M

Foundation: Early Palaeozoic limestone



Dates of Calibration:

WILLMORE Z ● May 9, 1968

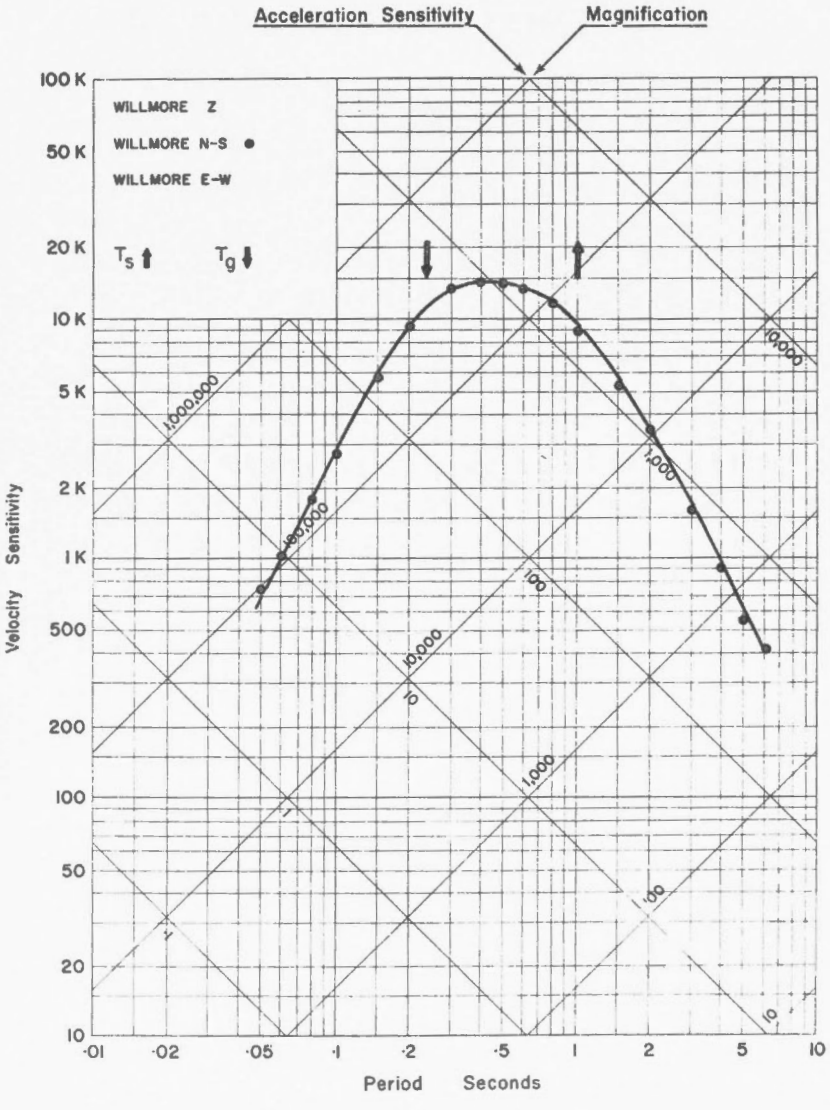
WILLMORE N-S

WILLMORE E-W

STATION: RESOLUTE, N.W.T. (RES)

ϕ= 74°41.2' N λ= 94°54.0' W Altitude 15 M

Foundation: Early Palaeozoic limestone



Dates of Calibration:

WILLMORE Z

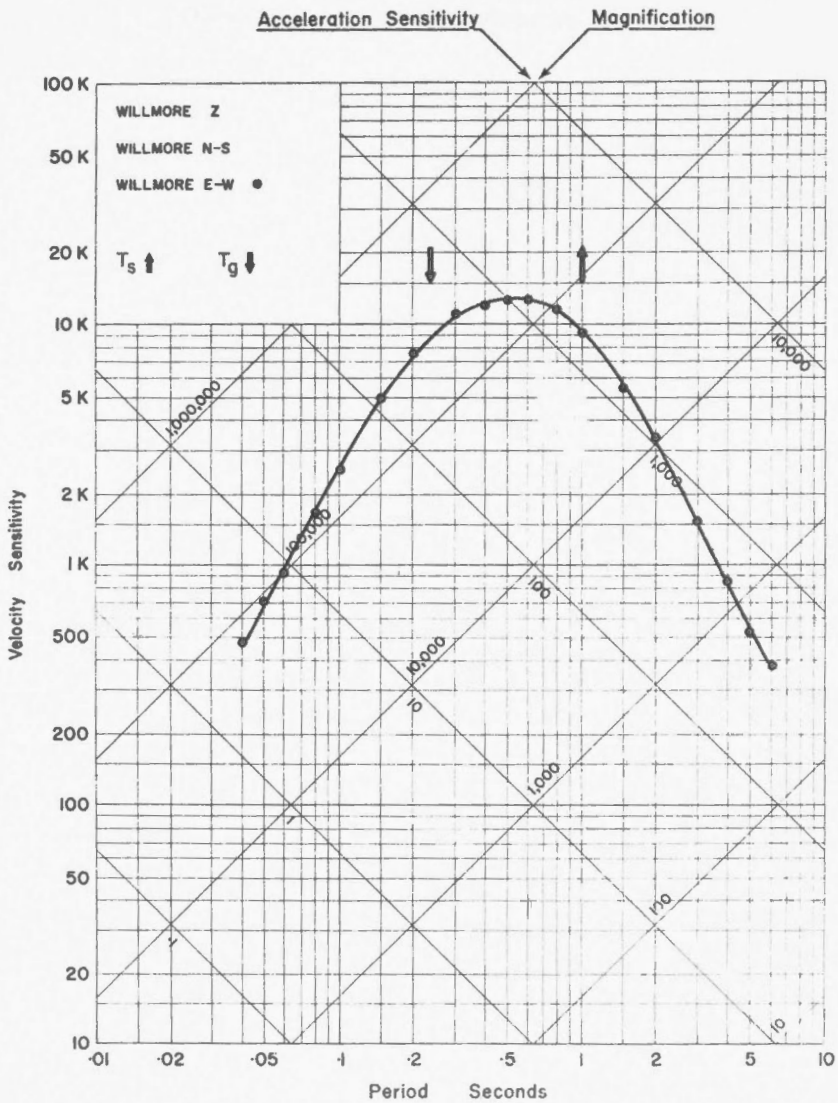
WILLMORE N-S • May 10, 1968

WILLMORE E-W

STATION: RESOLUTE, N.W.T. (RES)

$\phi = 74^{o}41.2'$ N $\lambda = 94^{o}54.0'$ W Altitude 15M

Foundation: Early Palaeozoic limestone



Dates of Calibration:

WILLMORE Z

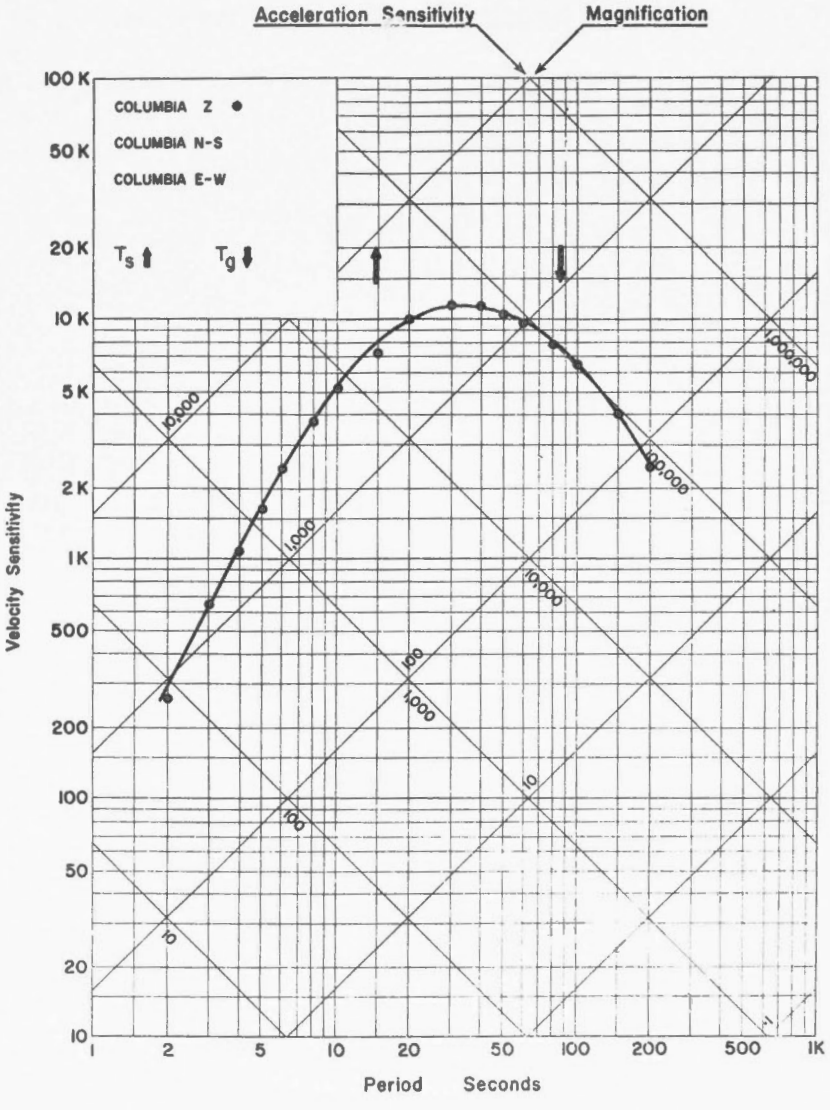
WILLMORE N-S

WILLMORE E-W • May 10, 1968

STATION: RESOLUTE, N.W.T. (RES)

ϕ= 74°41.2' N λ= 94°54.0' W Altitude 15M

Foundation: Early Palaeozoic limestone



Dates of Calibration:

COLUMBIA Z ● May 11, 1968

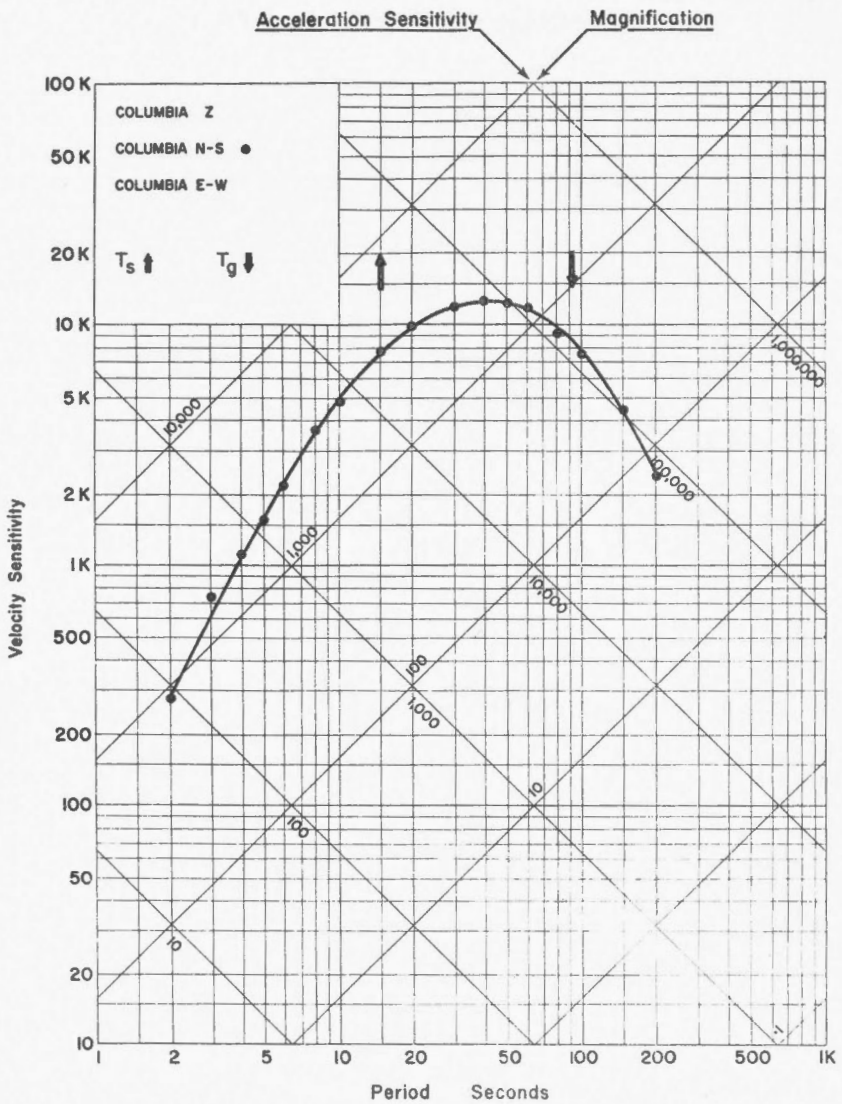
COLUMBIA N-S

COLUMBIA E-W

STATION: RESOLUTE, N.W.T. (RES)

ϕ= 74°41.2' N λ= 94°54.0' W **Altitude** 15 M

Foundation: Early Palaeozoic limestone



Dates of Calibration:

COLUMBIA Z

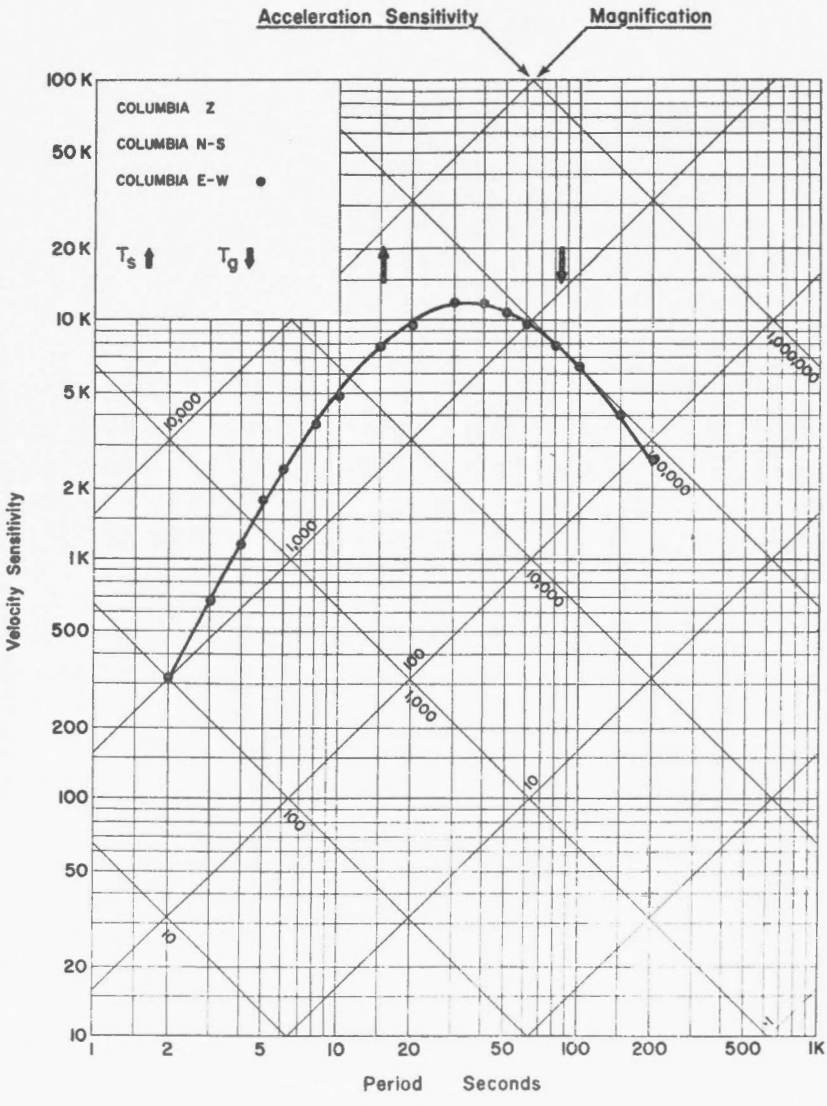
COLUMBIA N-S • May 11, 1968

COLUMBIA E-W

STATION: RESOLUTE, N.W.T. (RES)

ϕ= 74°41.2' N λ= 94°54.0' W Altitude 15 M

Foundation: Early Palaeozoic limestone



Dates of Calibration:

COLUMBIA Z

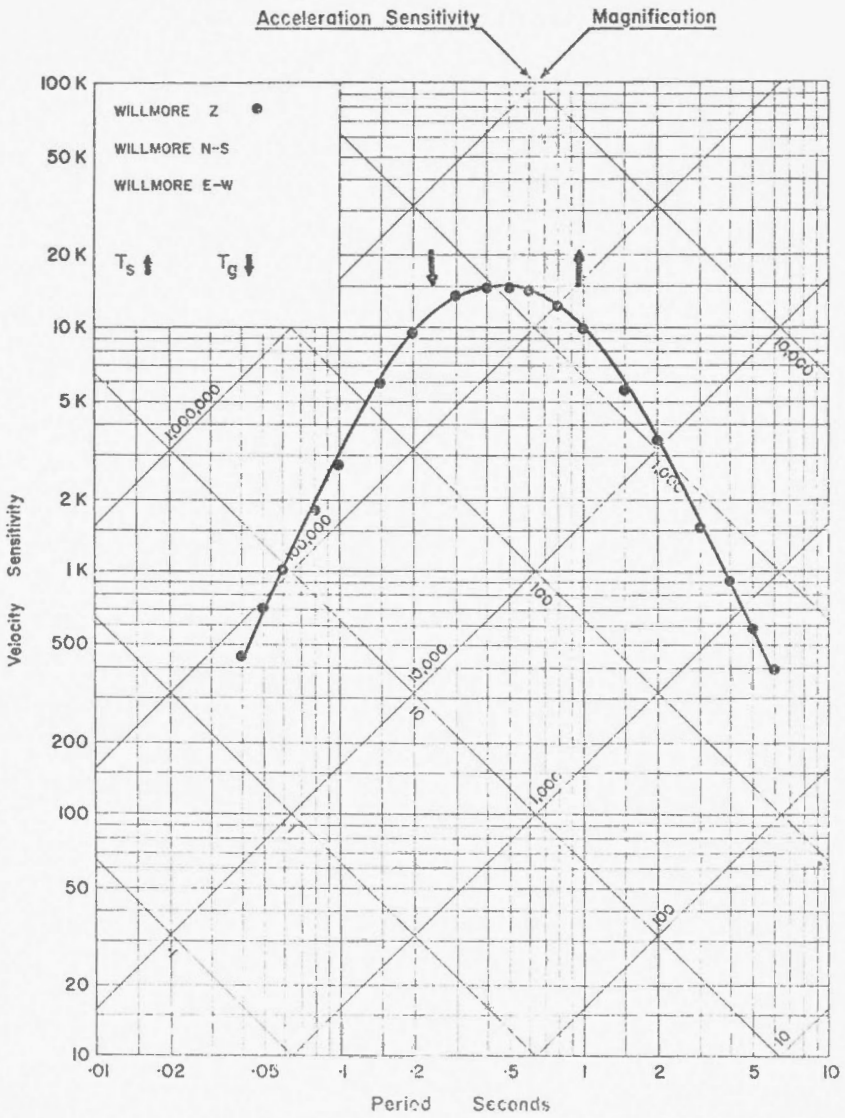
COLUMBIA N-S

COLUMBIA E-W • May 11, 1968

STATION: RESOLUTE, N.W.T. (RES)
(As found & left)

ϕ= 74°41.2'N λ= 94°54.0'W Altitude 15 M

Foundation: Early Palaeozoic limestone



Dates of Calibration:

WILLMORE Z ● May 3, 1973

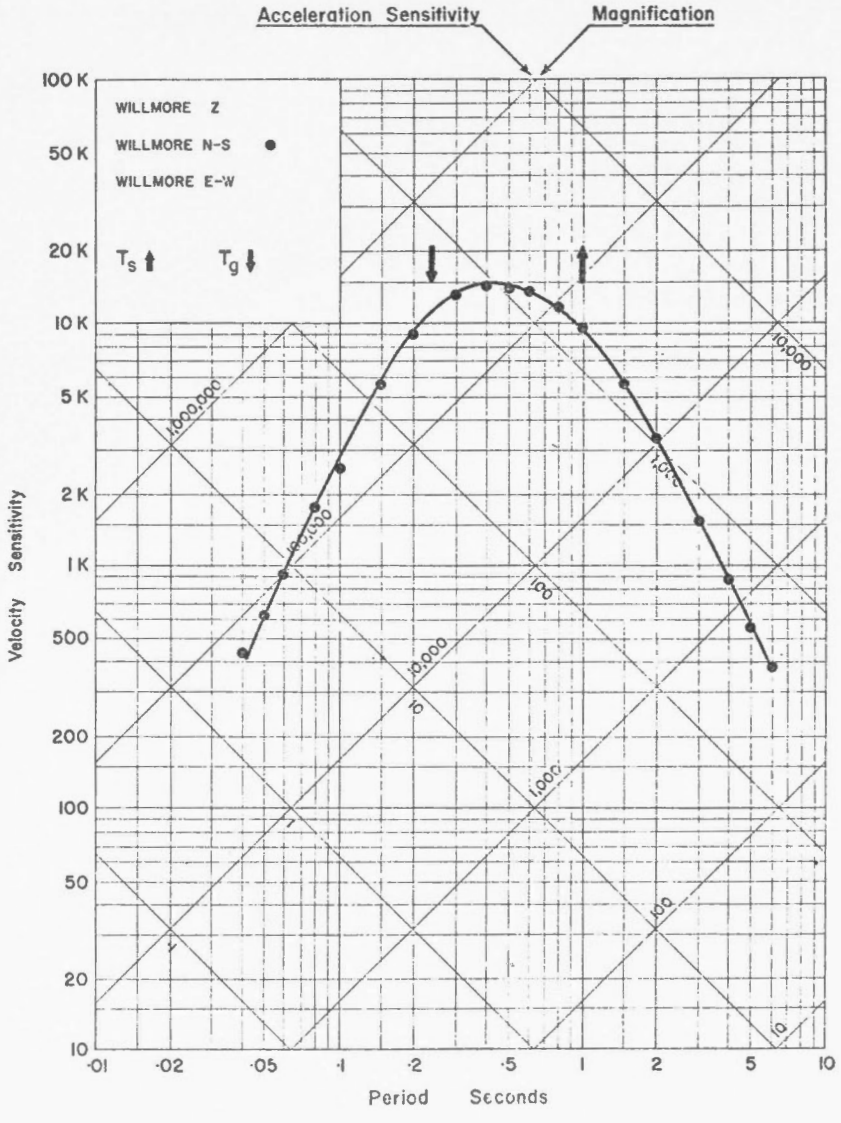
WILLMORE N-S

WILLMORE E-W

STATION: RESOLUTE, N.W.T. (RES)
(As found & left)

ϕ= 74°41.2'N λ= 94°54.0'W Altitude 15 M

Foundation: Early Palaeozoic limestone



Dates of Calibration:

WILLMORE Z

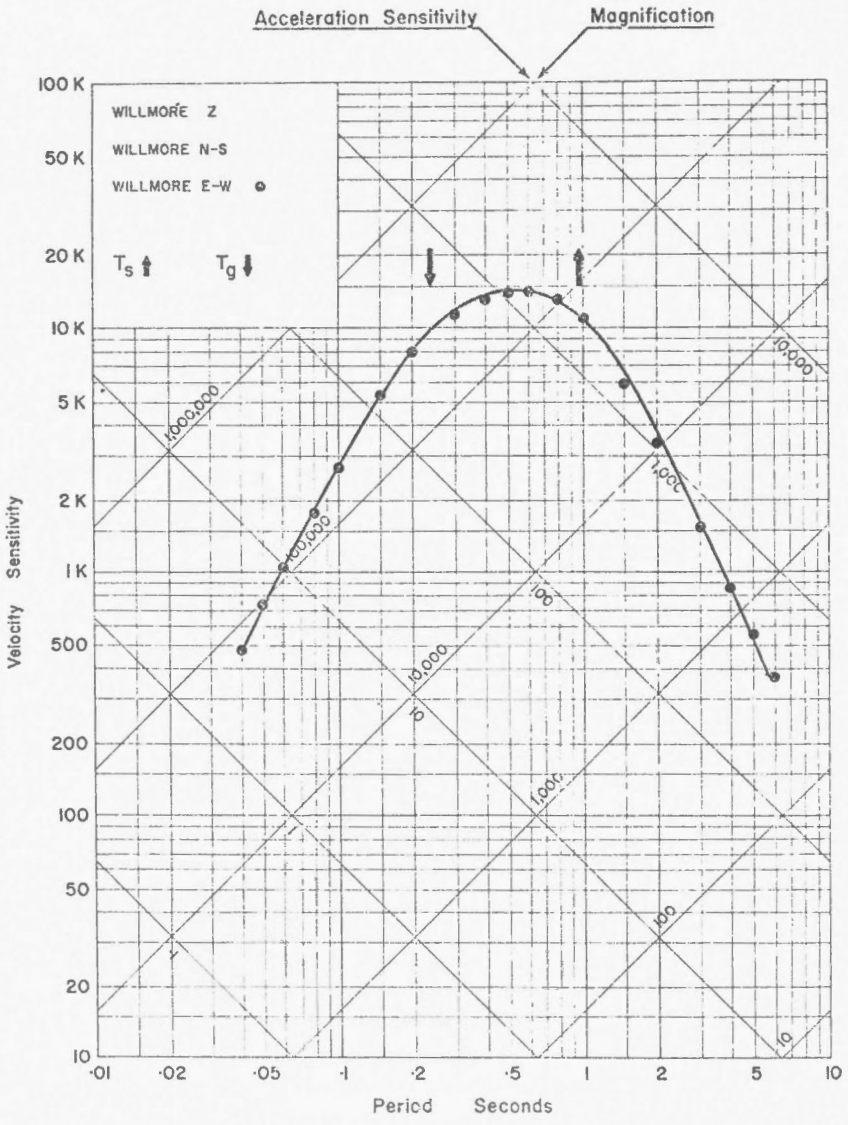
WILLMORE N-S • May 3, 1973

WILLMORE E-W

STATION: RESOLUTE, N.W.T. (RES)
(As found & left)

ϕ= 74°41.2'N λ= 94°54.0'W Altitude 15 M

Foundation: Early Palaeozoic limestone



Dates of Calibration:

WILLMORE Z

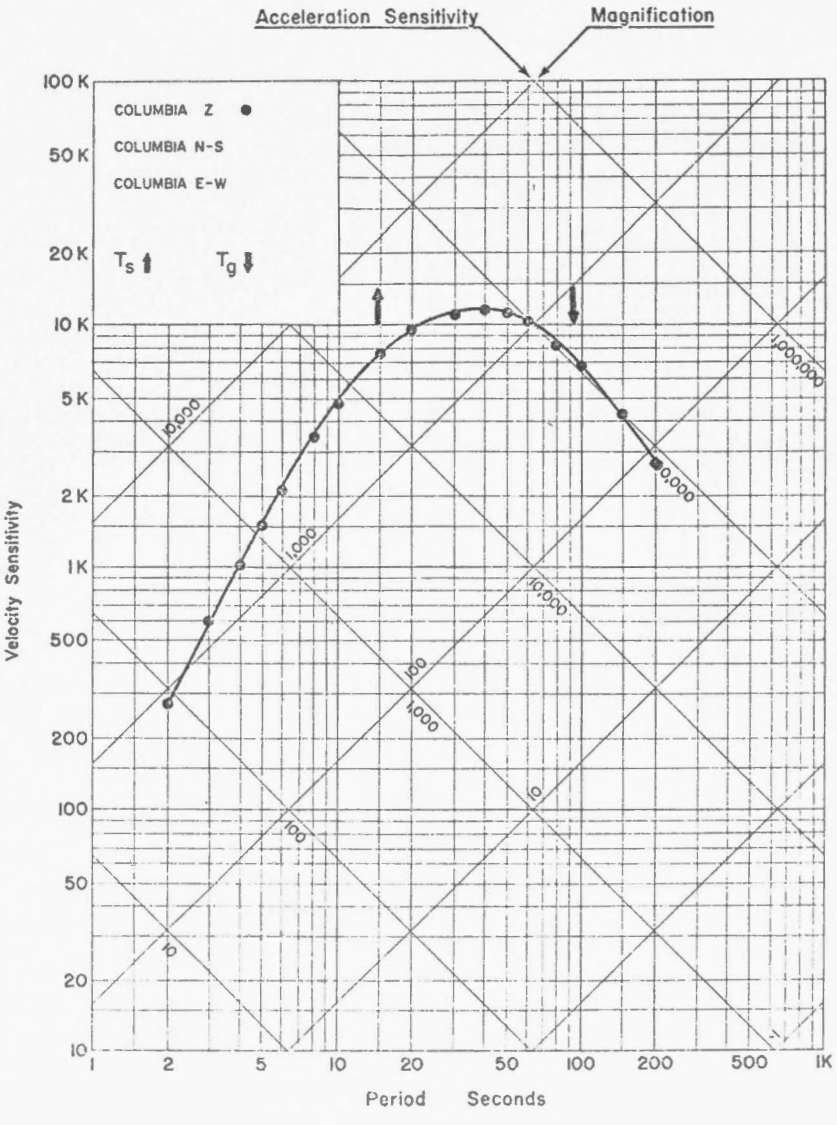
WILLMORE N-S

WILLMORE E-W May 3, 1973

STATION: RESOLUTE, N.W.T. (RES)
(As found)

ϕ= 74°41.2'N λ= 94°54.0'W Altitude 15 M

Foundation: Early Palaeozoic limestone



Dates of Calibration:

COLUMBIA Z @ May 3, 1973

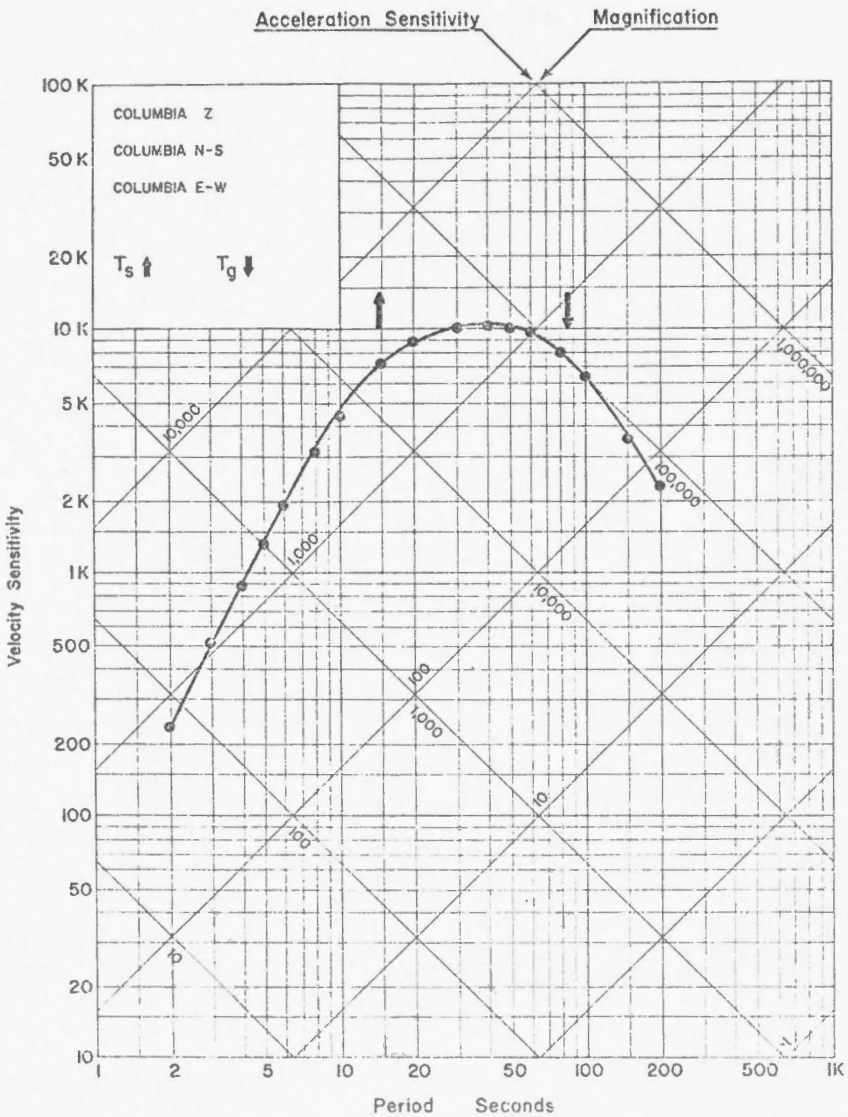
COLUMBIA N-S

COLUMBIA E-W

STATION: RESOLUTE, N.W.T. (RES)
(As found)

ϕ= 74°41.2'N λ= 94°54.0'W Altitude 15 M

Foundation: Early Palaeozoic limestone



Dates of Calibration:

COLUMBIA Z

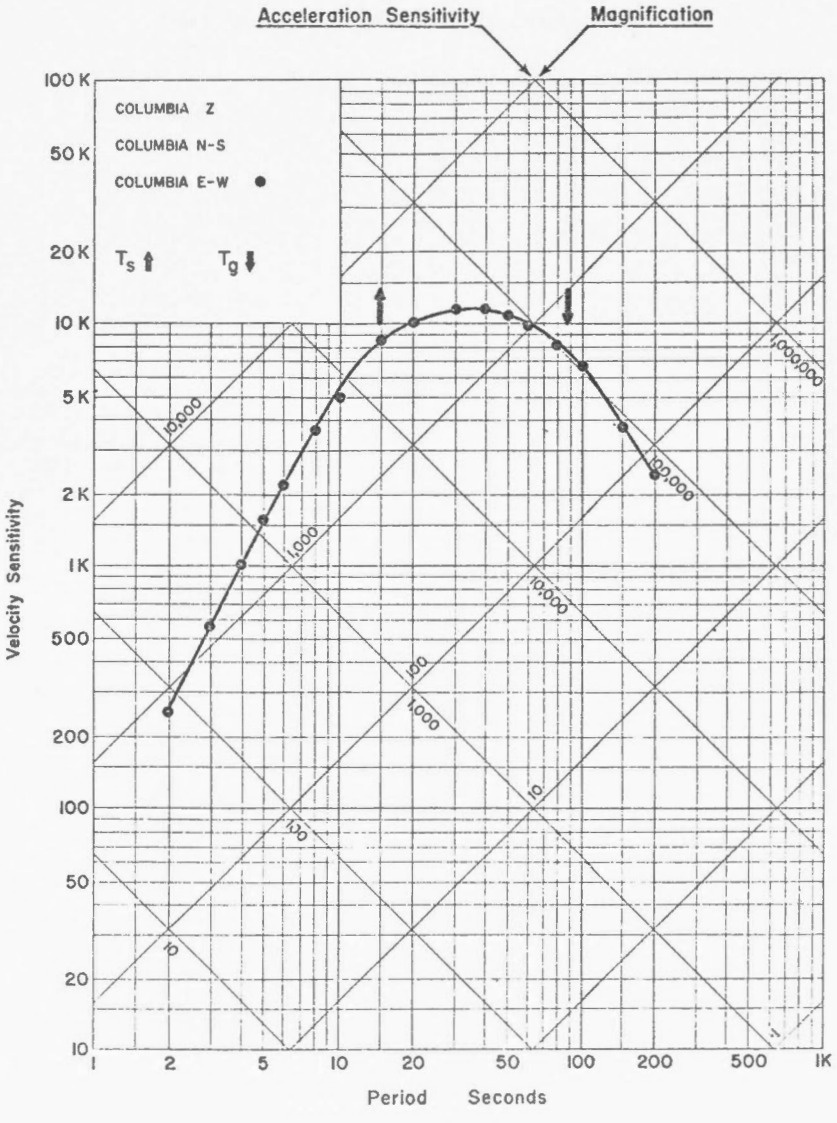
COLUMBIA N-S • May 2, 1973

COLUMBIA E-W

STATION: RESOLUTE, N.W.T. (RES)
(As found)

ϕ = 74°41.2'N λ = 94°54.0'W Altitude 15 M

Foundation: Early Palaeozoic limestone



Dates of Calibration:

COLUMBIA Z

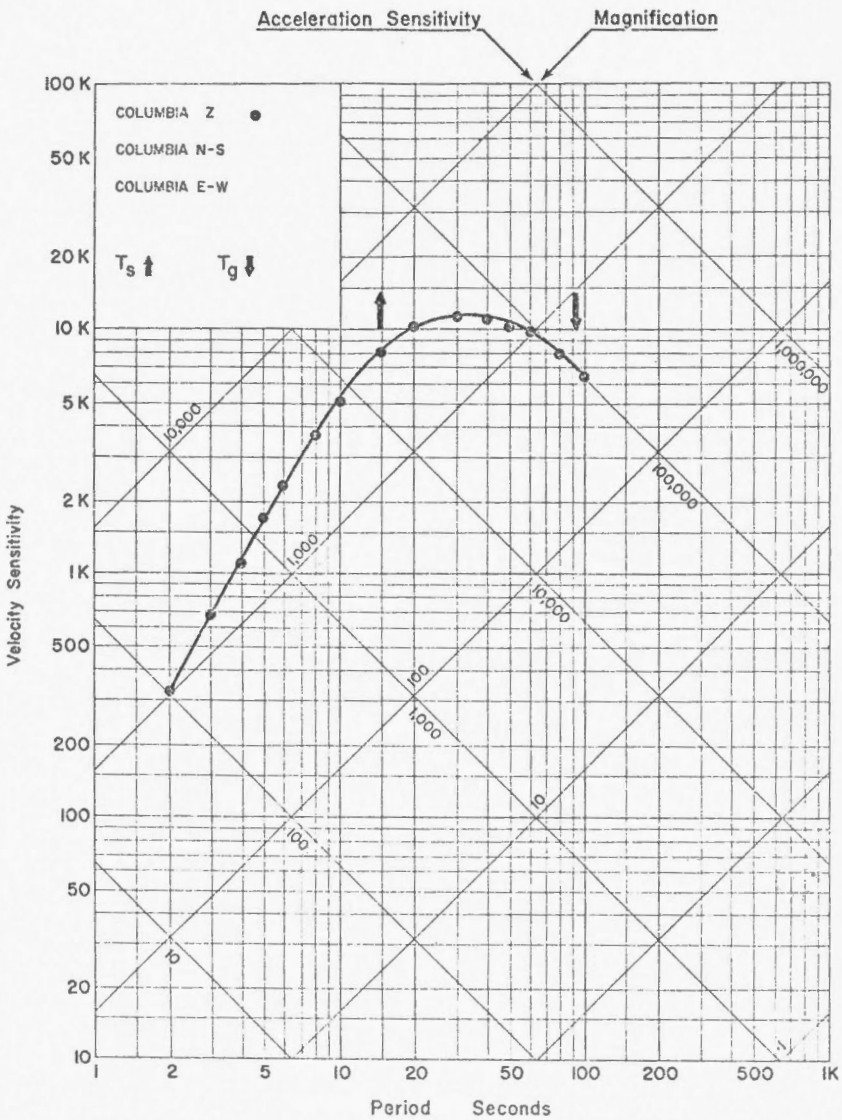
COLUMBIA N-S

COLUMBIA E-W ● May 2, 1973

STATION: RESOLUTE, N.W.T. (RES)
(Final)

ϕ= 74°41.2'N λ= 94°54.0'W Altitude 15 M

Foundation: Early Palaeozoic limestone



Dates of Calibration:

COLUMBIA Z ● May 9, 1973

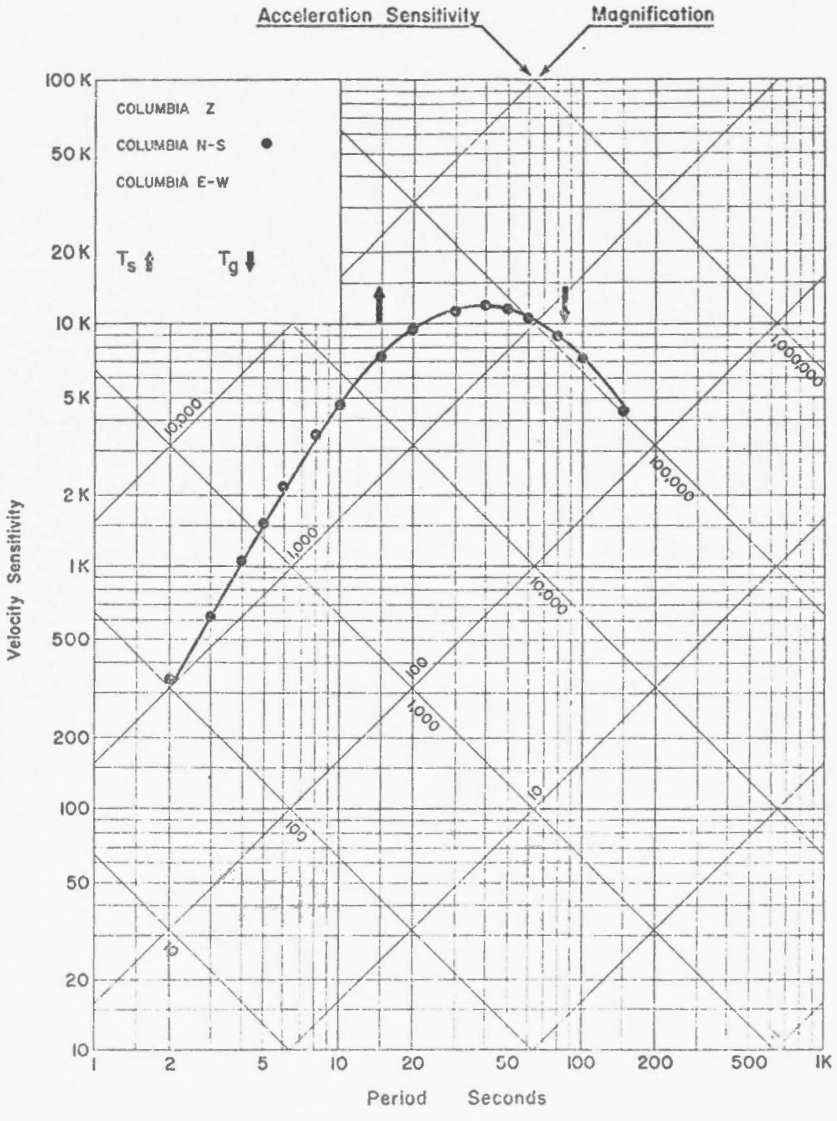
COLUMBIA N-S

COLUMBIA E-W

STATION: RESOLUTE, N.W.T. (RES)
(Final)

ϕ= 74°41.2'N λ= 94°54.0'W Altitude 15 M

Foundation: Early Palaeozoic limestone



Dates of Calibration:

COLUMBIA Z

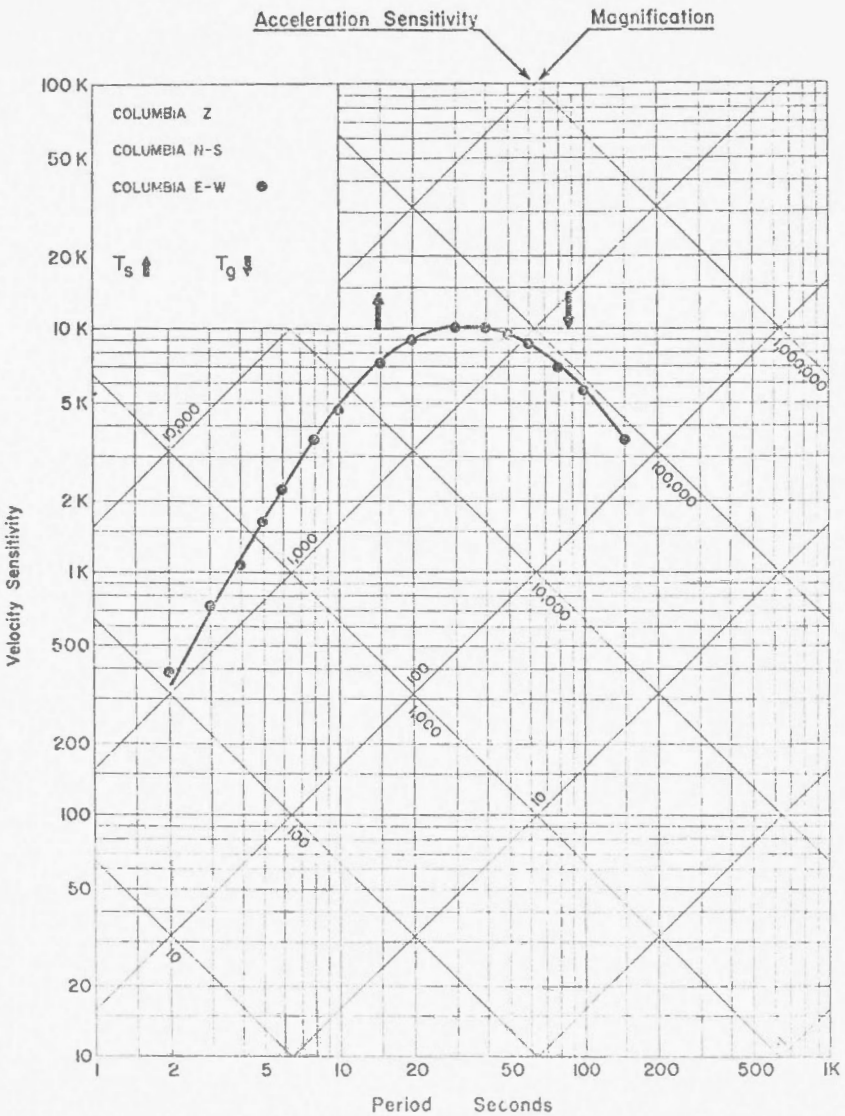
COLUMBIA N-S © May 10, 1973

COLUMBIA E-W

STATION: RESOLUTE, N.W.T. (RES)
(Final)

ϕ= 74°41.2'N λ= 94°54.0'W Altitude 15 M

Foundation: Early Palaeozoic limestone



Dates of Calibration:

COLUMBIA Z

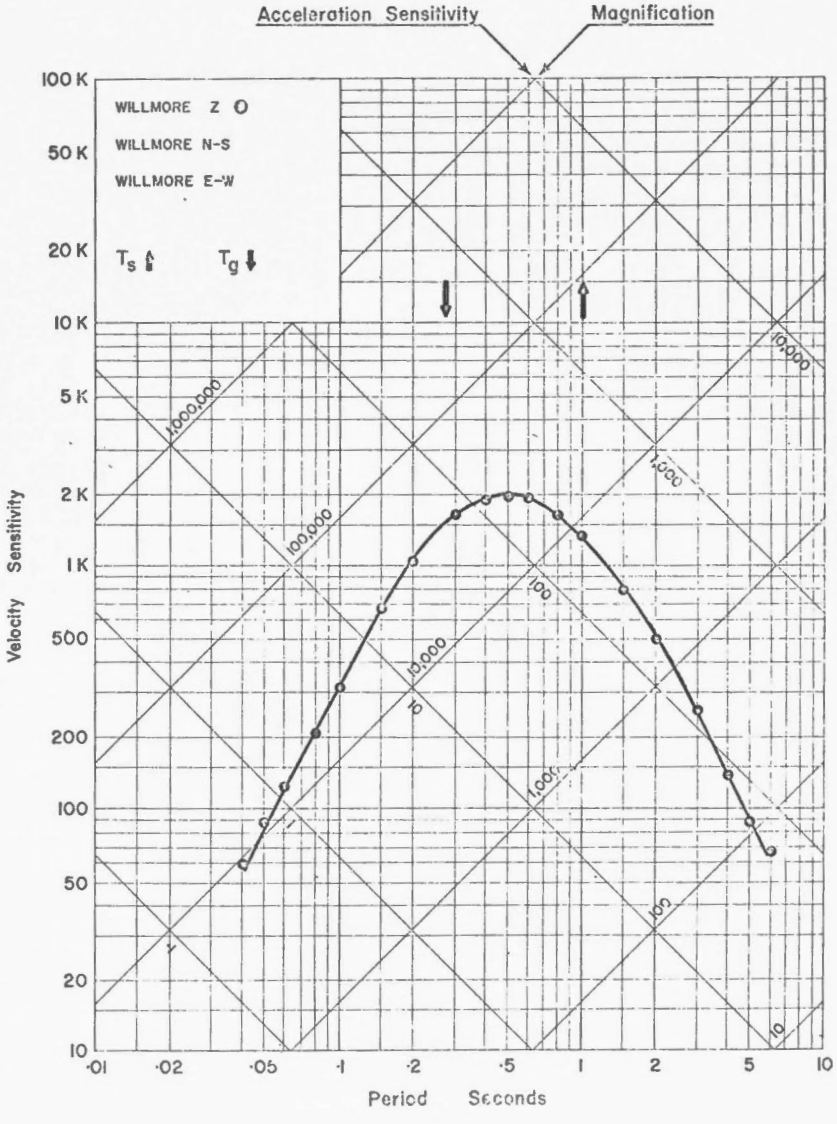
COLUMBIA N-S

COLUMBIA E-W May 10, 1973

STATION: ST. JOHN'S, NFLD. (STJ)

ϕ= 47°34.3'N λ=52°44.0'W Altitude 62 M

Foundation: Precambrian: Siliceous Mudstone



Dates of Calibration:

WILLMORE Z O Feb. 1, 1968 (Gain lowered to half of the 1967 calibrated value)

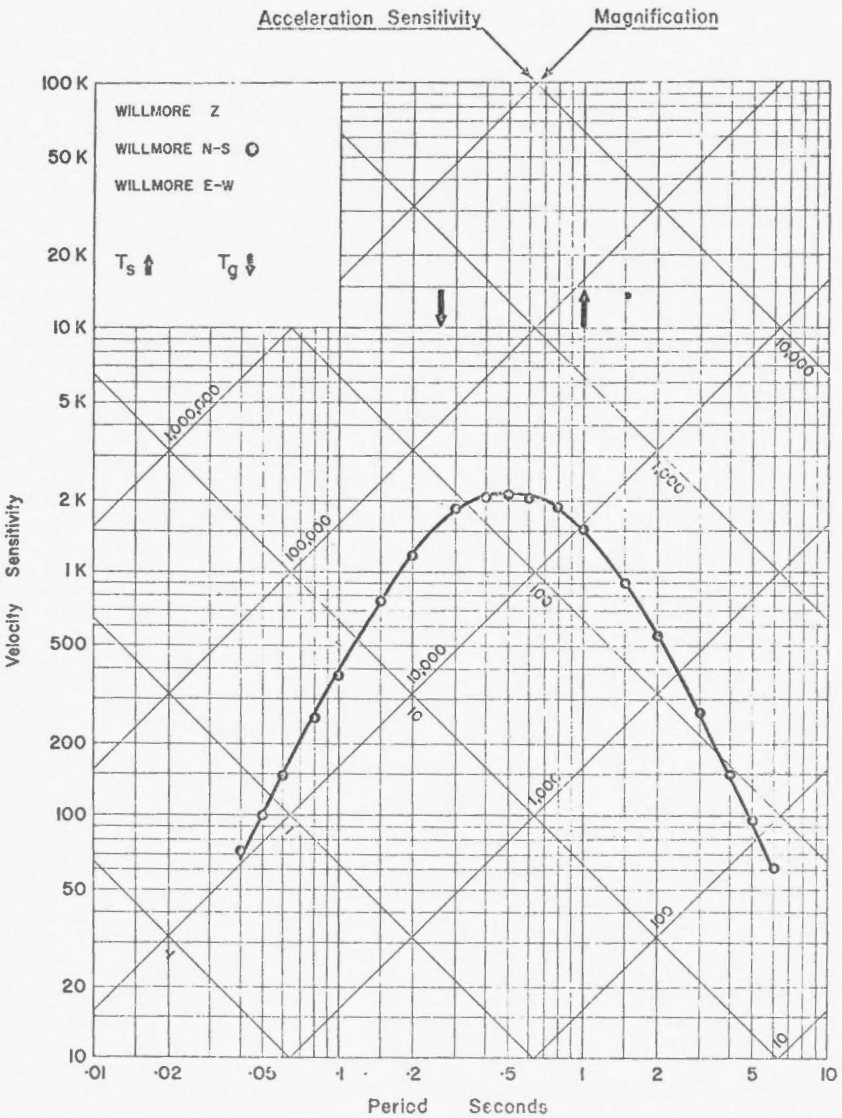
WILLMORE N-S

WILLMORE E-W

STATION: ST. JOHN'S, NFLD. (STJ)

$\phi = 47^{o}34.3'N$ $\lambda = 52^{o}44.0'W$ Altitude 62 M

Foundation: Precambrian: Siliceous Mudstone



Dates of Calibration:

WILLMORE Z

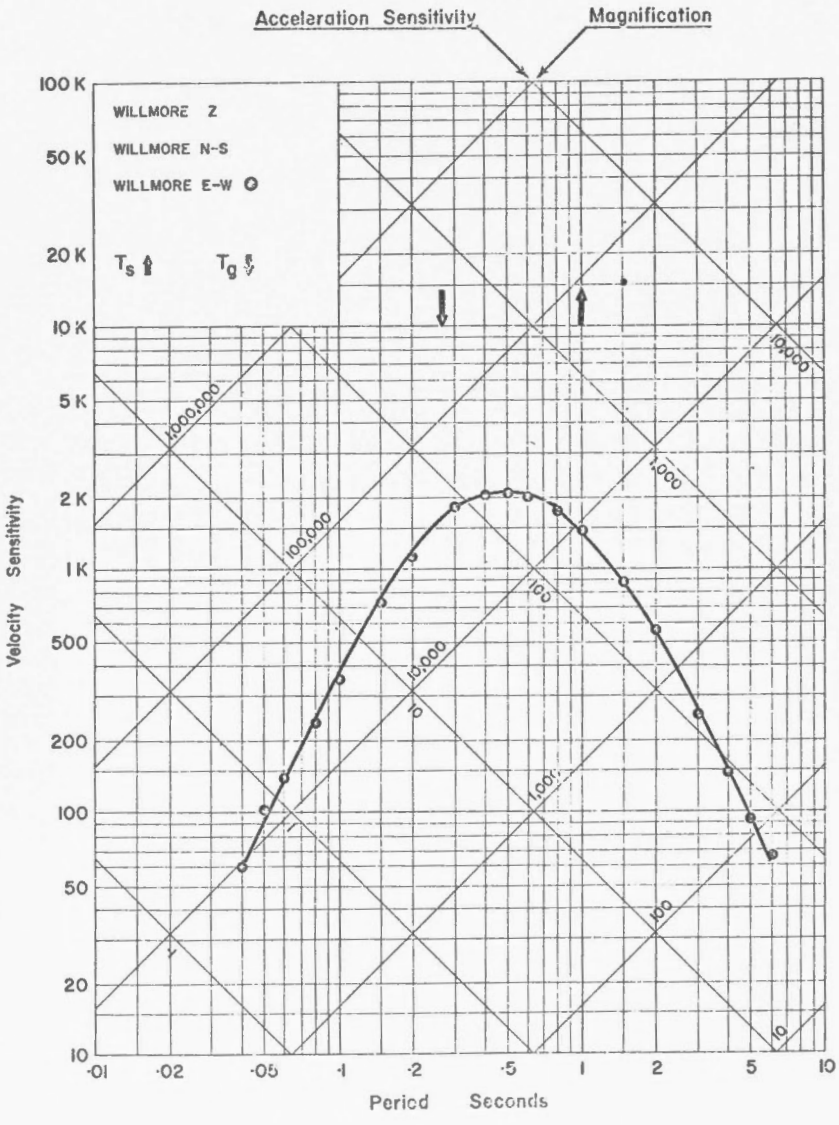
WILLMORE N-S O Feb. 1, 1968 (Gain lowered to half of the 1967 calibrated value)

WILLMORE E-W

STATION: ST. JOHN'S, NFLD. (STJ)

ϕ= 47°34.3'N λ= 52°44.0'W Altitude 62 M

Foundation: Precambrian: Siliceous Mudstone



Dates of Calibration:

WILLMORE Z

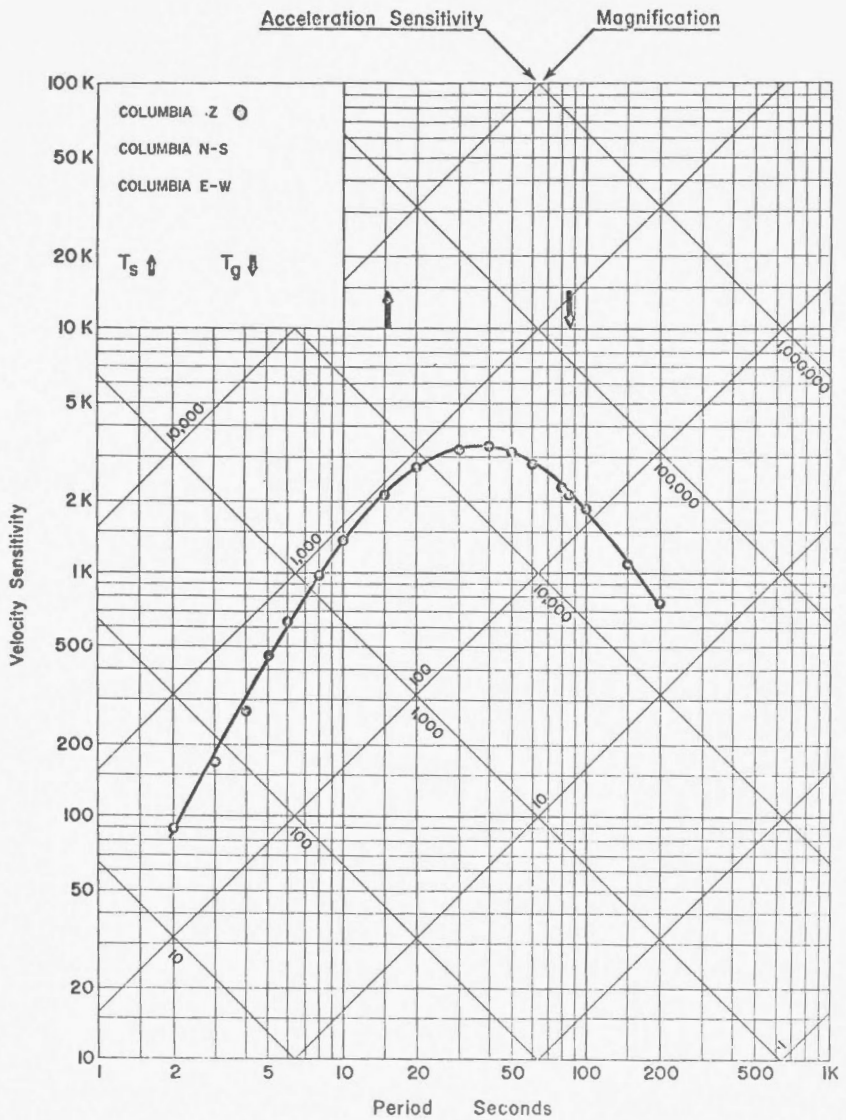
WILLMORE N-S

WILLMORE E-W O Feb. 1, 1968 (Gain lowered to half of the 1967 calibrated value)

STATION: ST. JOHN'S, NFLD. (STJ)

$\phi = 47^{o}34.3'N$ $\lambda = 52^{o}44.0'W$ Altitude 62 M

Foundation: Precambrian: Siliceous Mudstone



Dates of Calibration:

COLUMBIA Z O Feb. 1, 1968 (Gain lowered to half of the 1967 calibrated value)

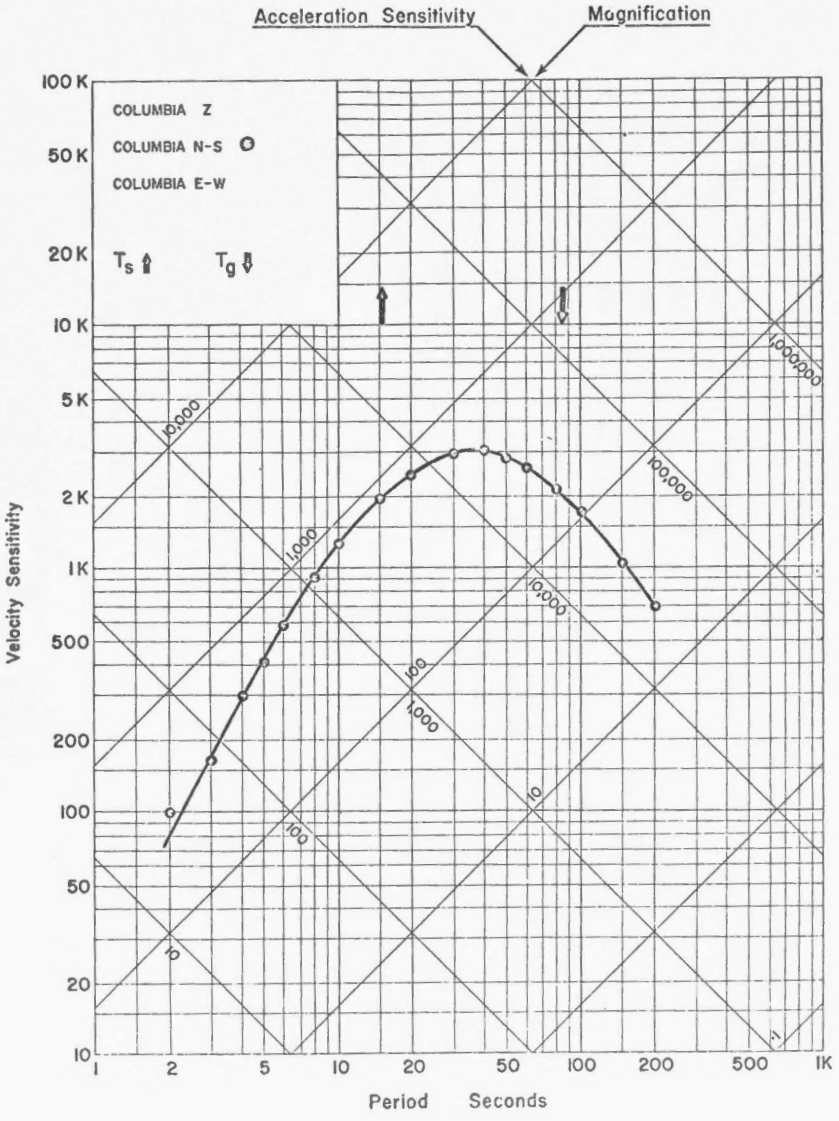
COLUMBIA N-S

COLUMBIA E-W

STATION: ST. JOHN'S, NFLD. (STJ)

ϕ = 47°34.3'N λ = 52°44.0'W Altitude 62 M

Foundation: Precambrian: Siliceous Mudstone



Dates of Calibration:

COLUMBIA Z

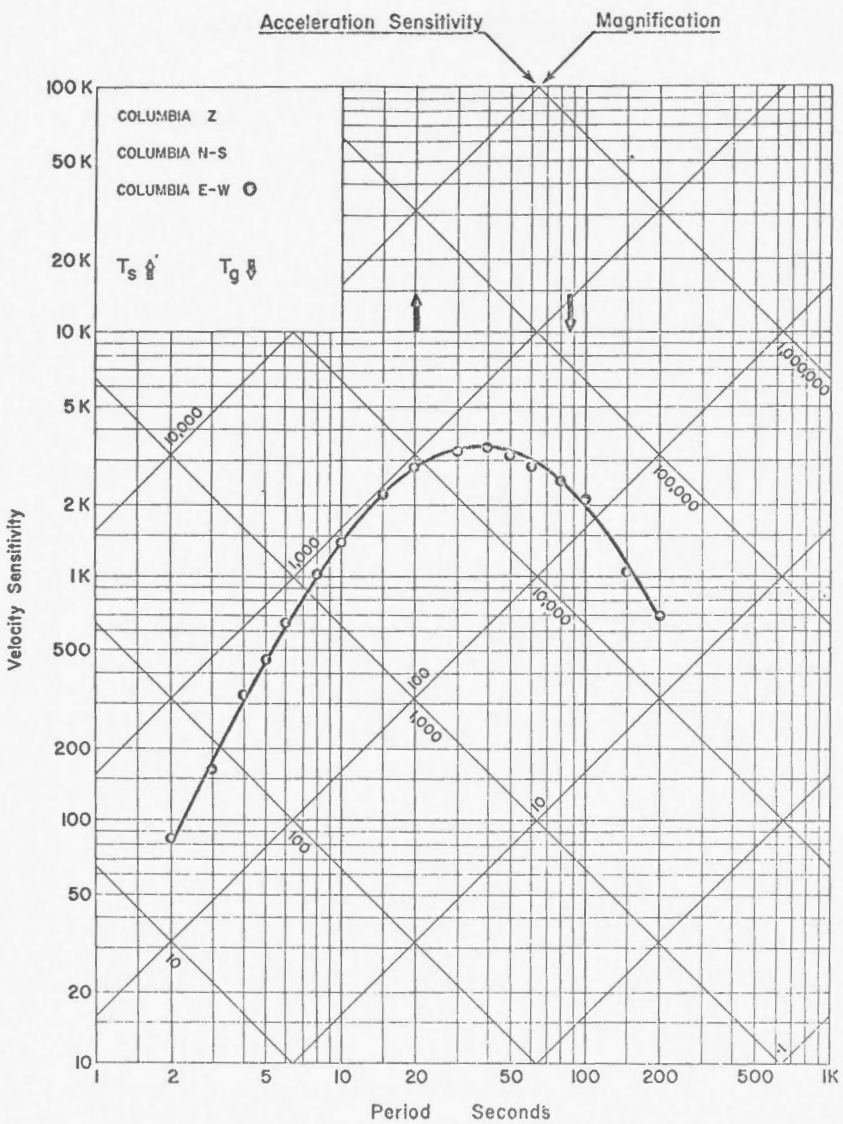
COLUMBIA N-S O Feb. 1, 1968 (Gain lowered to half of the 1967 calibrated value)

COLUMBIA E-W

STATION: ST. JOHN'S, NFLD. (STJ)

ϕ= 47°34.3'N λ= 52°44.0'W Altitude 62 M

Foundation: Precambrian: Siliceous Mudstone



Dates of Calibration:

COLUMBIA Z

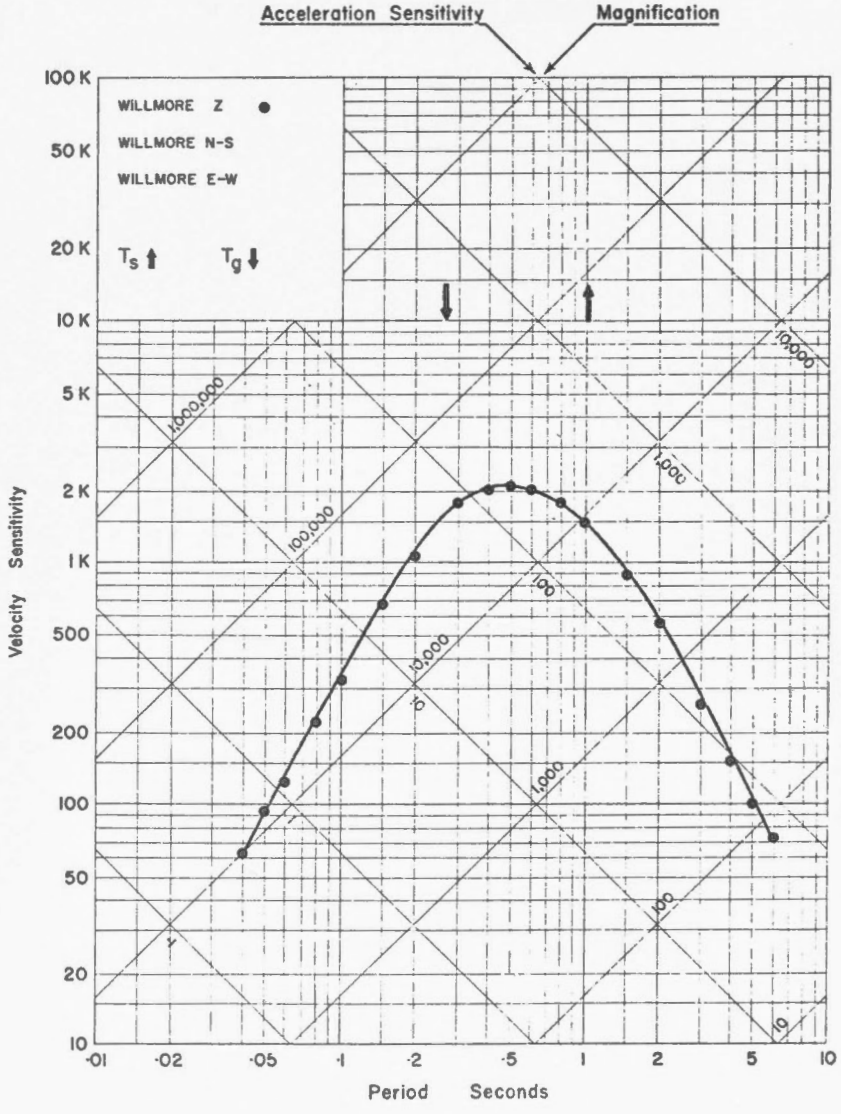
COLUMBIA N-S

COLUMBIA E-W ○ Feb. 1, 1968 (Gain lowered to half of the 1967 calibrated value)

STATION: ST. JOHN'S, NFLD. (STJ)

ϕ= 47°34.3'N λ= 52°44.0'W Altitude 62 M

Foundation: Precambrian: Siliceous Mudstone



Dates of Calibration:

WILLMORE Z ● Aug. 14, 1973

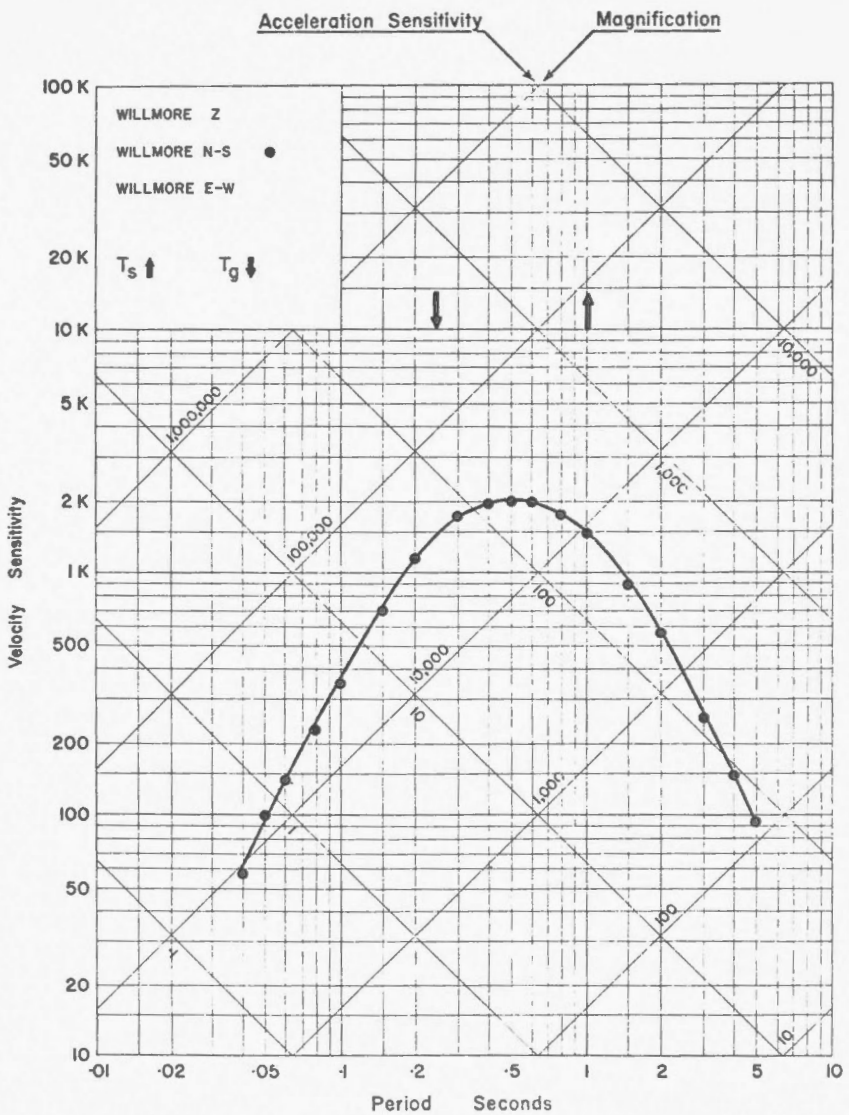
WILLMORE N-S

WILLMORE E-W

STATION: ST. JOHN'S, NFLD. (STJ)

ϕ= 47°34.3'N λ= 52°44.0'W Altitude 62 M

Foundation: Precambrian: Siliceous Mudstone



Dates of Calibration:

WILLMORE Z

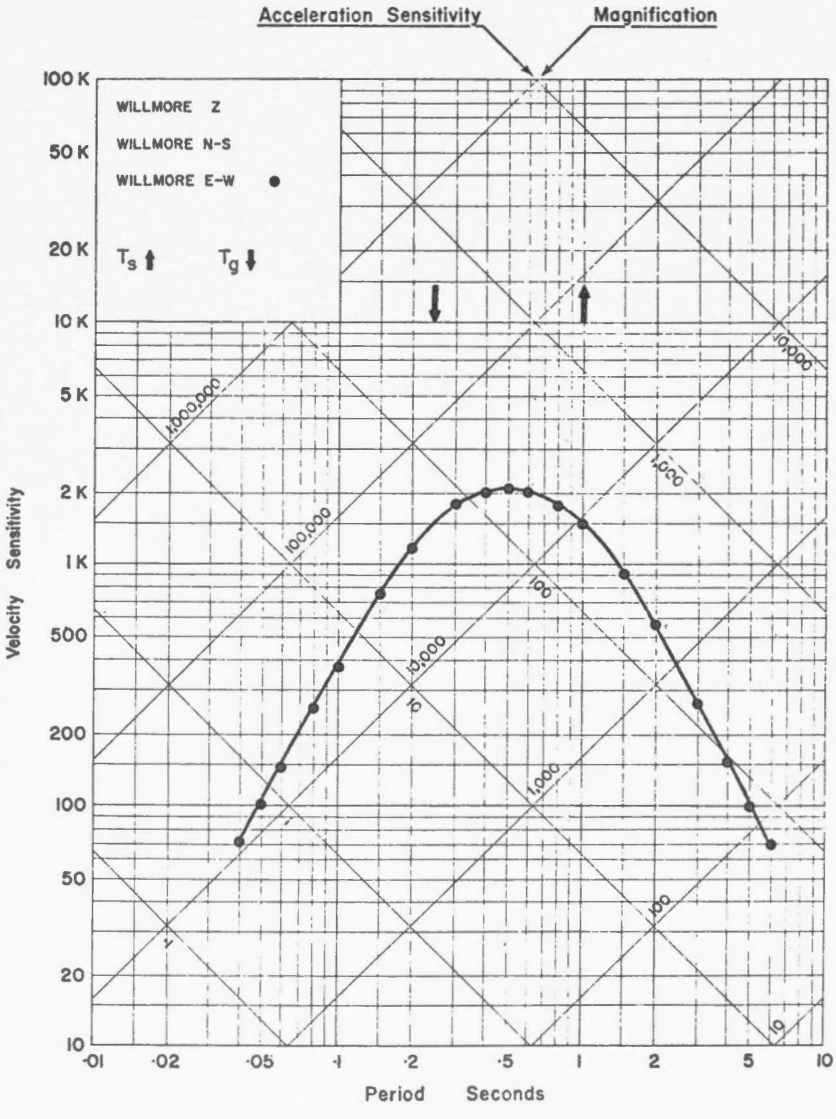
WILLMORE N-S ● Aug. 14, 1973

WILLMORE E-W

STATION: ST. JOHN'S, NFLD. (STJ)

ϕ= 47°34.3'N λ= 52°44.0'W Altitude 62 M

Foundation: Precambrian: Siliceous Mudstone



Dates of Calibration:

WILLMORE Z

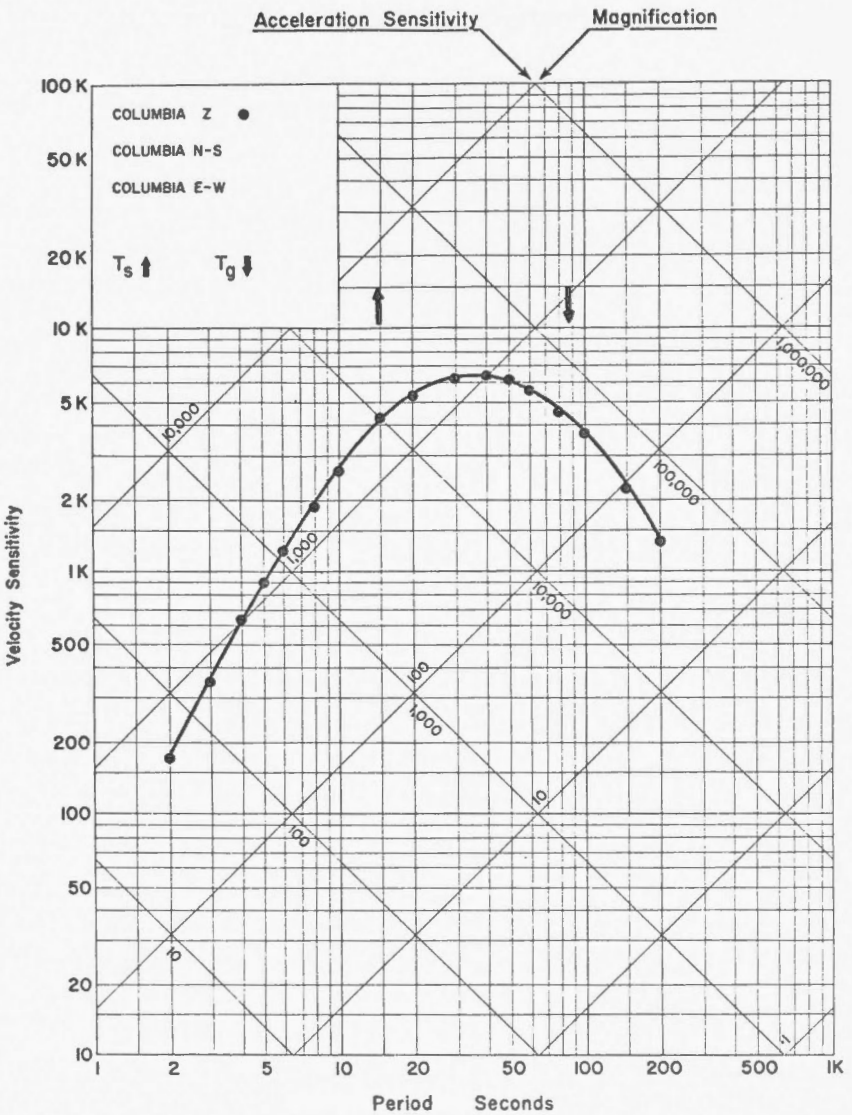
WILLMORE N-S

WILLMORE E-W • Aug. 15, 1973

STATION: ST. JOHN'S, NFLD. (STJ)

ϕ= 47°34.3'N λ= 52°44.0'W Altitude 62 M

Foundation: Precambrian: Siliceous Mudstone



Dates of Calibration:

COLUMBIA Z • Aug. 17, 1973

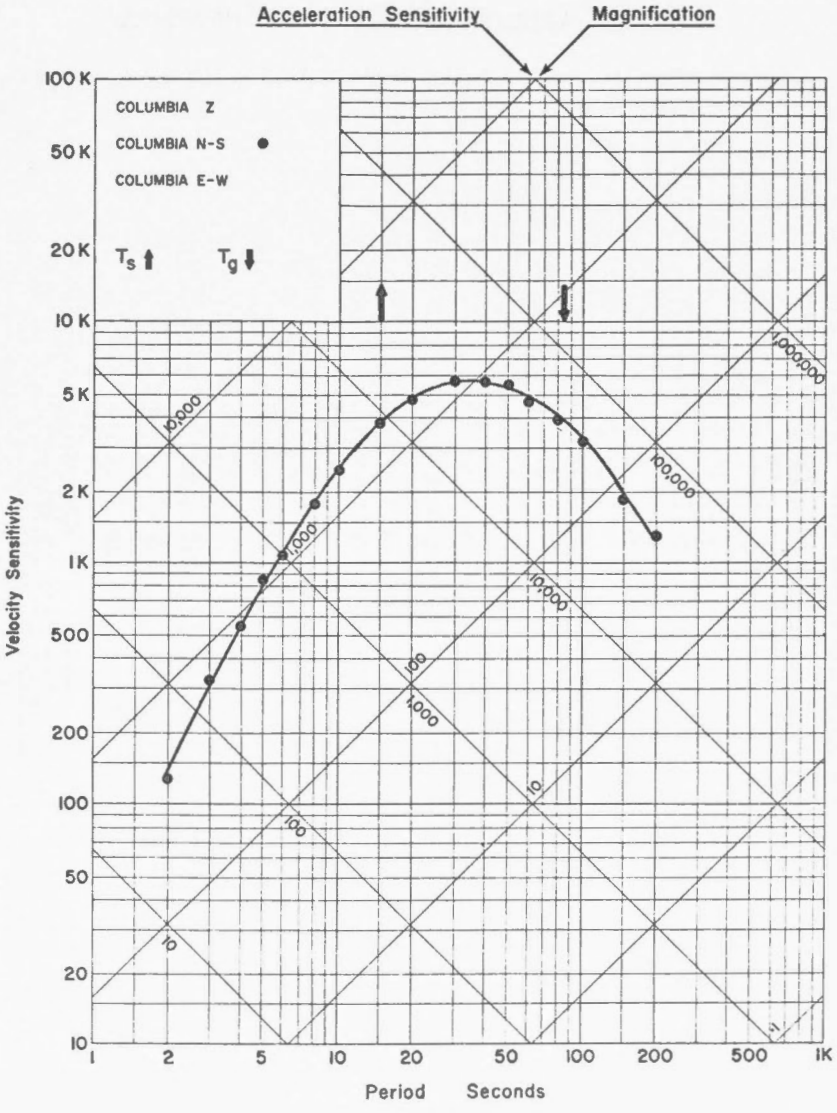
COLUMBIA N-S

COLUMBIA E-W

STATION: ST. JOHN'S, NFLD. (STJ)

ϕ= 47°34.3'N λ= 52°44.0'W Altitude 62 M

Foundation: Precambrian: Siliceous Mudstone



Dates of Calibration:

COLUMBIA Z

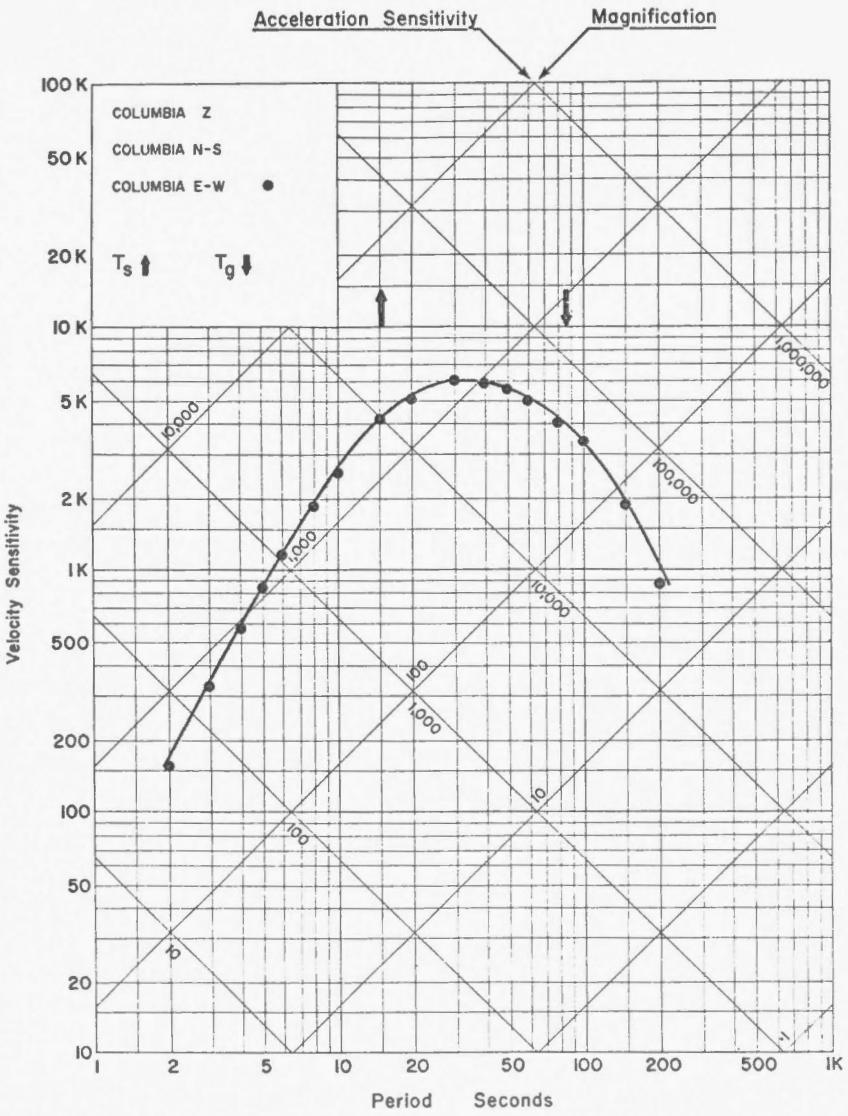
COLUMBIA N-S ● Aug. 17, 1973

COLUMBIA E-W

STATION: ST. JOHN'S, NFLD. (STJ)

ϕ= 47°34.3'N λ= 52°44.0'W Altitude 62 M

Foundation: Precambrian: Siliceous Mudstone



Dates of Calibration:

COLUMBIA Z

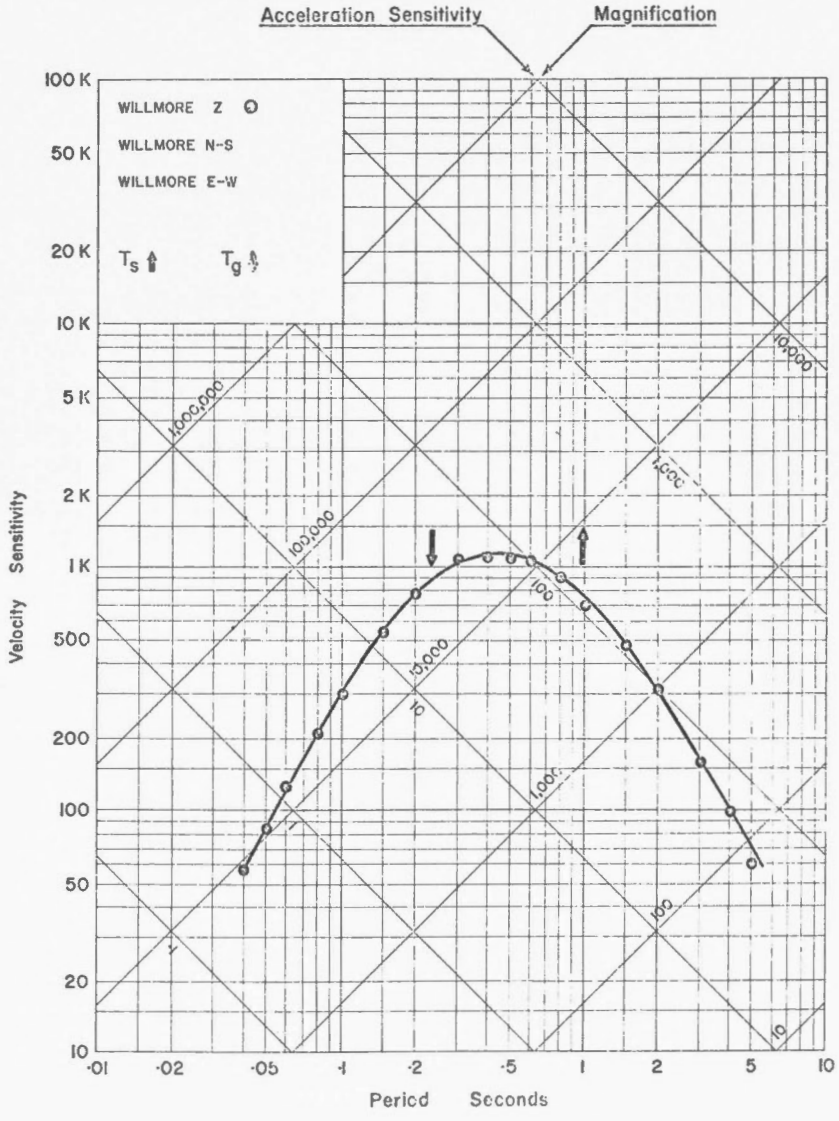
COLUMBIA N-S

COLUMBIA E-W • Aug. 18, 1973

STATION: SCARBOROUGH, ONT. (SCB)

ϕ= 43°43'N λ= 79°14'W Altitude 153M

Foundation: Glacial Till interlayered with river deposited sand



Dates of Calibration:

WILLMORE Z June 23 - 1969

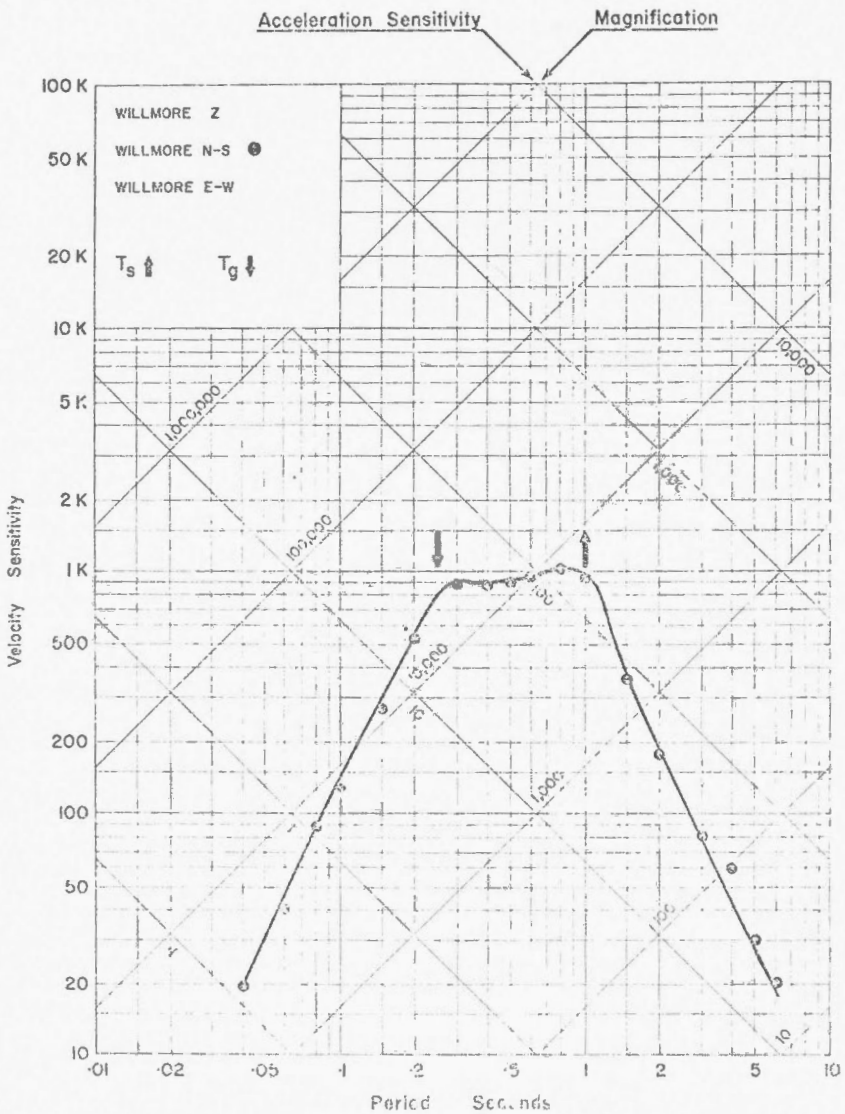
WILLMORE N-S

WILLMORE E-W

STATION: SCARBOROUGH, ONT. (SCB)

ϕ= 43°43'N λ= 79°14'W Altitude 153M

Foundation: Glacial Till interlayered with river deposited sand.



Dates of Calibration:

WILLMORE Z

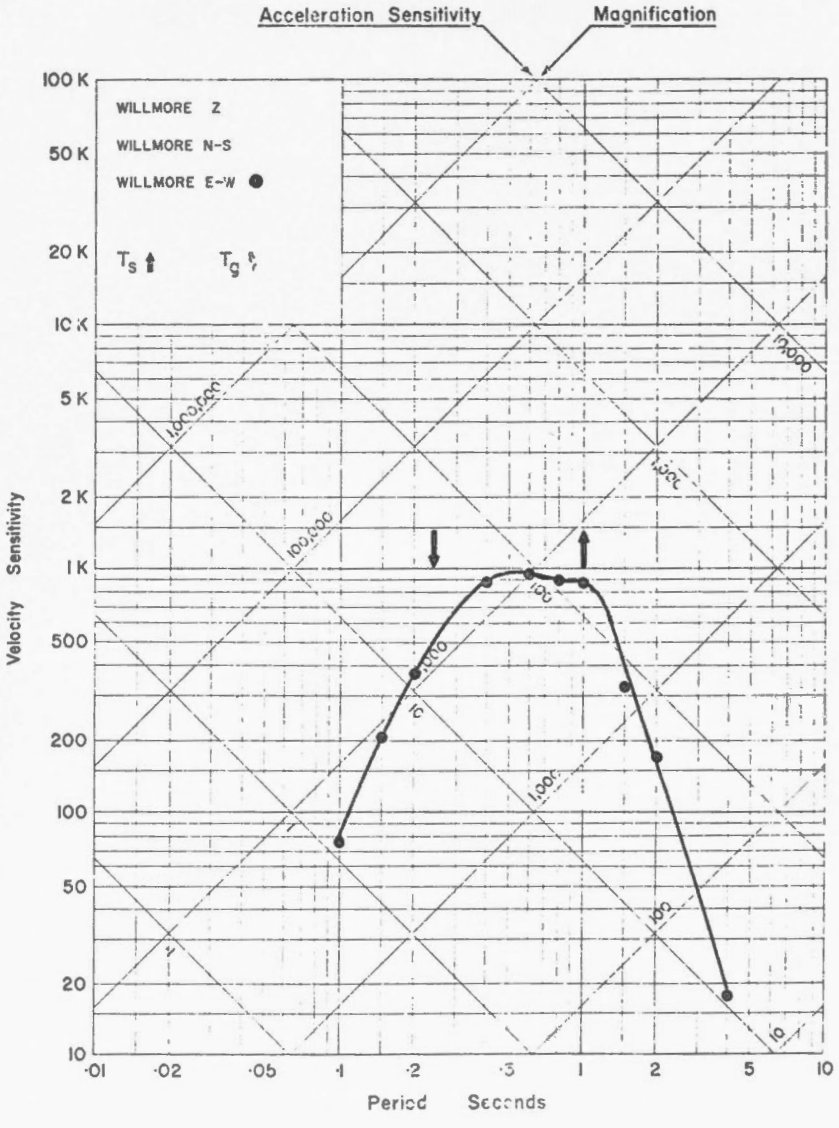
WILLMORE N-S @ June 23 - 1969

WILLMORE E-W

STATION: SCARBOROUGH, ONT. (SCB)

ϕ= 43°43'N λ= 79°14'W Altitude 153M

Foundation: Glacial Till interlayered with river deposited sand



Dates of Calibration:

WILLMORE Z

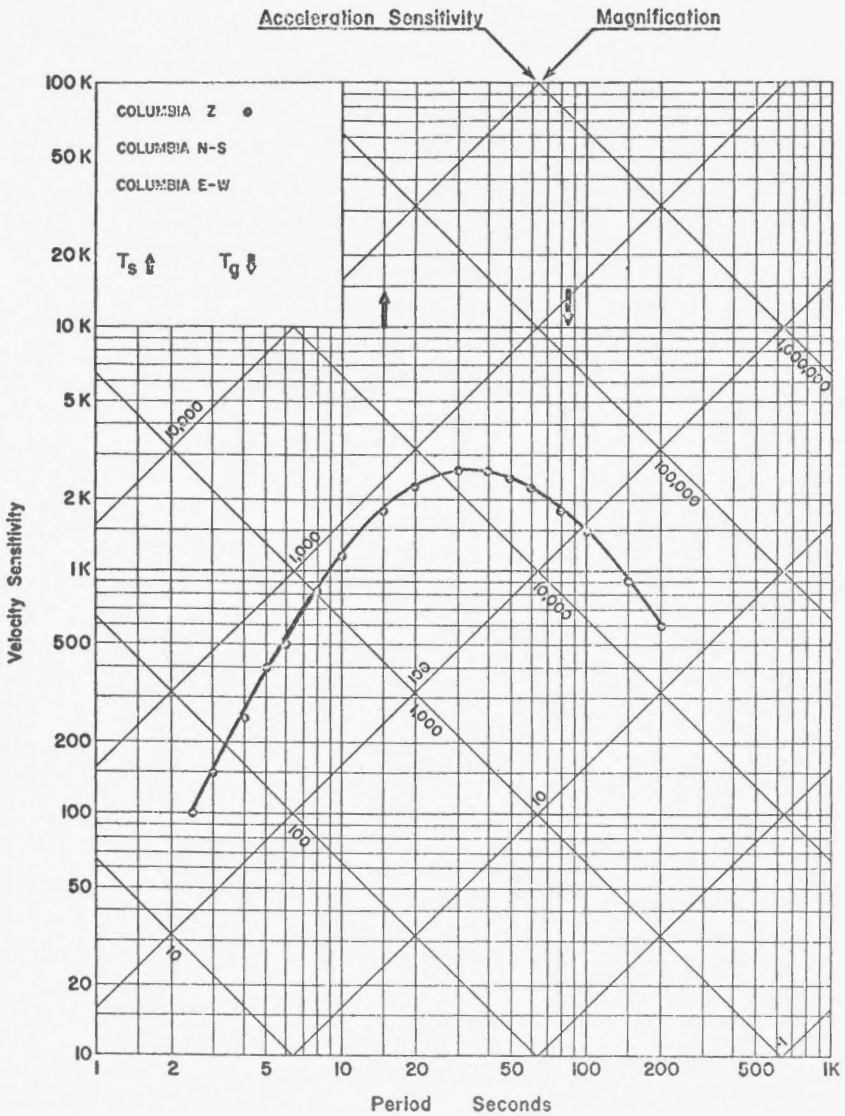
WILLMORE N-S

WILLMORE E-W ● June 23 - 1969

STATION: SCARBOROUGH, ONT. (SCB)

ϕ= 43°43'N λ= 79°14'W Altitude 153M

Foundation: Glacial Till interlayered with river deposited sand.



Dates of Calibration:

COLUMBIA Z • Jan. 18, 1968

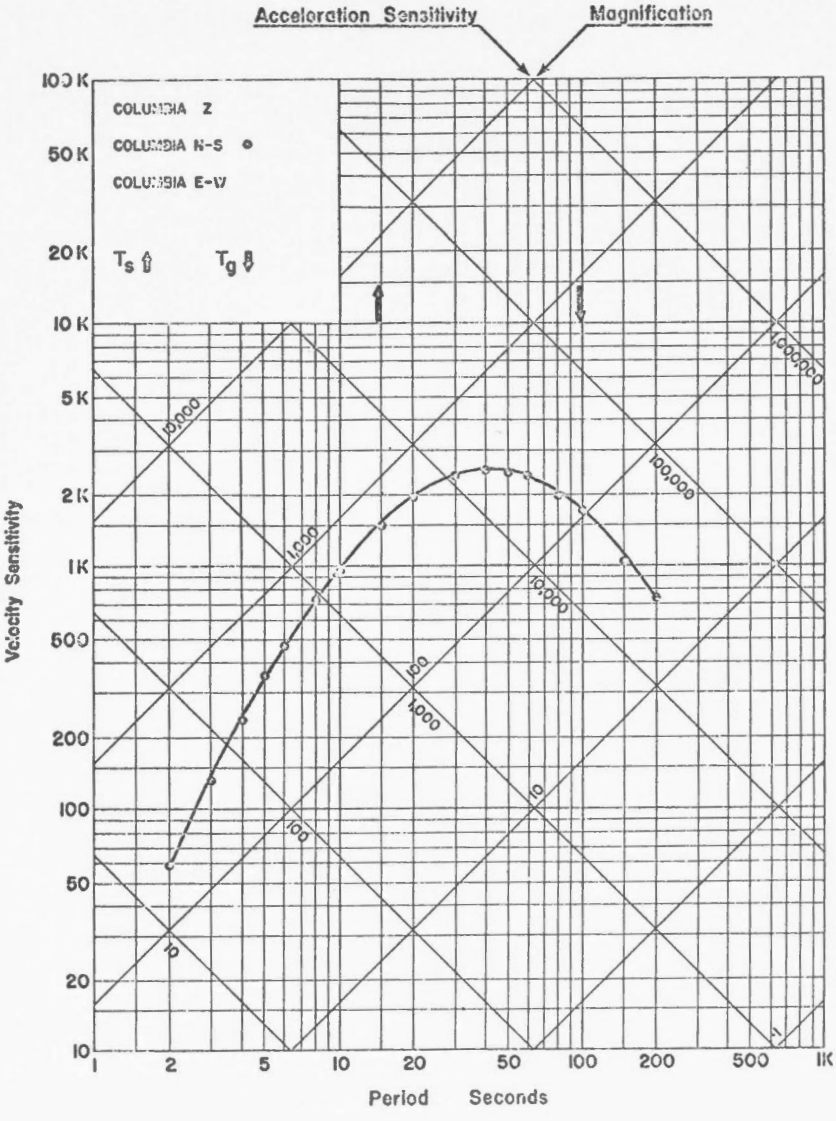
COLUMBIA N-S

COLUMBIA E-W

STATION: SCARBOROUGH, ONT. (SCB)

ϕ= 43°43'N λ= 79°14'W Altitude 153M

Foundation: Glacial Till interlayered with river deposited sand.



Dates of Calibration:

COLUMBIA Z

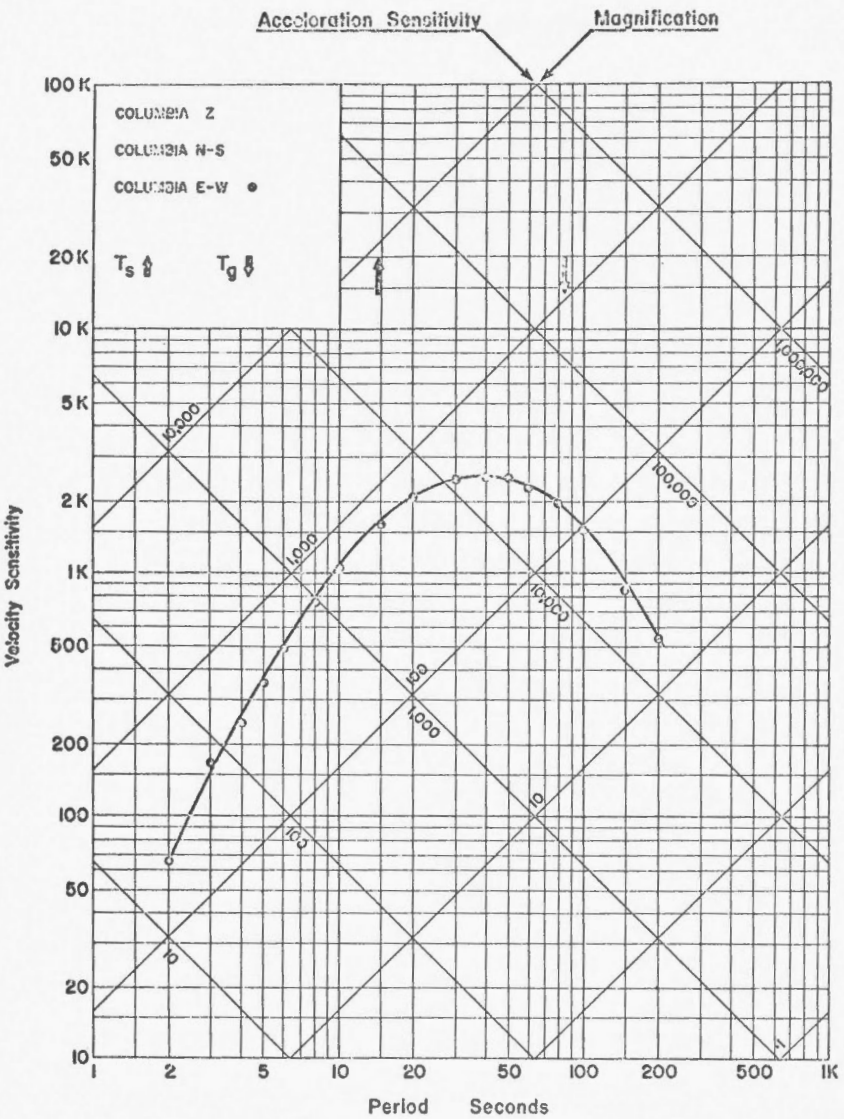
COLUMBIA N-S • Jan. 19, 1968

COLUMBIA E-W

STATION: SCARBOROUGH, ONT. (SCB)

ϕ= $43^{o}43'N$ λ= $79^{o}14'W$ Altitude 153M

Foundation: Glacial Till interlayered with river deposited sand.



Dates of Calibration:

COLUMBIA Z

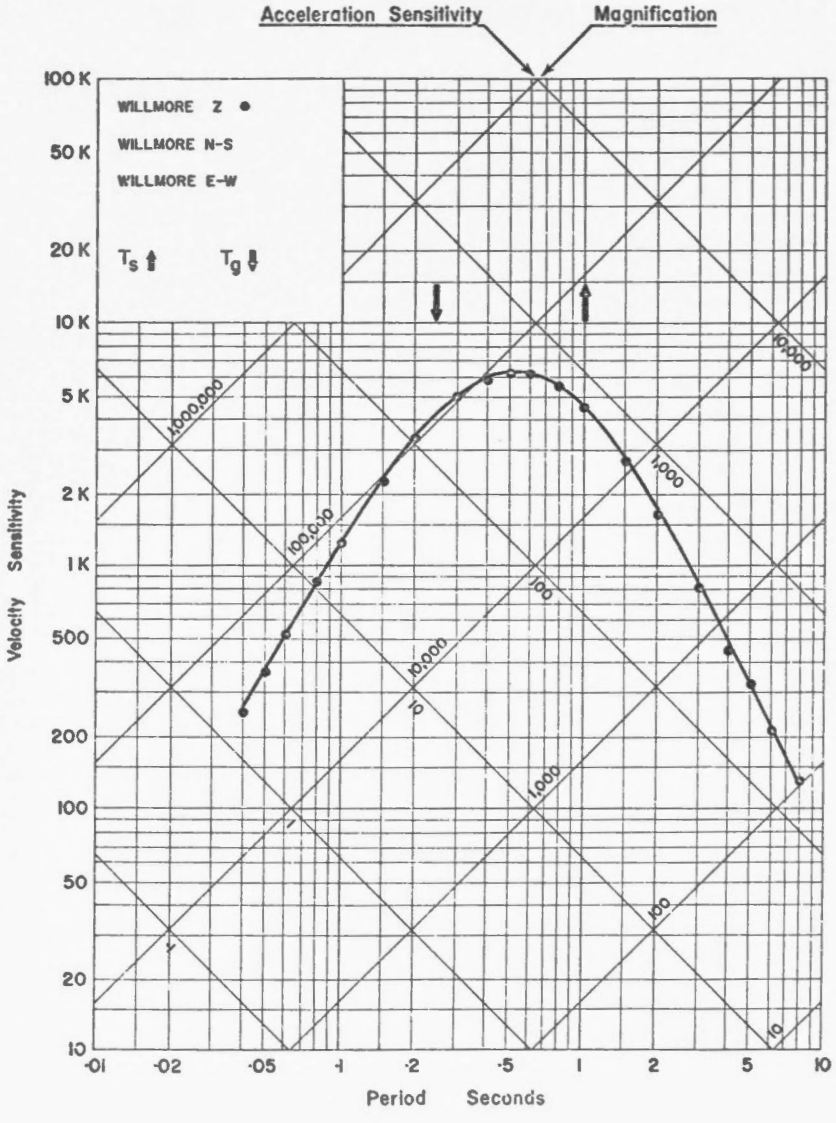
COLUMBIA N-S

COLUMBIA E-W o Jan. 19, 1968

STATION: SCHEFFERVILLE, QUE. (SCH)

ϕ= 54°49'N λ= 66°47'W Altitude 540M

Foundation: Competent Precambrian slate-shale



Dates of Calibration:

WILLMORE Z ● Dec. 8, 1968

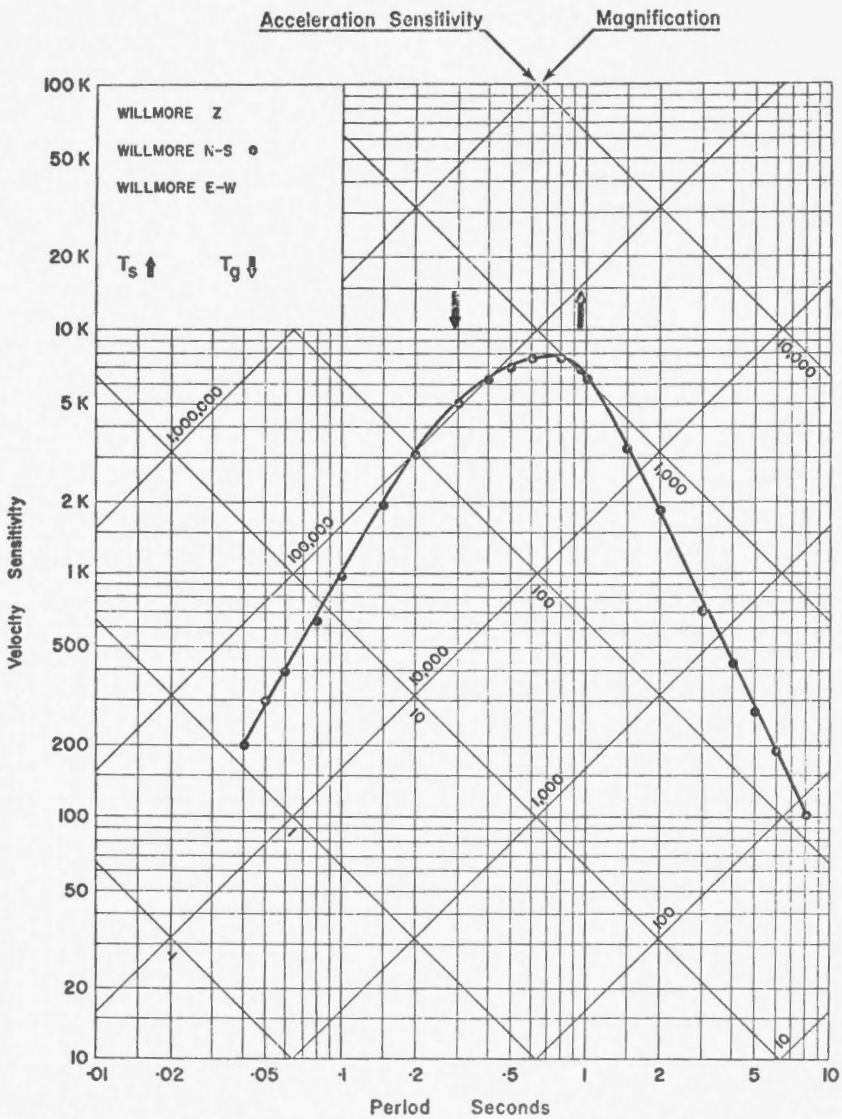
WILLMORE N-S

WILLMORE E-W

STATION: SCHEFFERVILLE, QUE. (SCH)

ϕ= 54°49'N λ= 66°47'W Altitude 540M

Foundation: Competent Precambrian slate-shale



Dates of Calibration:

WILLMORE Z

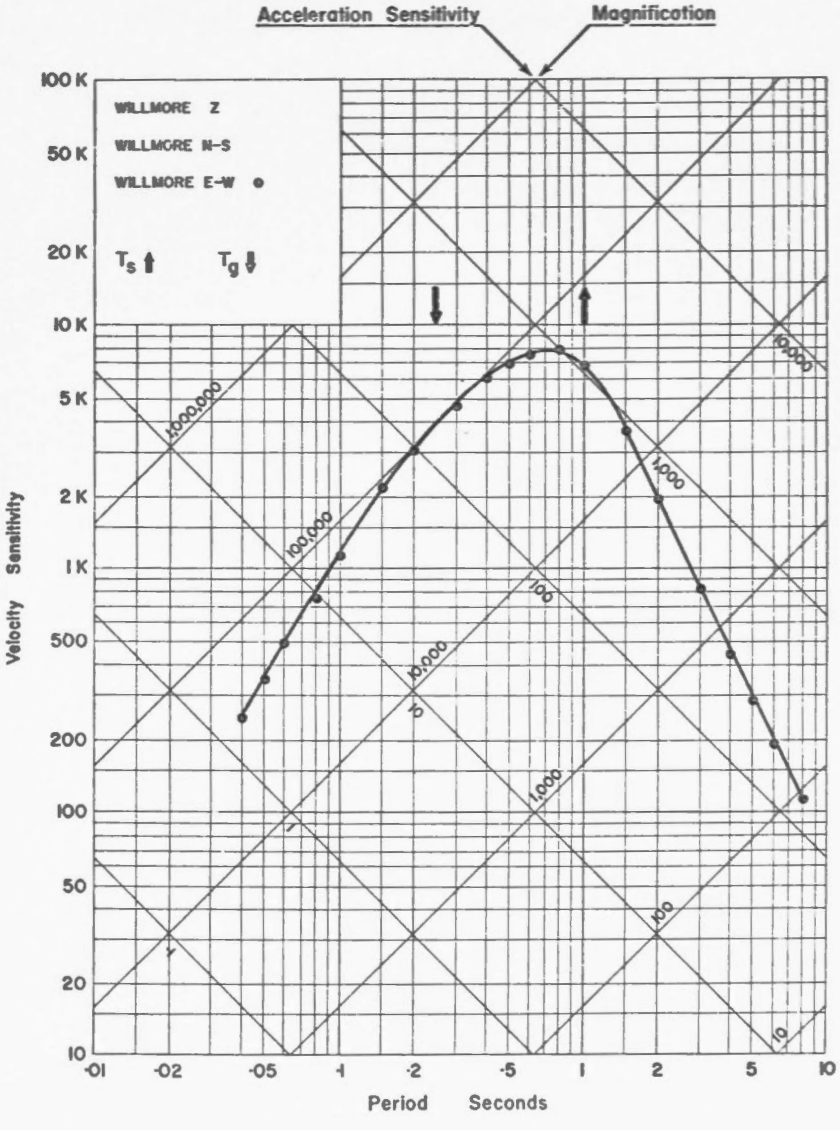
WILLMORE N-S • Feb. 14, 1969

WILLMORE E-W

STATION: SCHEFFERVILLE, QUE. (SCH)

ϕ= 54°49'N λ= 66°47'W Altitude 540M

Foundation: Competent Precambrian slate-shale



Dates of Calibration:

WILLMORE Z

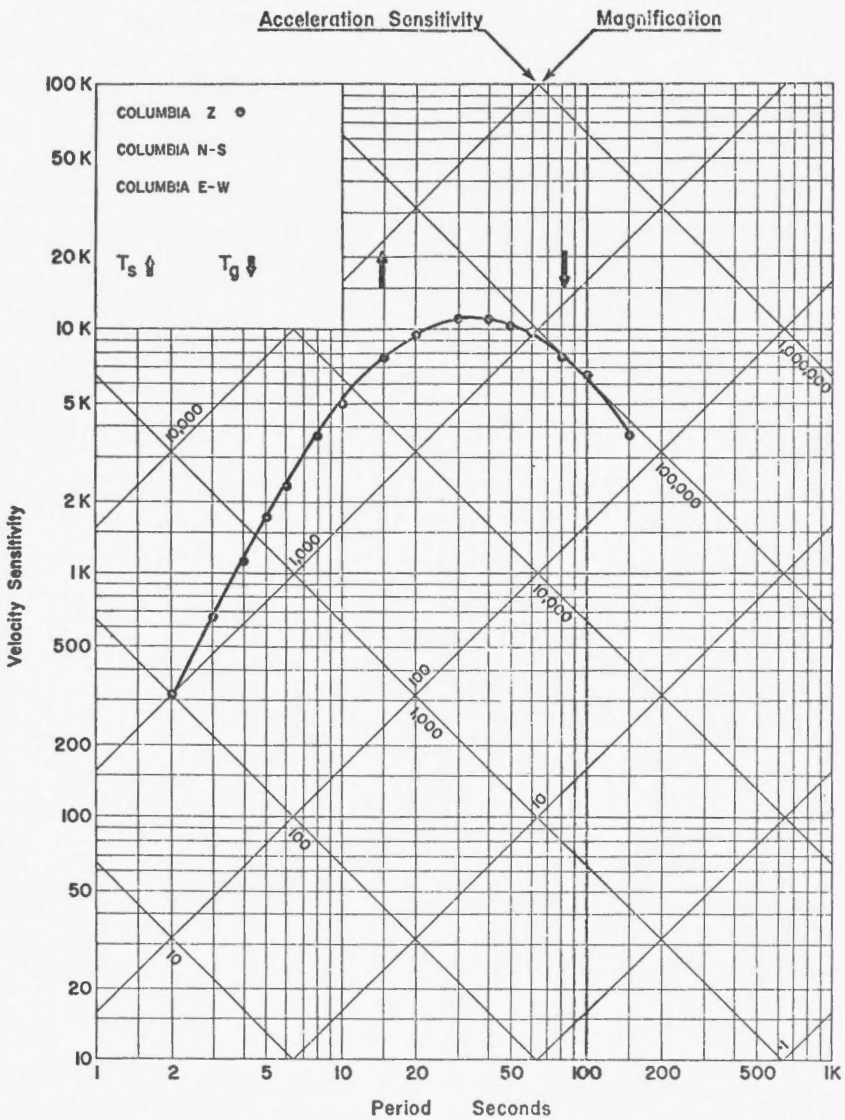
WILLMORE N-S

WILLMORE E-W • Dec. 9, 1968

STATION: SCHEFFERVILLE, QUE. (SCH)

ϕ= 54°49'N λ= 66°47'W Altitude 540M

Foundation: Competent Precambrian slate-shale



Dates of Calibration:

COLUMBIA Z • Dec. 11, 1968

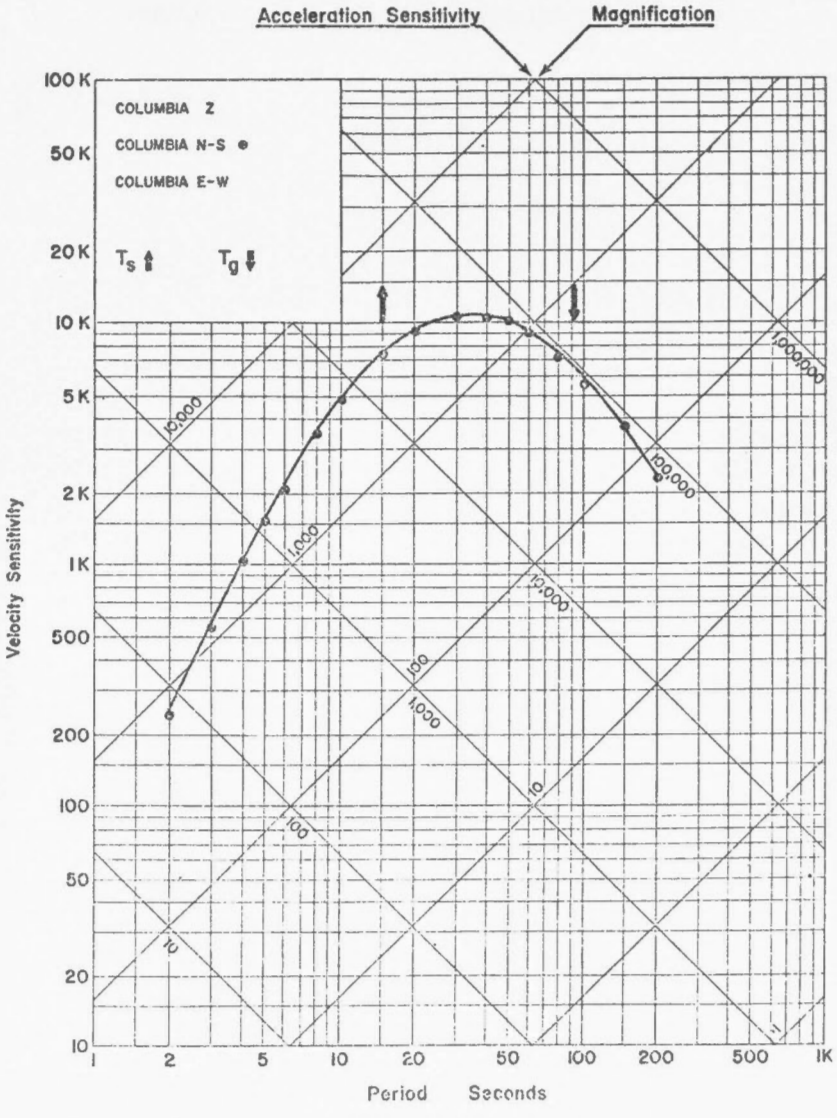
COLUMBIA N-S

COLUMBIA E-W

STATION: SCHEFFERVILLE, QUE. (SCH)

ϕ= 54°49'N λ= 66°47'W Altitude 540M

Foundation: Competent Precambrian slate-shale



Dates of Calibration:

COLUMBIA Z

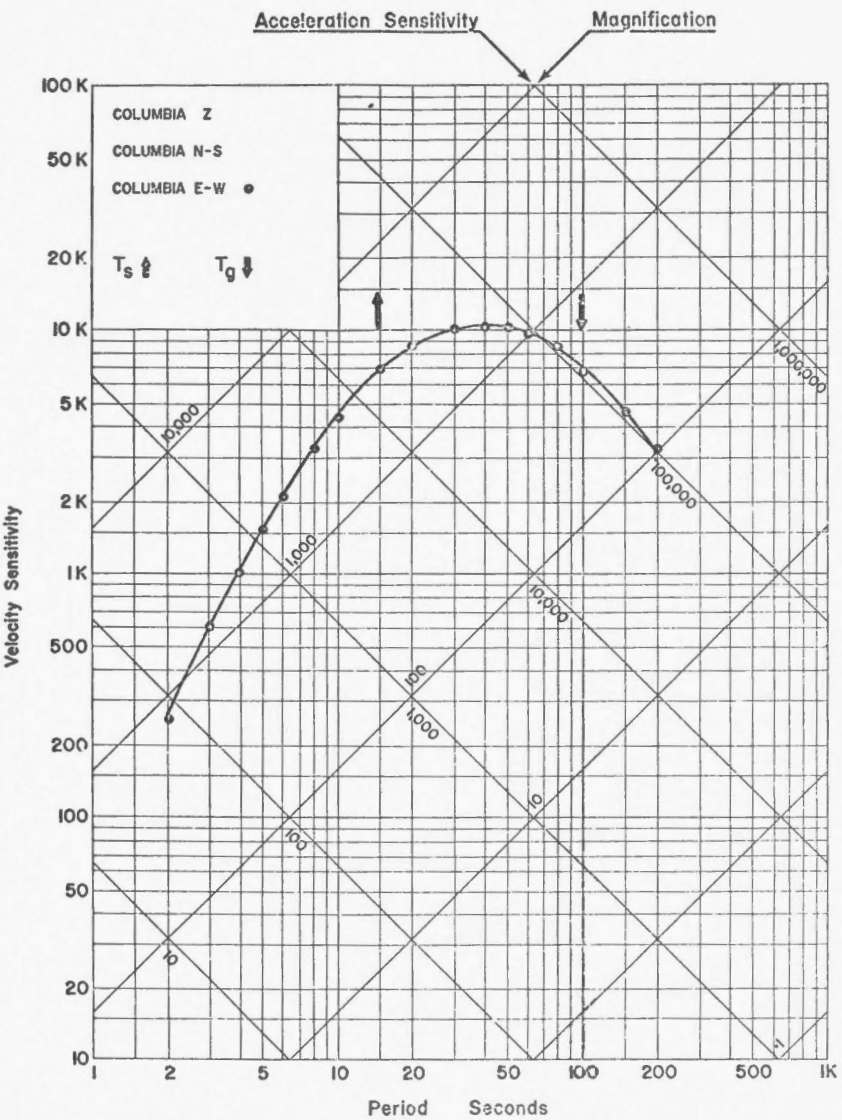
COLUMBIA N-S Dec. 10, 1968

COLUMBIA E-W

STATION: SCHEFFERVILLE, QUE (SCH)

ϕ= 54°49'N λ= 66°47'W Altitude 540M

Foundation: Competent Precambrian slate-shale



Dates of Calibration:

COLUMBIA Z

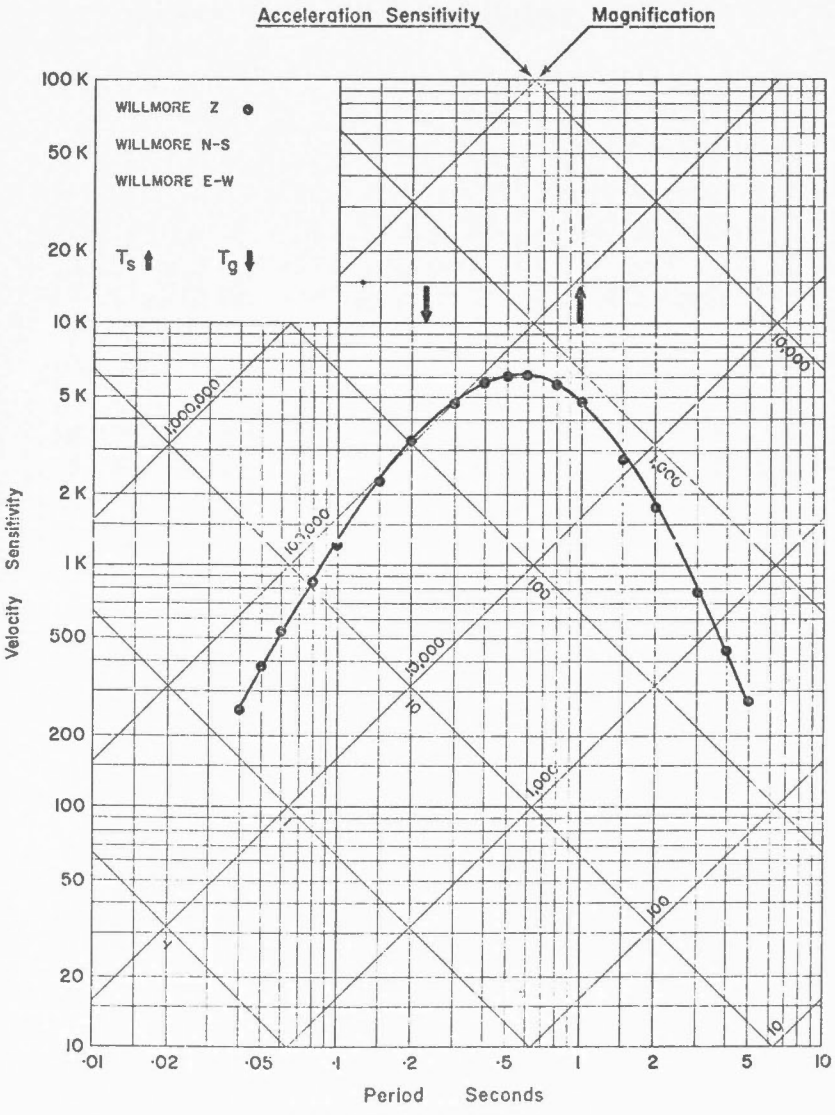
COLUMBIA N-S

COLUMBIA E-W • Dec. 11, 1968

STATION: SCHEFFERVILLE, QUE. (AS FOUND AND LEFT) (SCH)

ϕ = 54°49'N λ = 66°47'W Altitude 540 M

Foundation: Competent Precambrian state-shale



Dates of Calibration:

WILLMORE Z ● 22 Feb. 1973

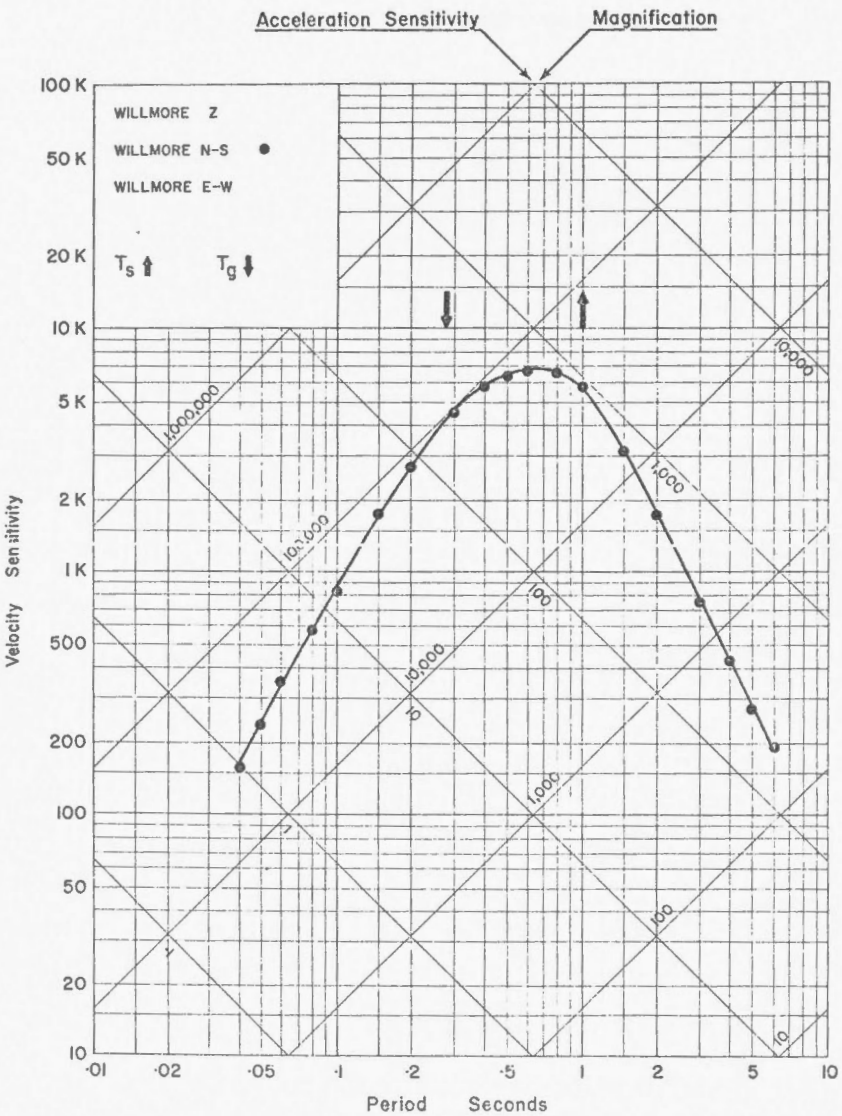
WILLMORE N-S

WILLMORE E-W

STATION: **SCHEFFERVILLE, QUE.** (AS FOUND AND LEFT) (SCH)

ϕ = 54°49'N λ = 66°47'W Altitude 540 M

Foundation: Competent Precambrian slate-shale



Dates of Calibration:

WILLMORE Z

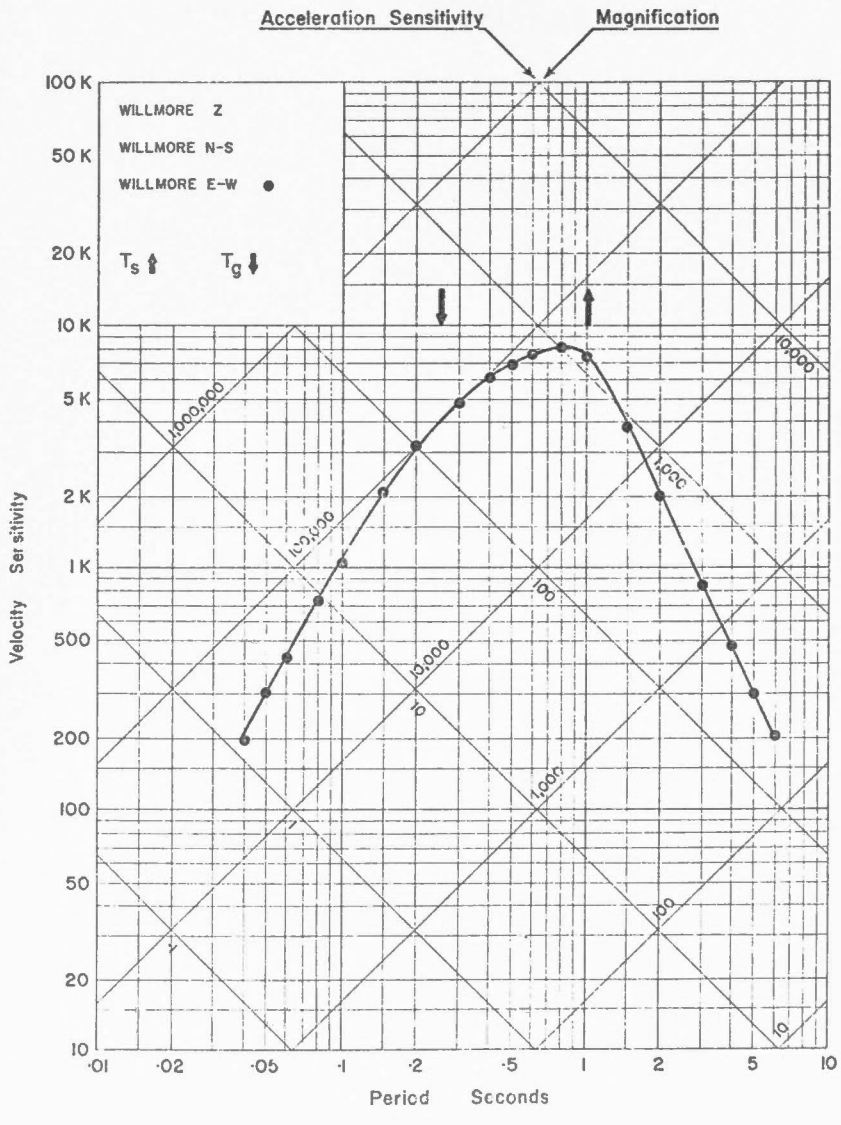
WILLMORE N-S ● 22 Feb. 1973

WILLMORE E-W

STATION: **SCHEFFERVILLE, QUE.** (AS FOUND AND LEFT) **(SCH)**

ϕ= 54°49'N λ=66°47'W Altitude 540 M

Foundation: Competent Precambrian state-shale



Dates of Calibration:

WILLMORE Z

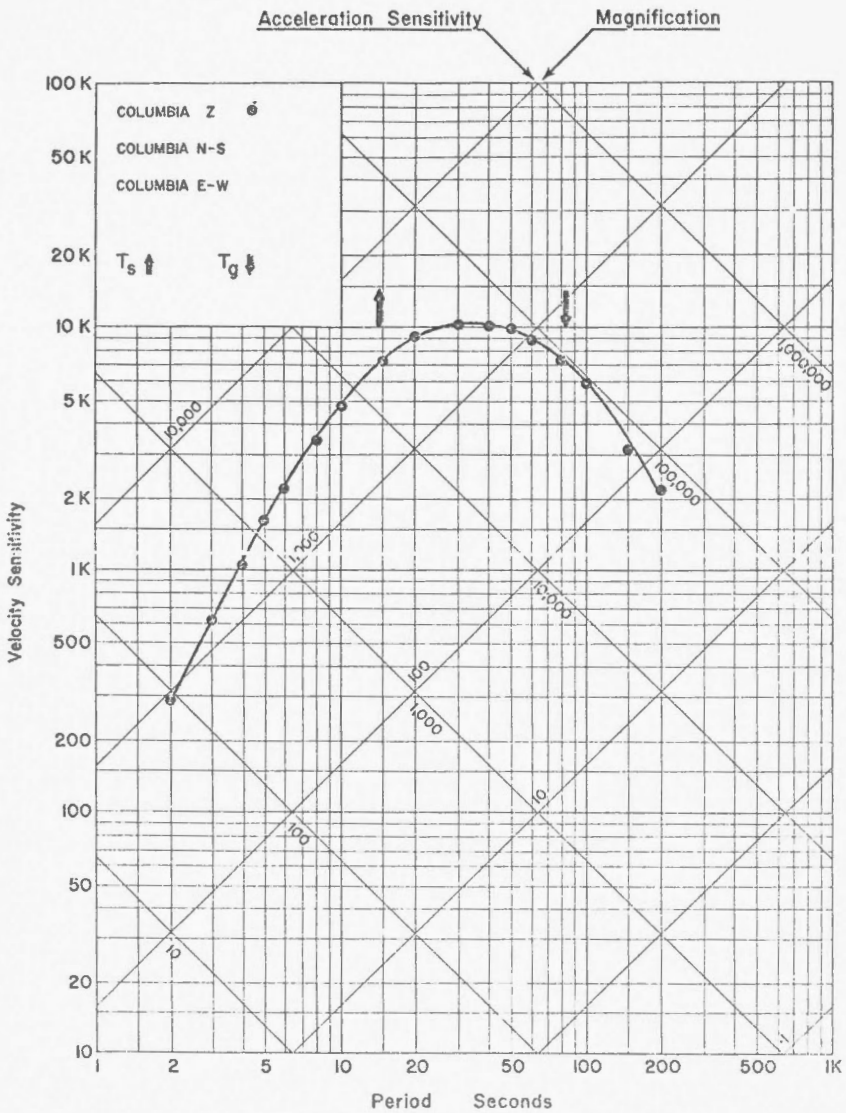
WILLMORE N-S

WILLMORE E-W ● 22 Feb. 1973

STATION: **SCHEFFERVILLE, QUE.** (AS FOUND AND LEFT) **(SCH)**

ϕ= 54°49'N λ= 66°47'W Altitude 540 M

Foundation: Competent Precambrian slate-shale



Dates of Calibration:

COLUMBIA Z ● 21 Feb. 1973

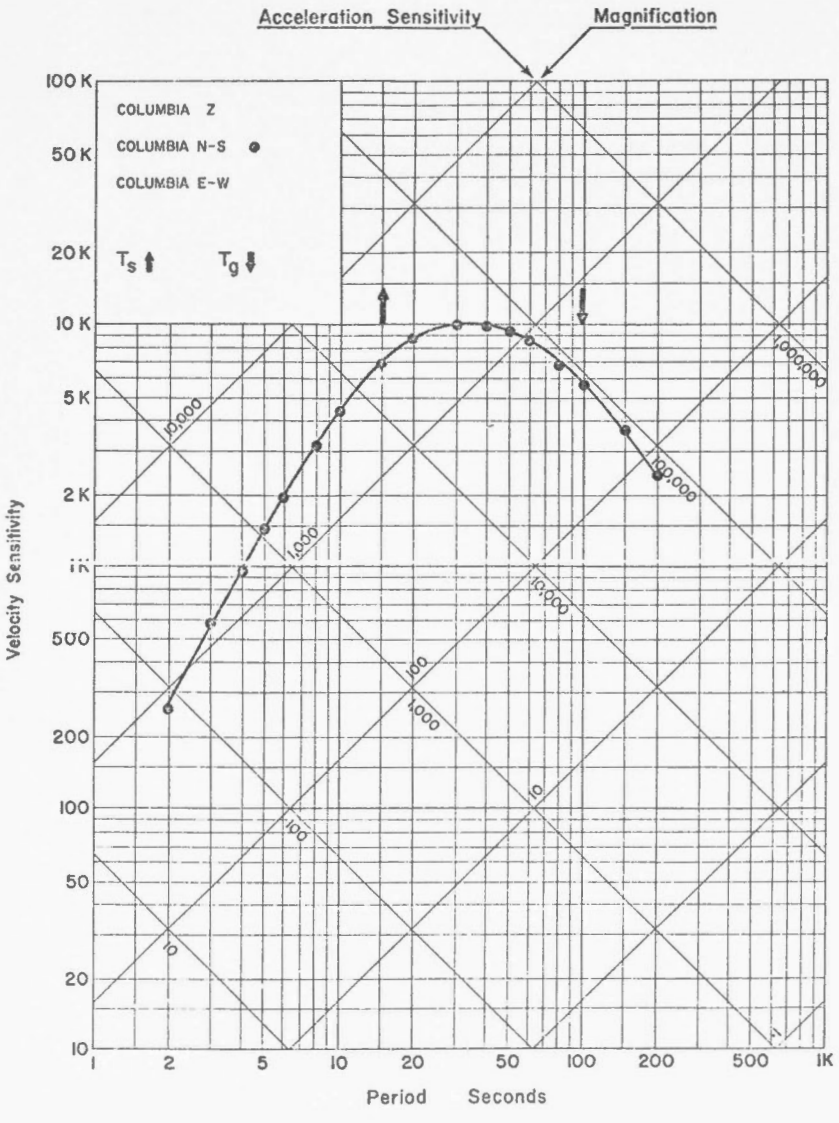
COLUMBIA N-S

COLUMBIA E-W

STATION: **SCHEFFERVILLE, QUE.** (AS FOUND AND LEFT) **(SCH)**

ϕ= 54°49'N λ=66°47'W Altitude 540 M

Foundation: Competent Precambrian slate-shale



Dates of Calibration:

COLUMBIA Z

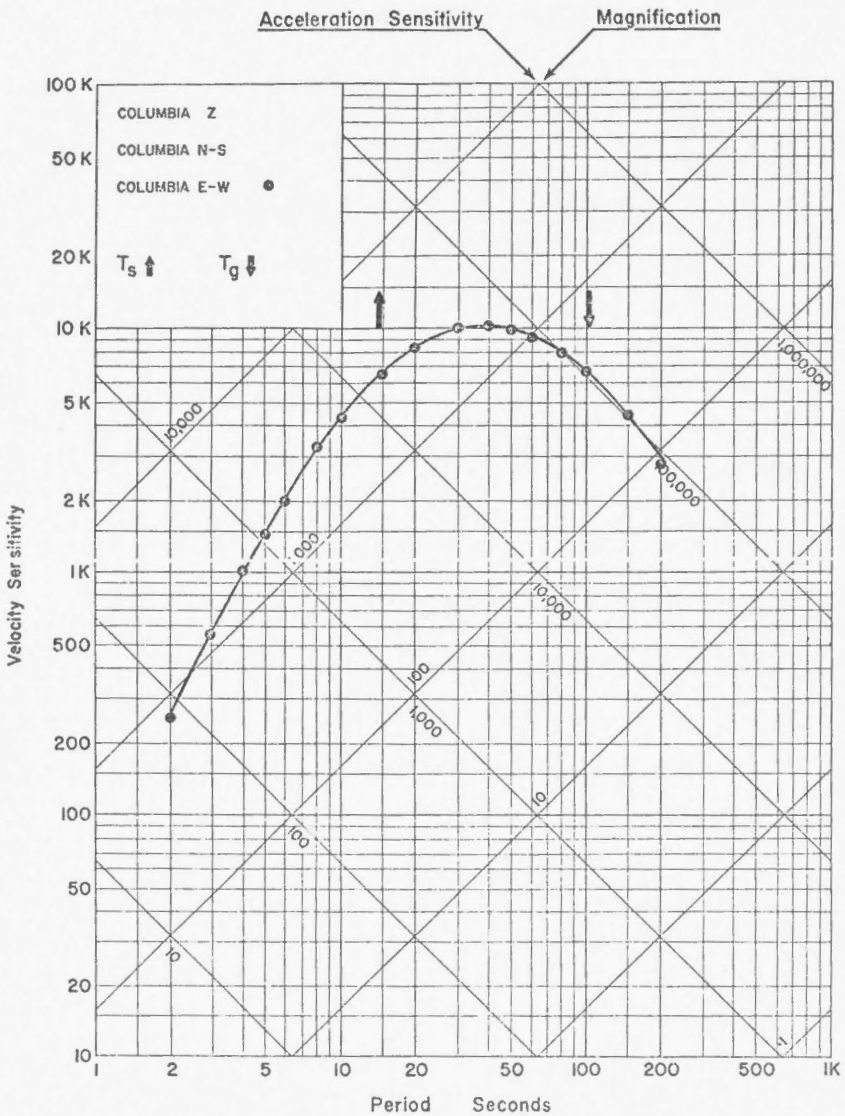
COLUMBIA N-S ● 22 Feb. 1973

COLUMBIA E-W

STATION: **SCHEFFERVILLE, QUE.** (AS FOUND AND LEFT) (SCH)

ϕ= 54°49'N λ= 66°47'W Altitude 540 M

Foundation: Competent Precambrian slate-shale



Dates of Calibration:

COLUMBIA Z

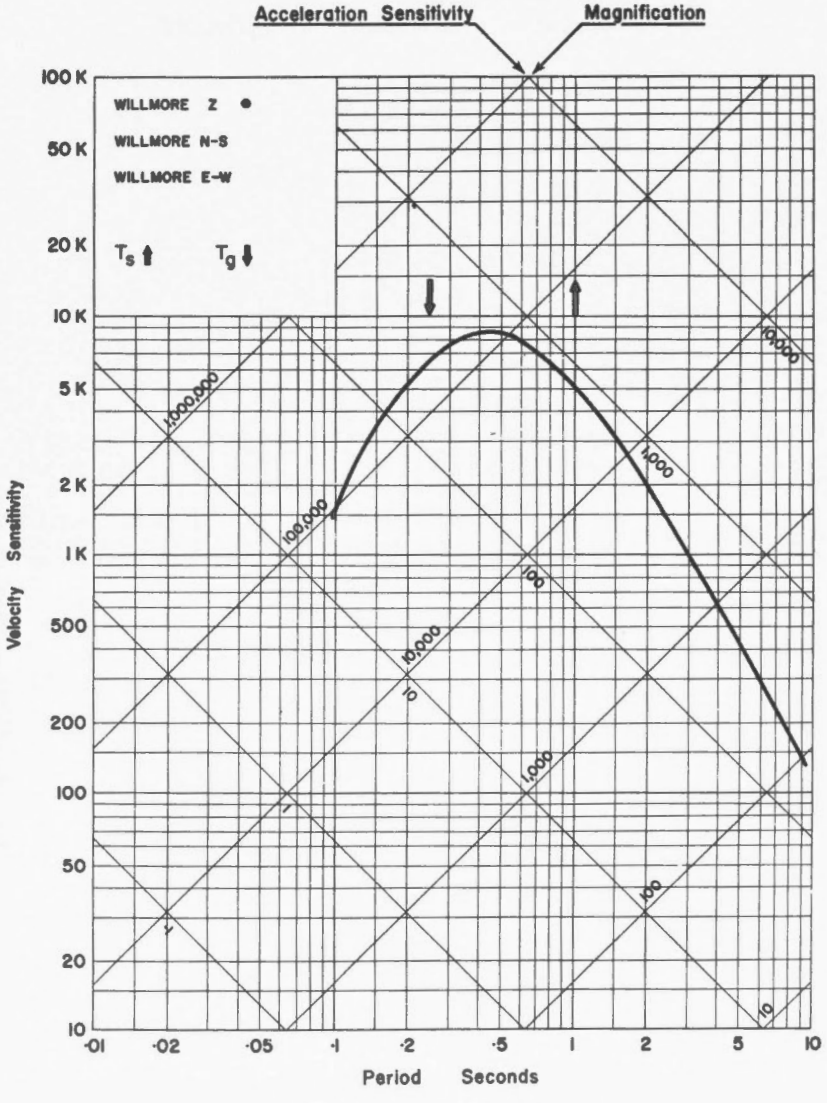
COLUMBIA N-S

COLUMBIA E-W ● 22 Feb. 1973

STATION: SEPT ILES, QUE. (SIC)

ϕ= 50°10.2'N λ= 66°39.8'W Altitude 283 M

Foundation:



Dates of Calibration:

WILLMORE Z ● MAR. 11 - 1964

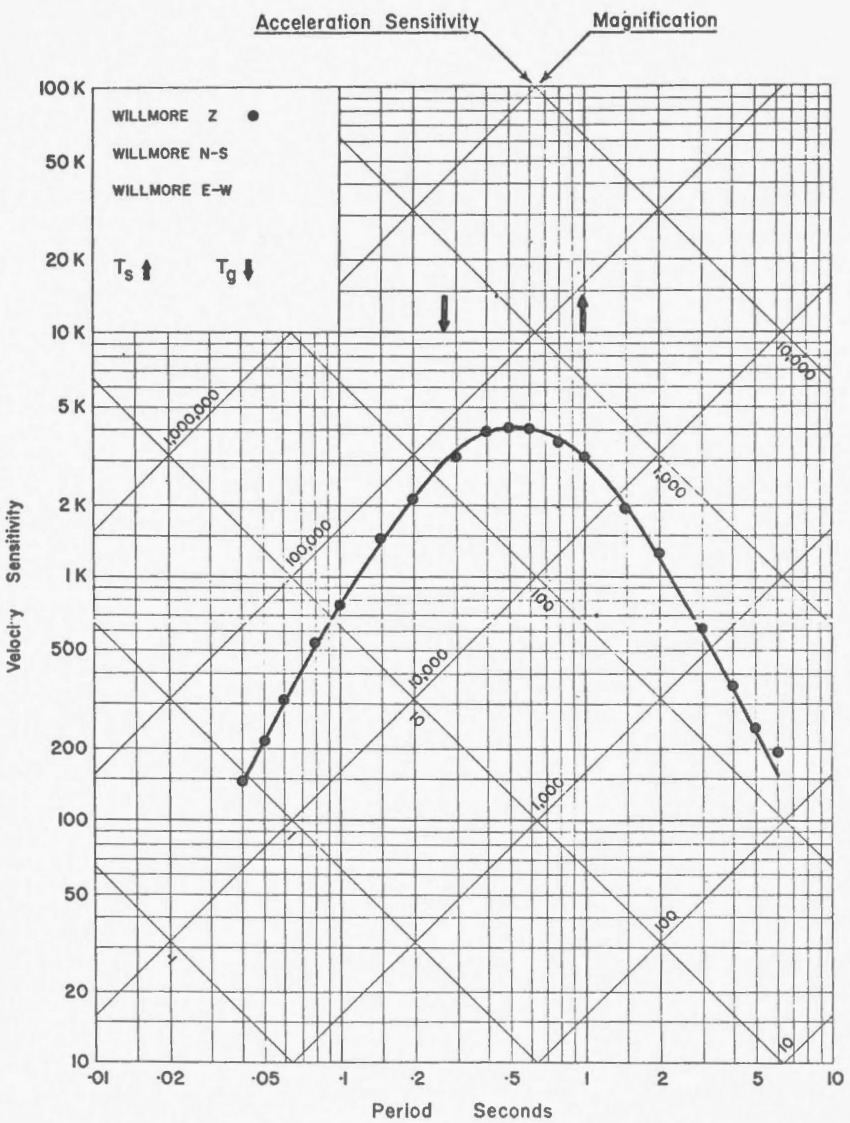
WILLMORE N-S

WILLMORE E-W

STATION: SEVEN FALLS, QUE. (SFA)

$\phi = 47^{o}07.4'N$ $\lambda = 70^{o}49.6'W$ Altitude 232 M

Foundation: Precambrian basement rocks



Dates of Calibration:

WILLMORE Z ● Feb. 9, 1972

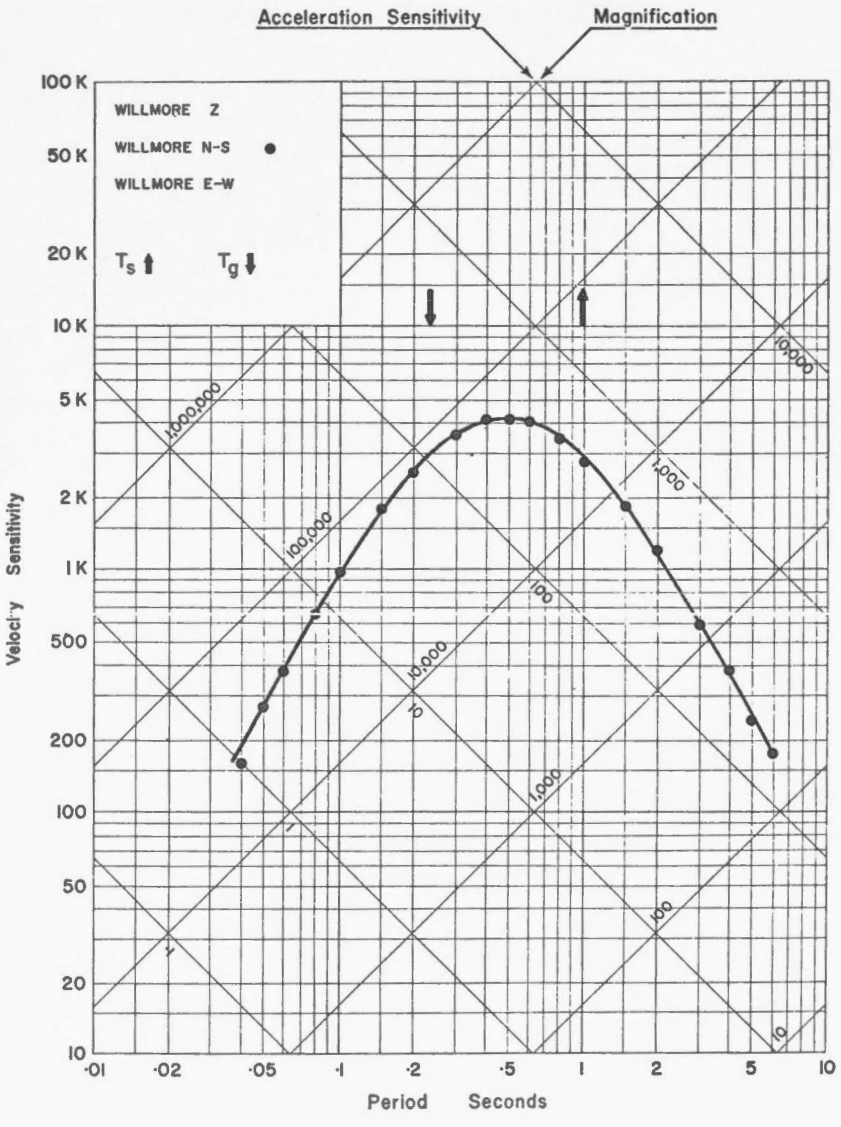
WILLMORE N-S

WILLMORE E-W

STATION: SEVEN FALLS, QUE. (SFA)

$\phi = 47^{o}07.4'N$ $\lambda = 70^{o}49.6'W$ Altitude 232 M

Foundation: Precambrian basement rocks



Dates of Calibration:

WILLMORE Z

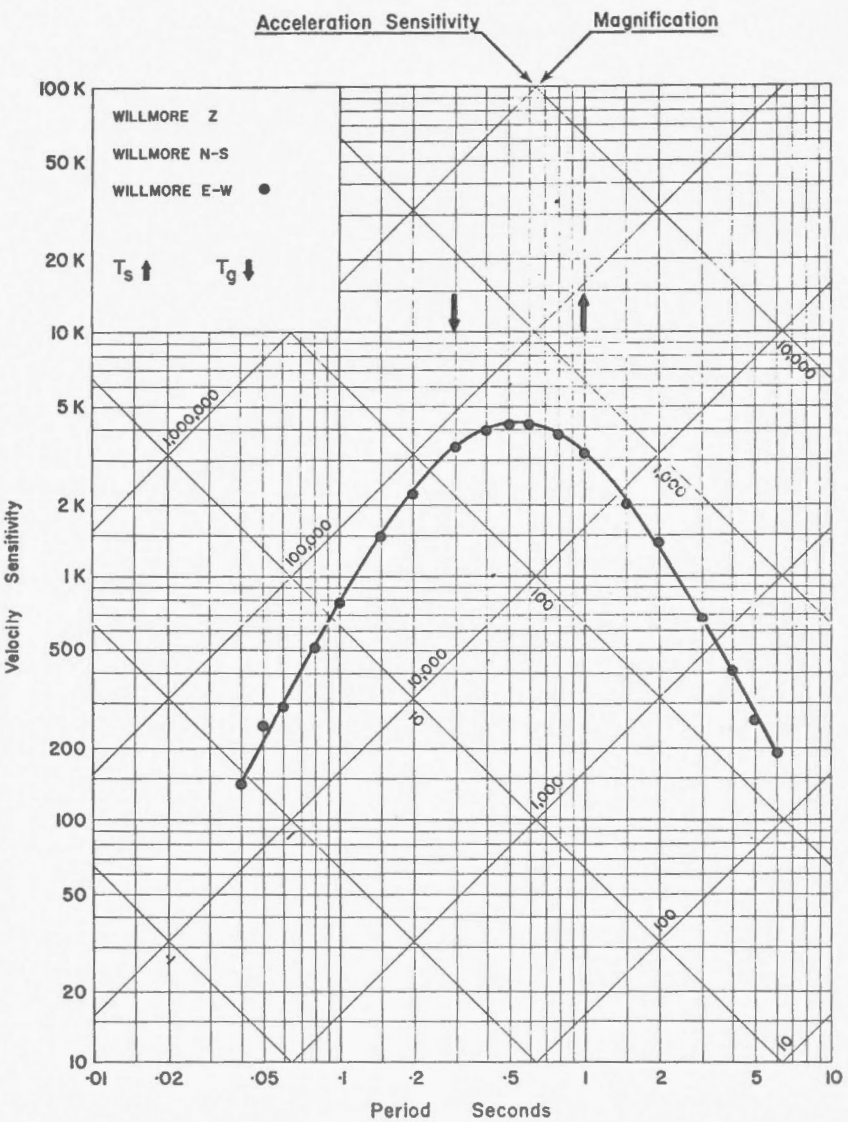
WILLMORE N-S ● Feb. 9, 1972

WILLMORE E-W

STATION: SEVEN FALLS, QUE. (SFA)

ϕ = 47°07.4'N λ = 70°49.6'W Altitude 232 M

Foundation: Precambrian basement rocks



Dates of Calibration:

WILLMORE Z

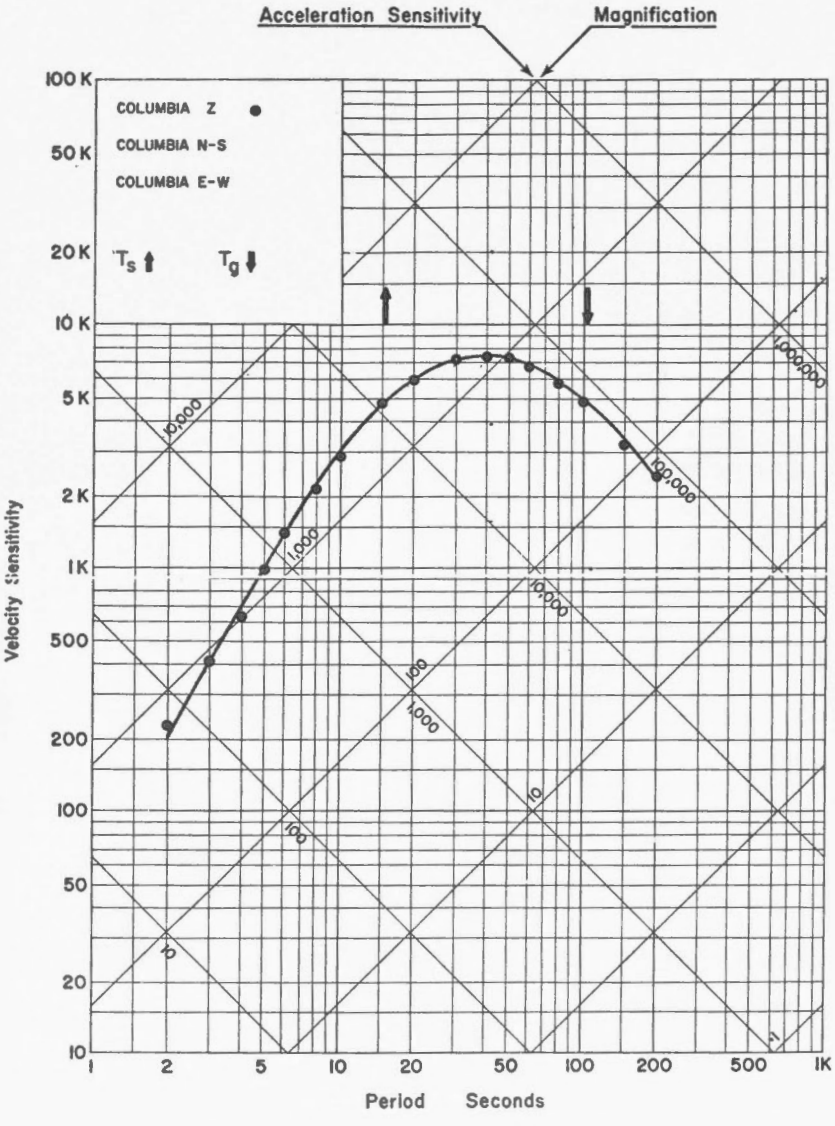
WILLMORE N-S

WILLMORE E-W ● Feb. 11, 1972

STATION: SEVEN FALLS, QUE. (SFA)

ϕ= 47°07.4'N λ= 70°49.6'W Altitude 232 M

Foundation: Precambrian basement rocks



Dates of Calibration:

COLUMBIA Z • Feb. 10, 1972 (see "Instrument Changes during 1972" - notes)

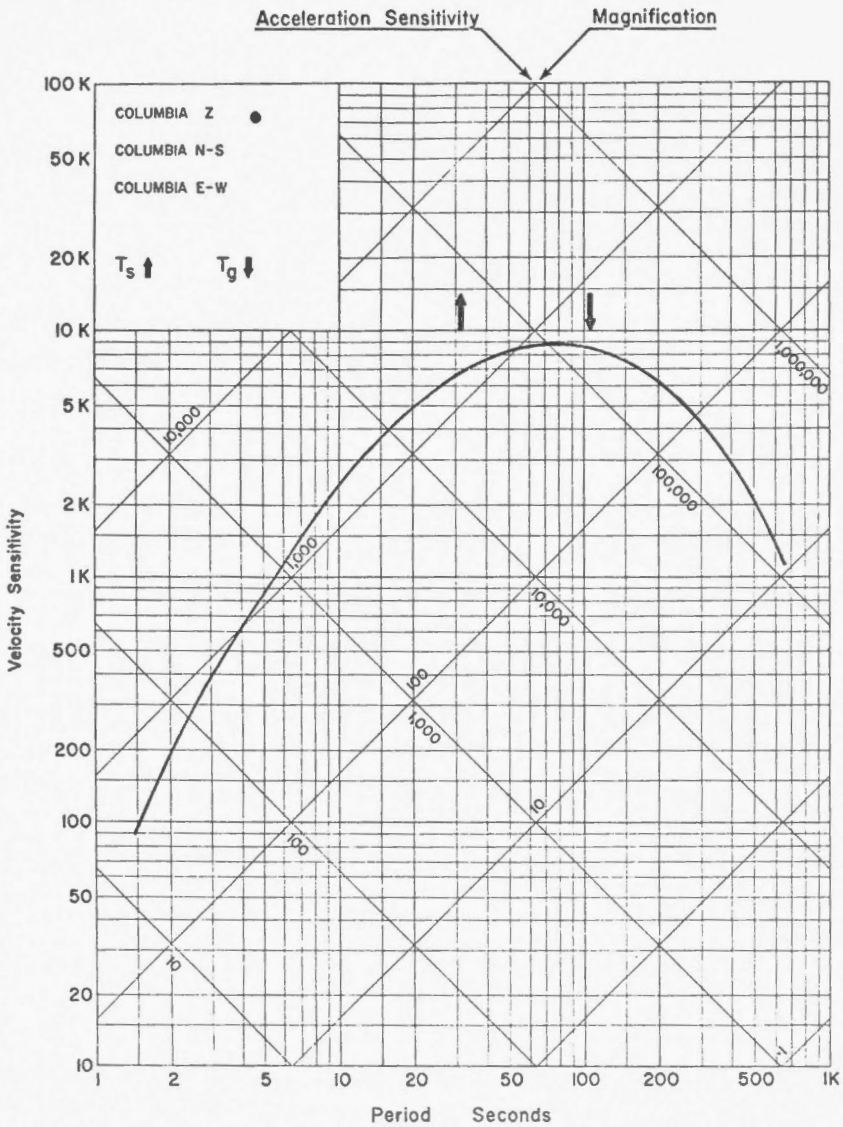
COLUMBIA N-S

COLUMBIA E-W

STATION: SEVEN FALLS, QUE. (SFA)

ϕ=47°07.4'N λ=70°49.6'W Altitude 232 M

Foundation: Precambrian basement rocks



Dates of Calibration:

COLUMBIA Z • Valid from May 10, 1972 to February 1, 1973

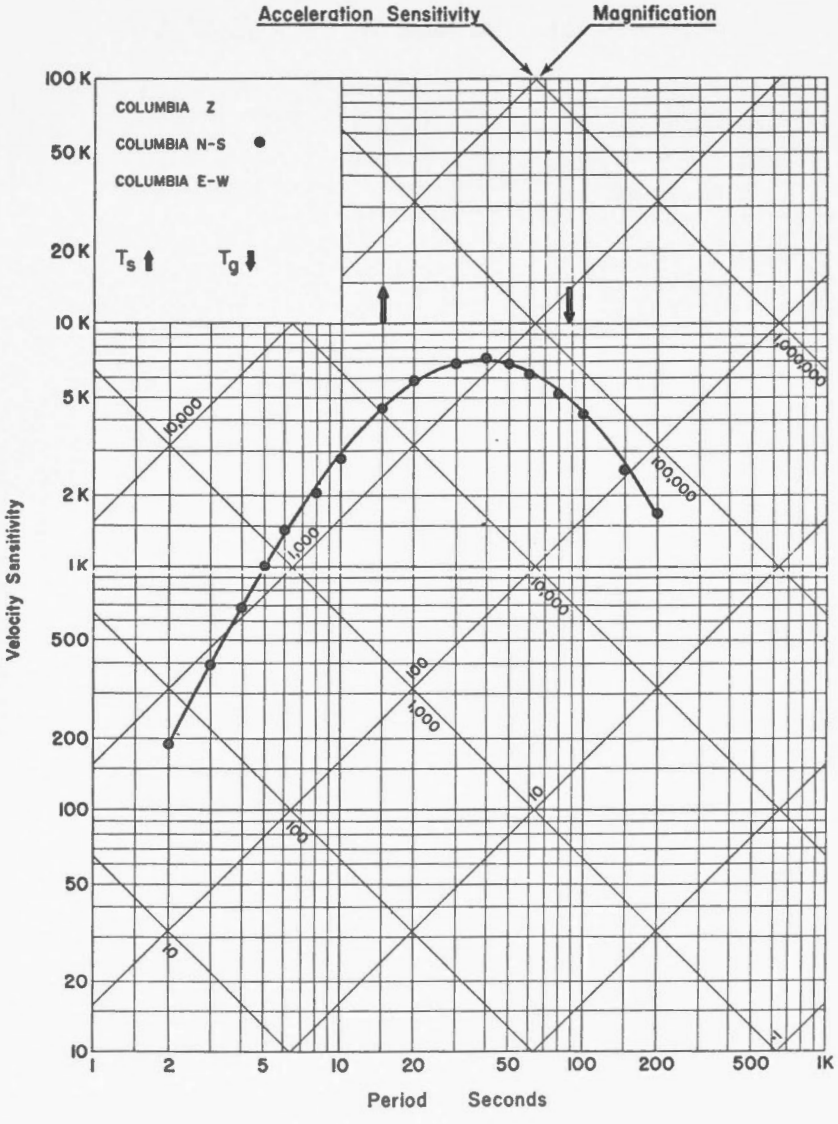
COLUMBIA N-S

COLUMBIA E-W

STATION: SEVEN FALLS, QUE. (SFA)

ϕ= 47°07.4'N λ= 70°49.6'W Altitude 232 M

Foundation: Precambrian basement rocks



Dates of Calibration:

COLUMBIA Z

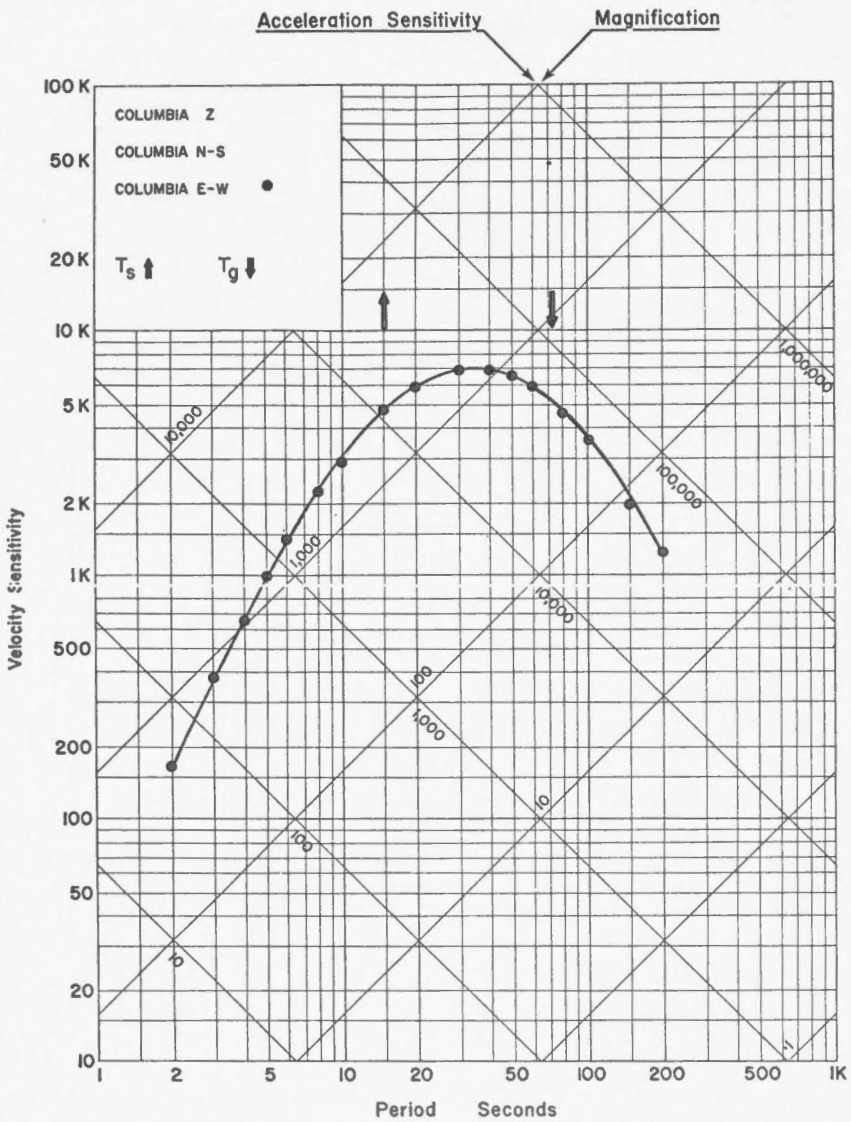
COLUMBIA N-S ● Feb. 10, 1972

COLUMBIA E-W

STATION: SEVEN FALLS, QUE. (SFA)

ϕ= 47°07.4'N λ= 70°49.6'W Altitude 232 M

Foundation: Precambrian basement rocks



Dates of Calibration:

COLUMBIA Z

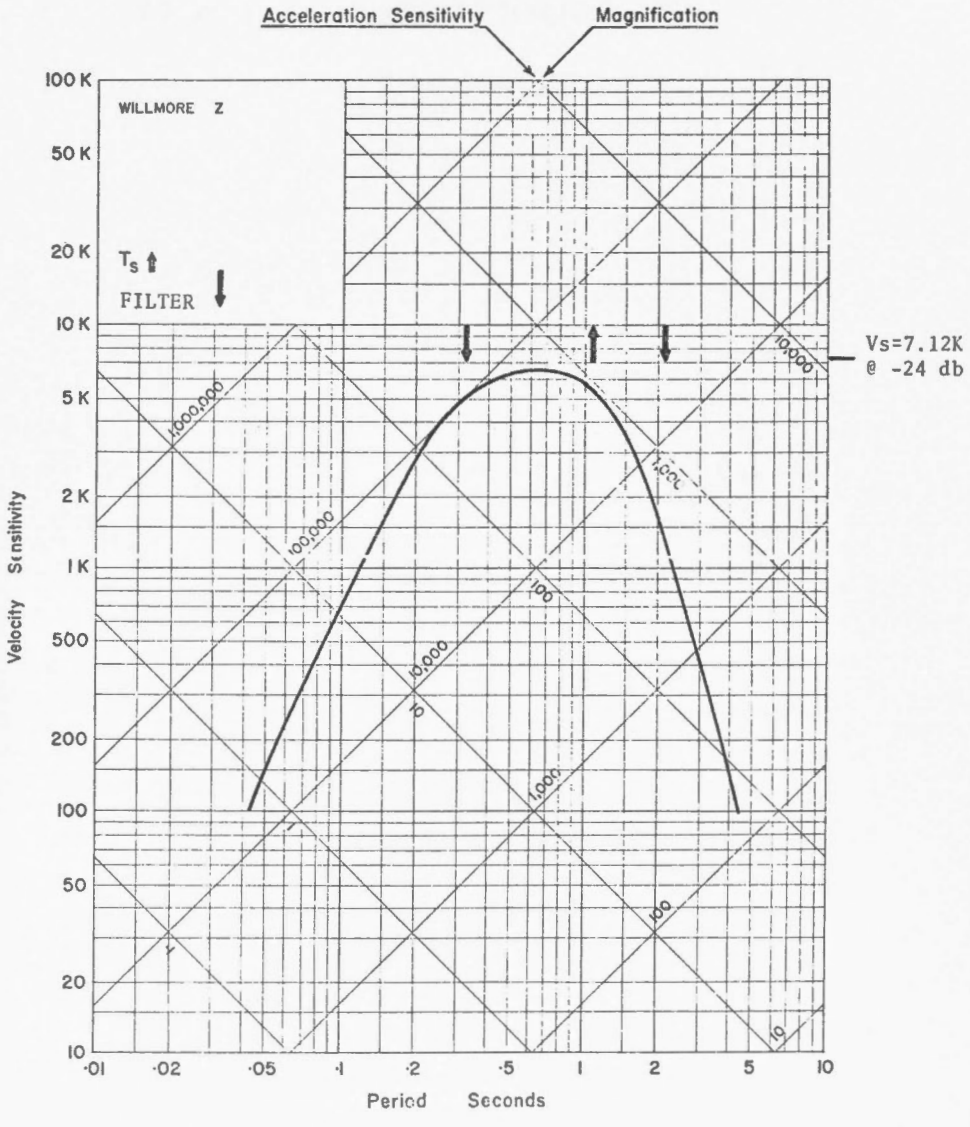
COLUMBIA N-S

COLUMBIA E-W ● Feb. 11, 1972

STATION: SUDBURY, ONTARIO (SUD)

$\phi = 46^{o}28'N$ $\lambda = 80^{o}58'W$ Altitude 267 M

Foundation: Proterozoic, Huronian, Wanapitae Quartzite



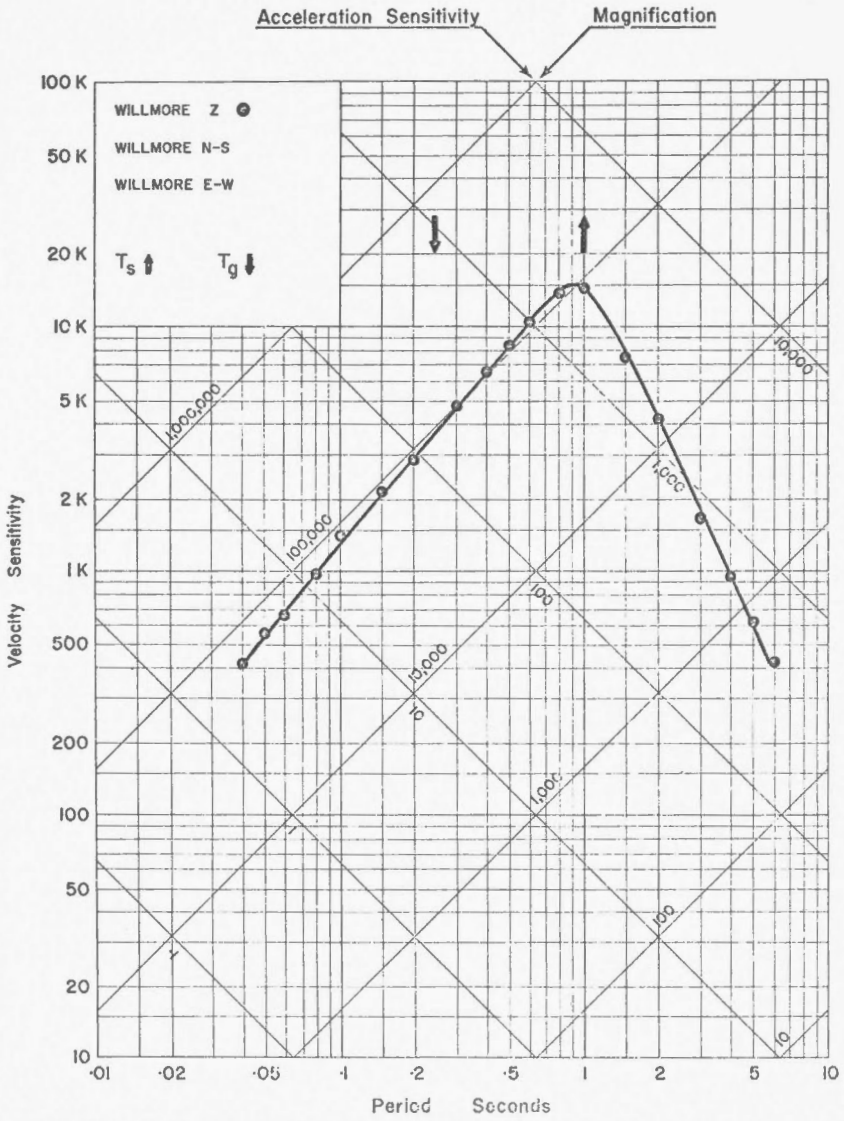
Dates of Calibration: Dec. 13, 1972

SEISMOMETER: Willmore K = 1.90 V/$\frac{cm}{sec}$
PREAMPLIFIER: AS310 operated at
24 - 30 (ATT-SEP)
Filter Bandpass - 0.5 - 3 Hz
HELICORDER: RV301 - Bandpass - 0 - 30 Hz
Sensitivity - 1 cm/Volt

STATION: SUFFIELD, ALTA. (SES)

ϕ= 50°23'45"N λ= 111°02'30"W Altitude 770 M

Foundation: Grey Competent Sandstone



Dates of Calibration:

WILLMORE Z May 24, 1970

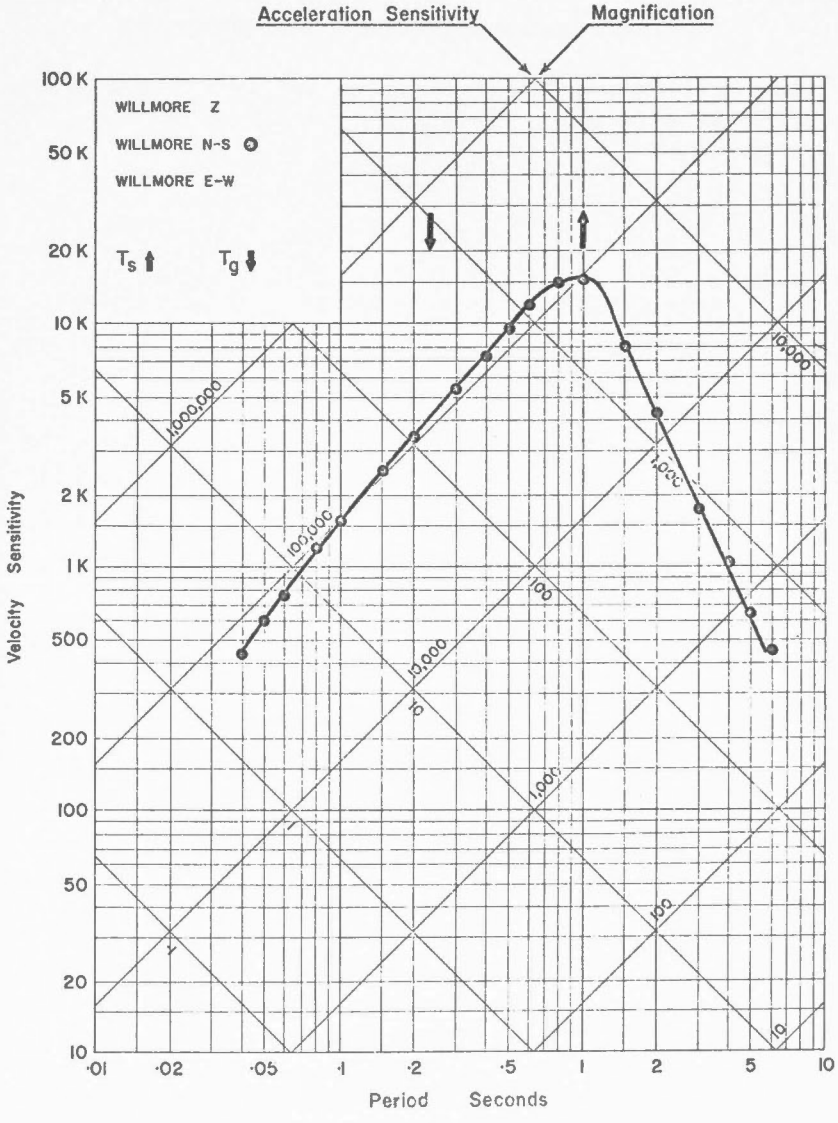
WILLMORE N-S

WILLMORE E-W

STATION: SUFFIELD, ALTA. (SES)

ϕ= 50°23'45"N λ= 111°02'30"W Altitude 770M

Foundation: Grey Competent Sandstone



Dates of Calibration:

WILLMORE Z

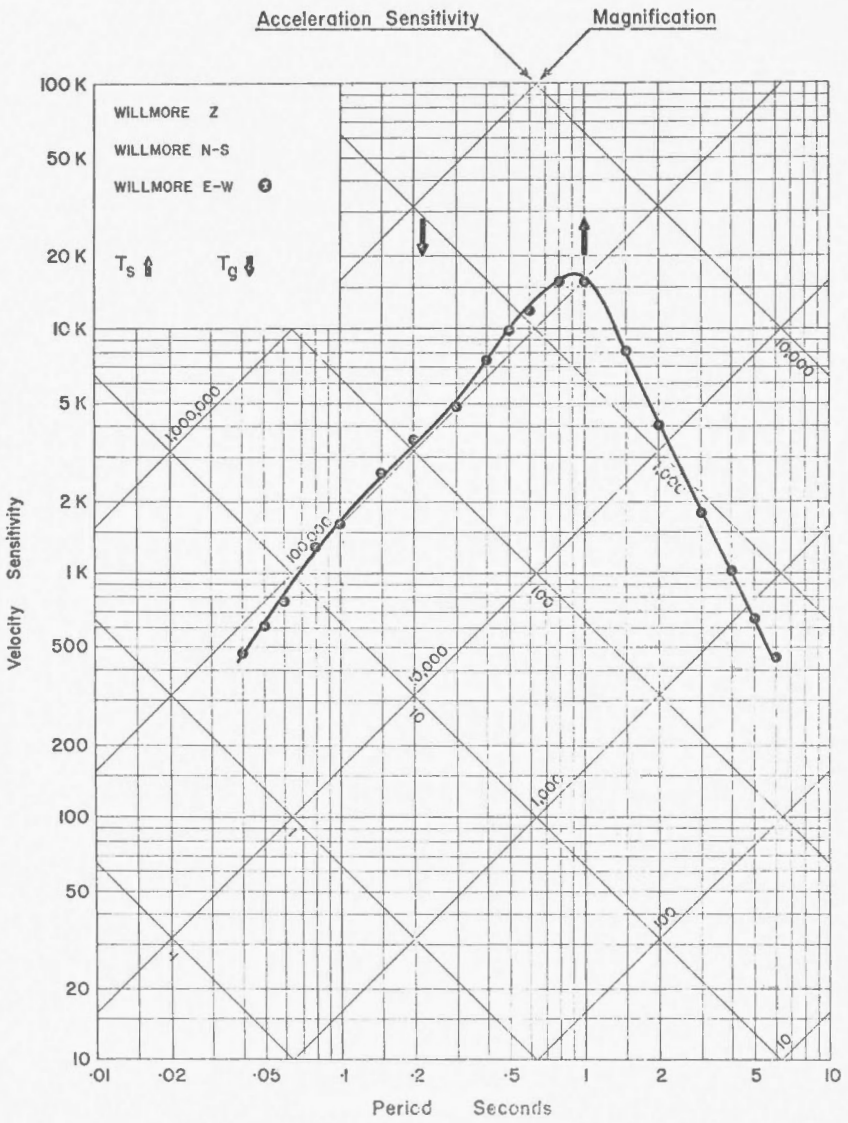
WILLMORE N-S May 25, 1970

WILLMORE E-W

STATION: SUFFIELD, ALTA. (SES)

ϕ= 50°23'45"N λ= 111°02'30"W Altitude 770M

Foundation: Grey Competent Sandstone



Dates of Calibration:

WILLMORE Z

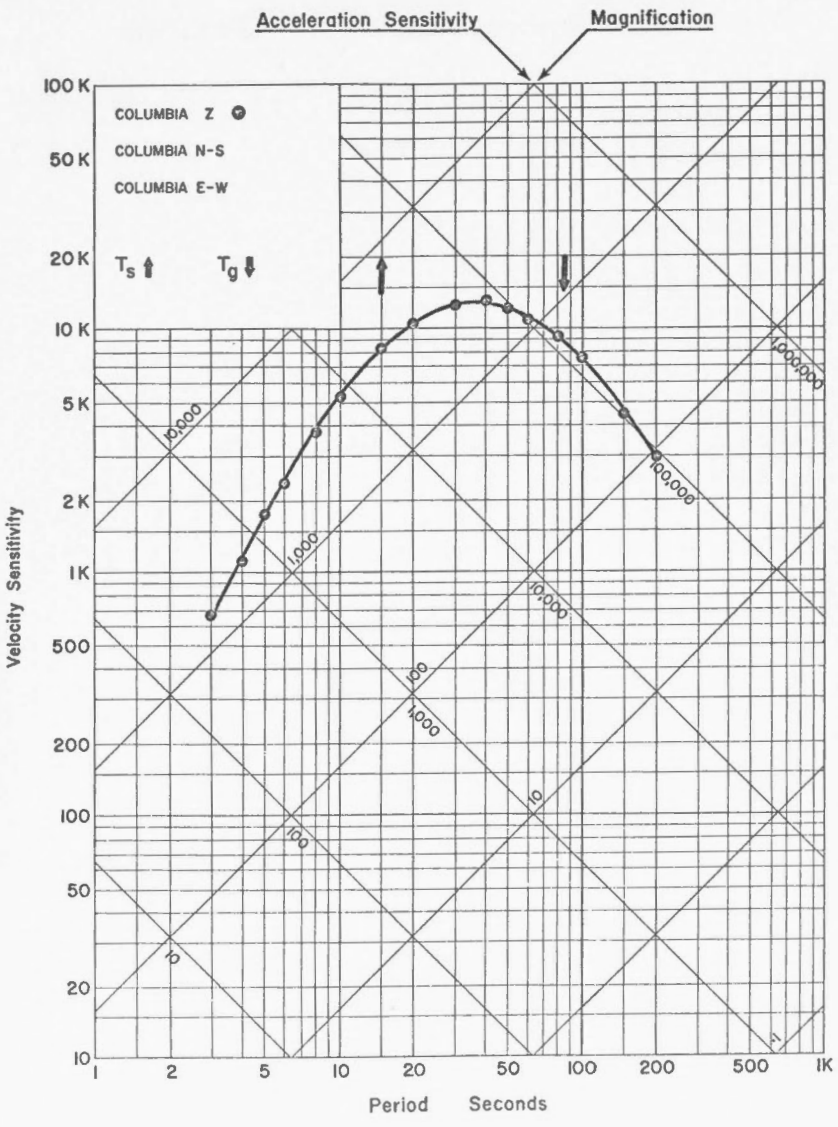
WILLMORE N-S

WILLMORE E-W ● May 25, 1970

STATION: SUFFIELD, ALTA. (SES)

ϕ= 50°23'45"N λ= 111°02'30"W Altitude 770M

Foundation: Grey Competent Sandstone



Dates of Calibration:

COLUMBIA Z May 23, 1970

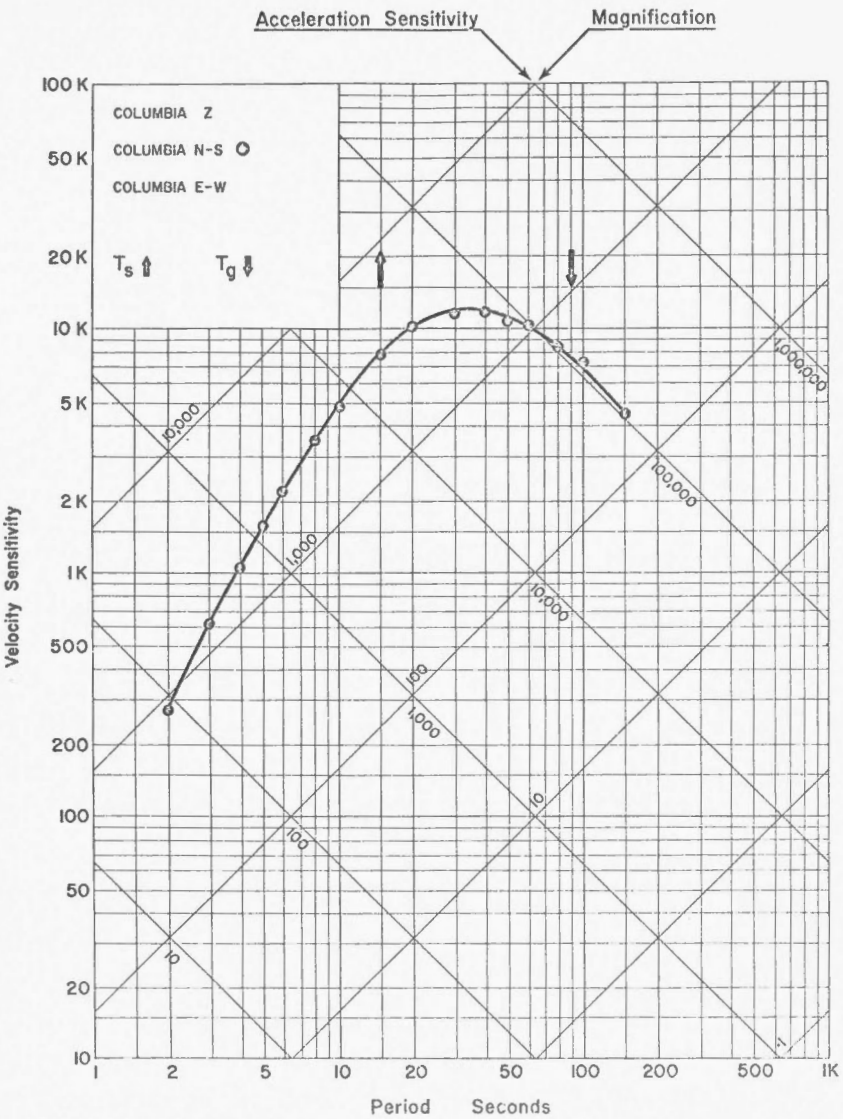
COLUMBIA N-S

COLUMBIA E-W

STATION: SUFFIELD, ALTA. (SES)

ϕ= 50°23'45"N λ= 111°02'30"W Altitude 770M

Foundation: Grey Competent Sandstone



Dates of Calibration:

COLUMBIA Z

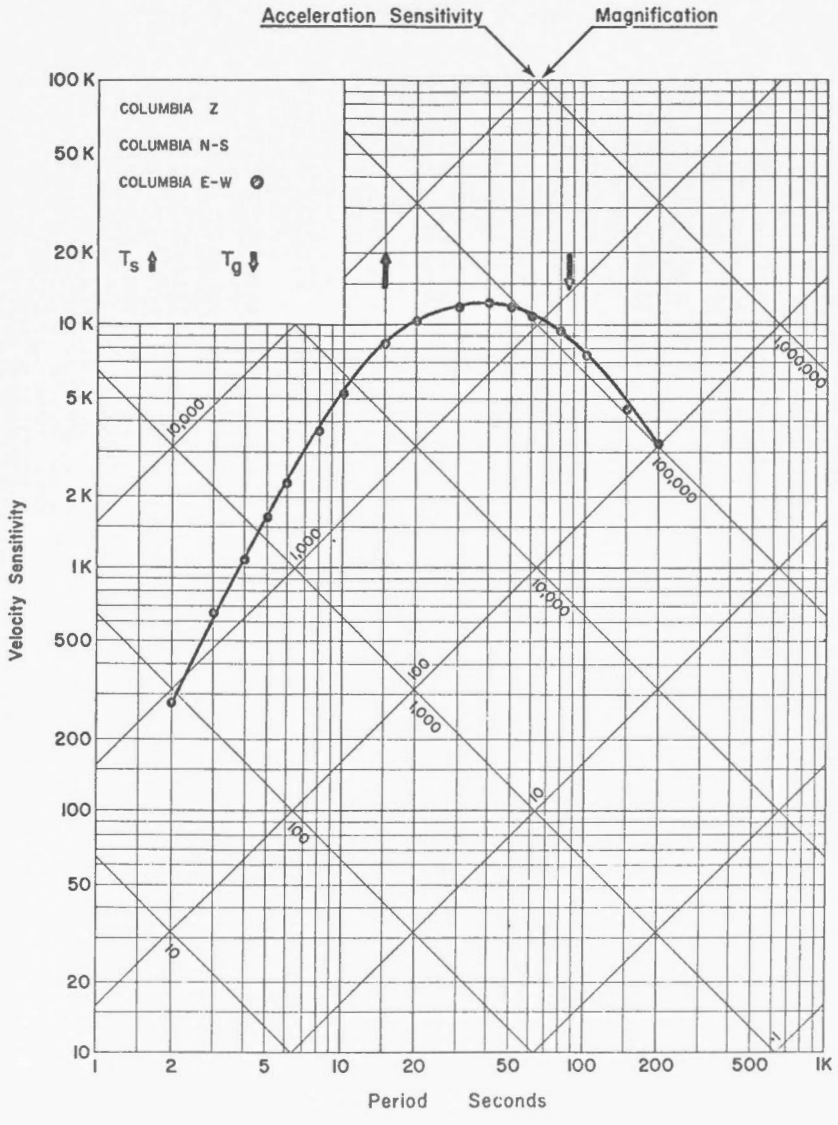
COLUMBIA N-S May 23, 1970

COLUMBIA E-W

STATION: SUFFIELD, ALTA. (SES)

ϕ= 50°23'45"N λ= 111°02'30"W Altitude 770M

Foundation: Grey Competent Sandstone



Dates of Calibration:

COLUMBIA Z

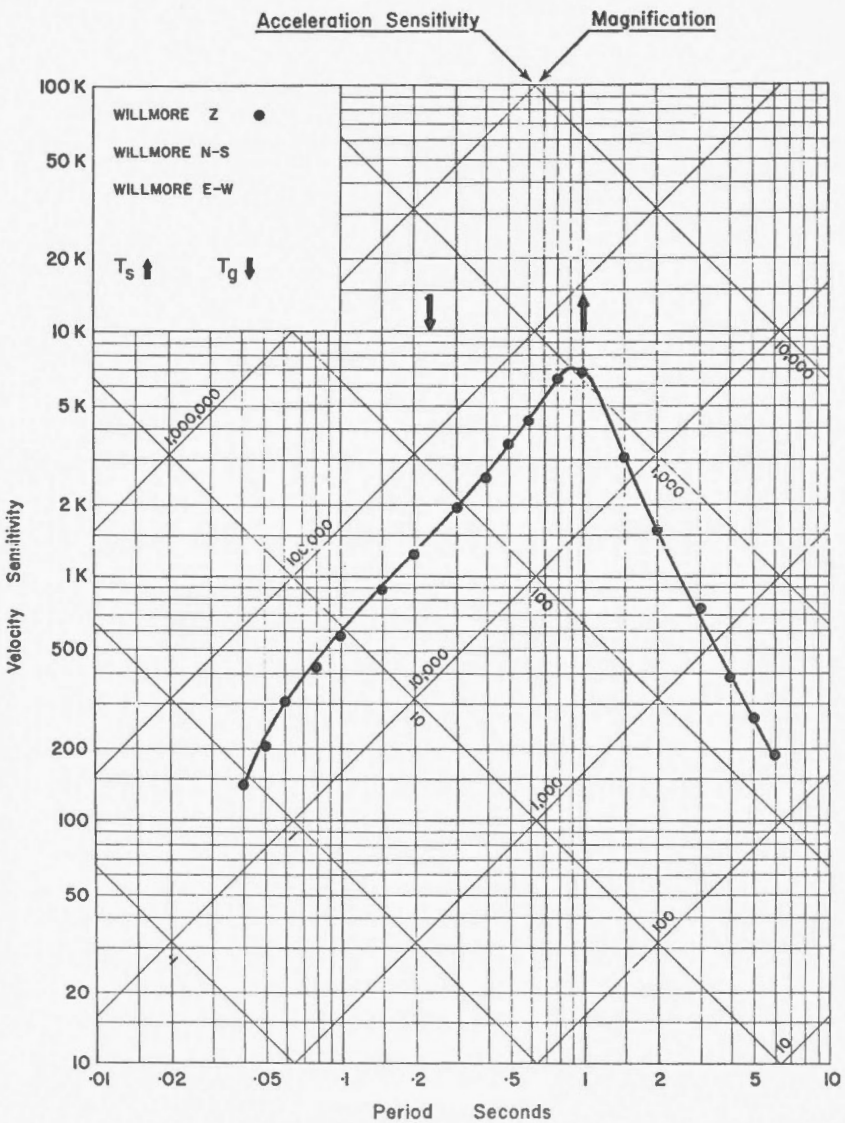
COLUMBIA N-S

COLUMBIA E-W ⊘ May 23, 1970

STATION: THUNDER BAY, ONT. (FINAL) (LHC)

ϕ= 48°25'N λ= 89°16'W Altitude 196 M

Foundation: Precambrian, upper gunflint, iron formation



Dates of Calibration:

WILLMORE Z ● Sept. 19, 1972

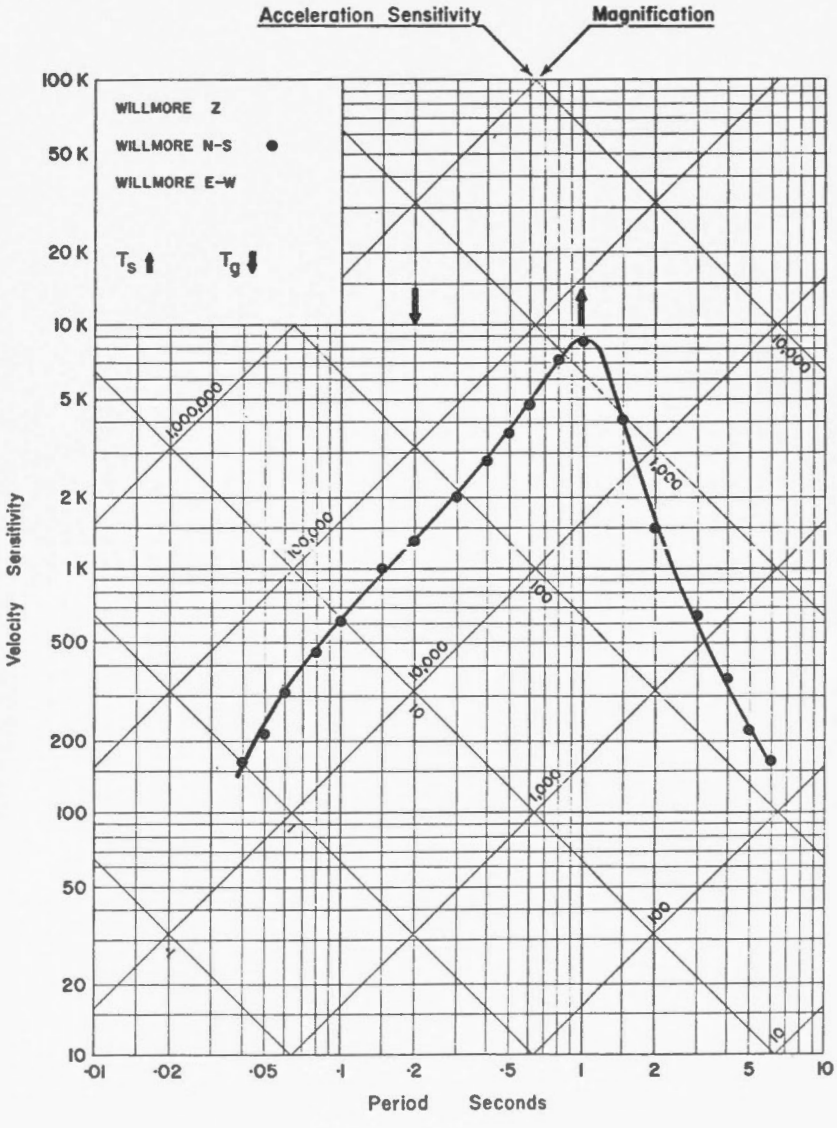
WILLMORE N-S

WILLMORE E-W

STATION: THUNDER BAY, ONT. (FINAL) (LHC)

ϕ= 48°25'N λ= 89°16'W Altitude 196 M

Foundation: Precambrian, upper gunflint, iron formation



Dates of Calibration:

WILLMORE Z

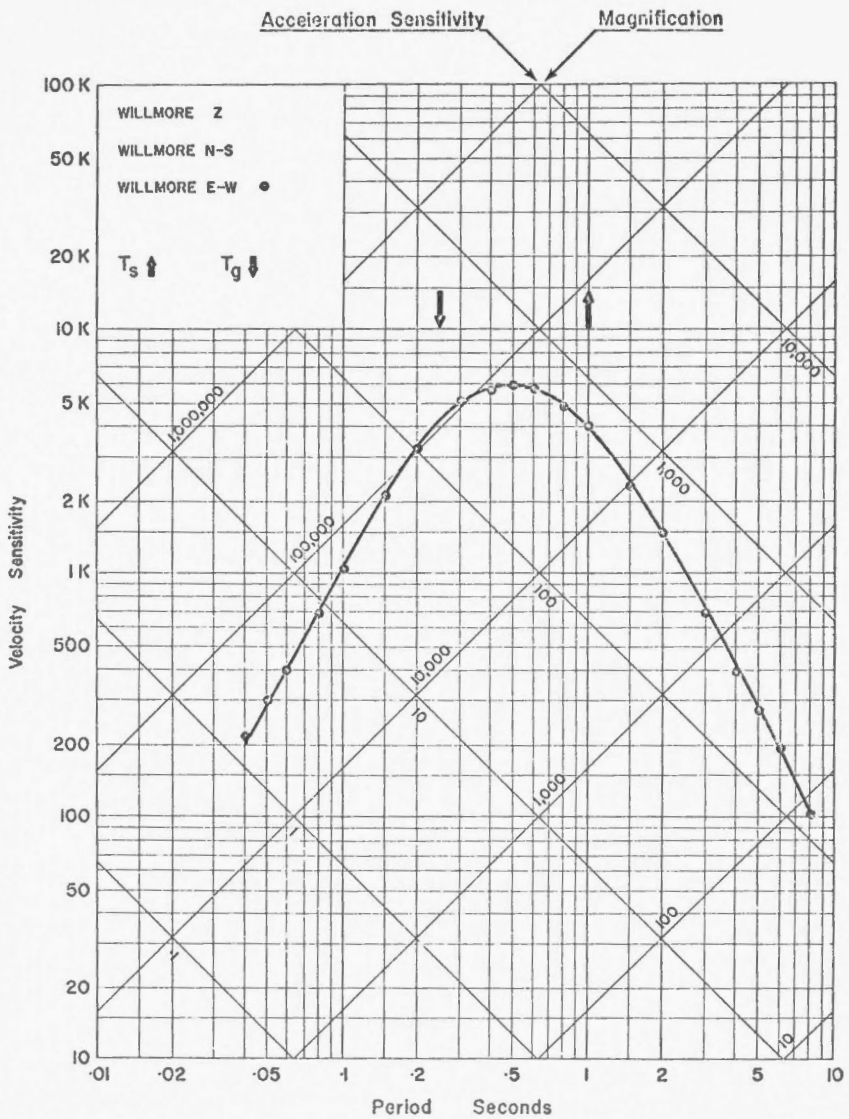
WILLMORE N-S ● Sept. 20, 1972

WILLMORE E-W

STATION: THUNDER BAY, ONT. (LHC)

ϕ= 48°25'N λ= 89°16'W Altitude 196M

Foundation: Precambrian, upper gunflint, iron formation



Dates of Calibration:

WILLMORE Z

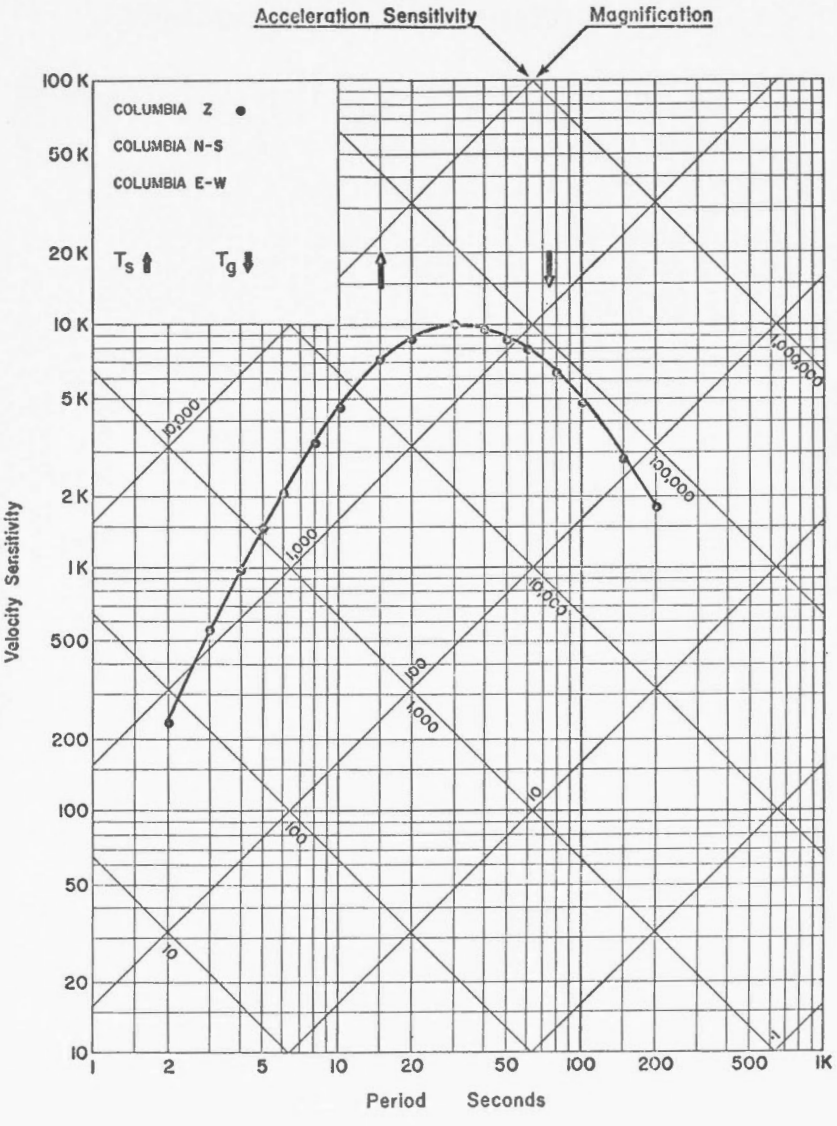
WILLMORE N-S

WILLMORE E-W ● Feb. 27, 1969

STATION: THUNDER BAY, ONT. (LHC)

ϕ= 48°25'N λ= 89°16'W Altitude 196M

Foundation: Precambrian, upper gunflint, iron formation



Dates of Calibration:

COLUMBIA Z • Feb. 28, 1969

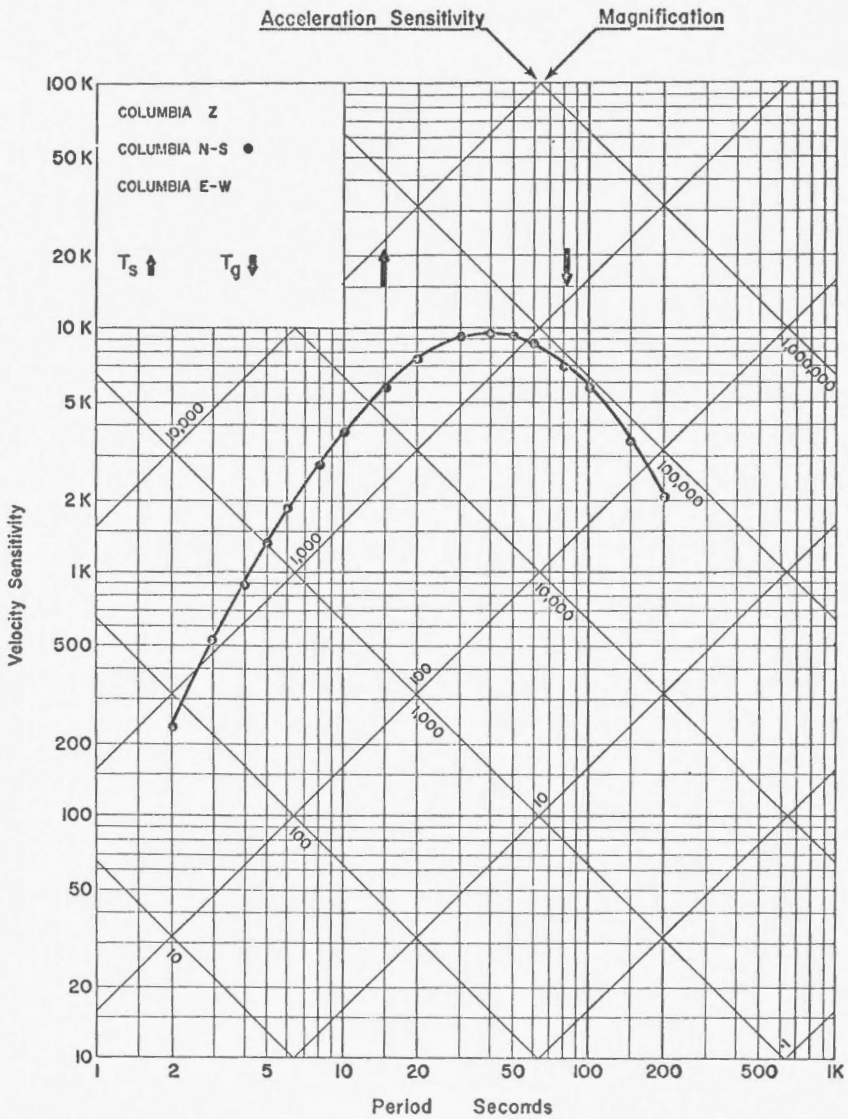
COLUMBIA N-S

COLUMBIA E-W

STATION: THUNDER BAY, ONT. (LHC)

ϕ= $48^{o}25'$N λ= $89^{o}16'$W Altitude 196M

Foundation: Precambrian, upper gunflint, iron formation



Dates of Calibration:

COLUMBIA Z

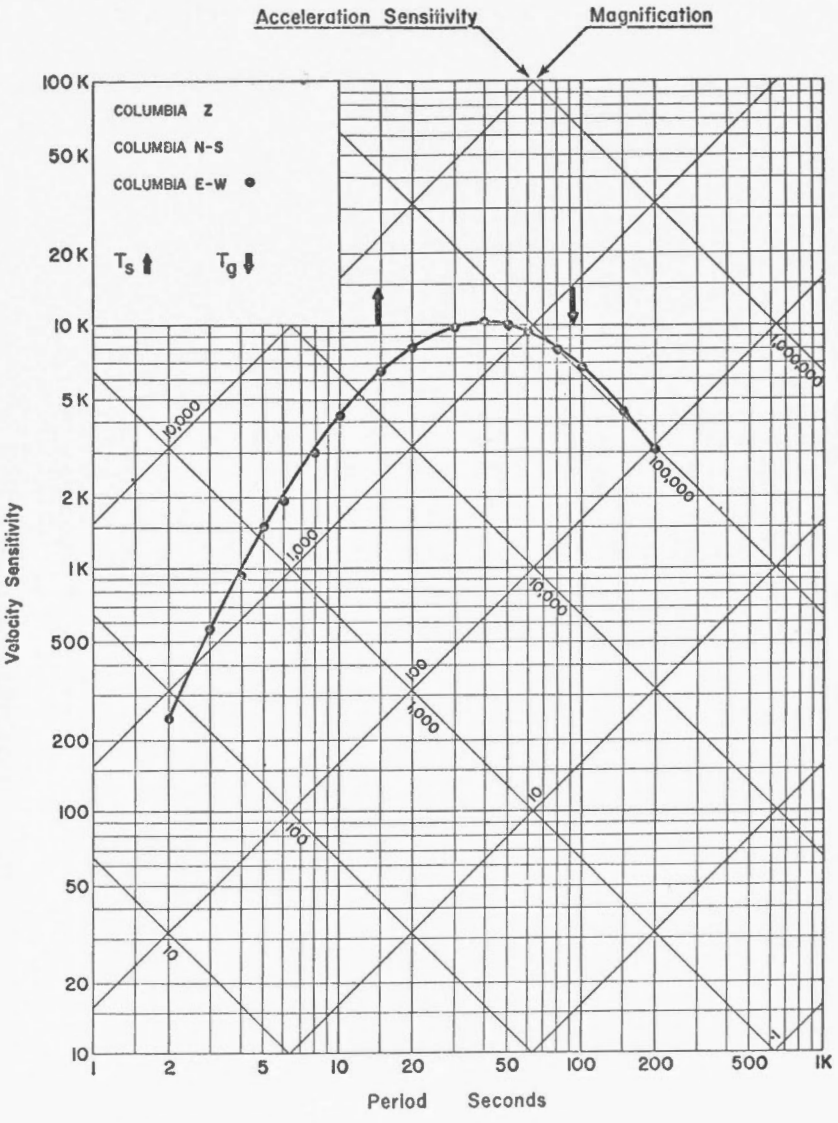
COLUMBIA N-S ● Mar. 1, 1969

COLUMBIA E-W

STATION: THUNDER BAY, ONT. (LHC)

ϕ= 48°25'N λ= 89°16'W Altitude 196M

Foundation: Precambrian, upper gunflint, iron formation



Dates of Calibration:

COLUMBIA Z

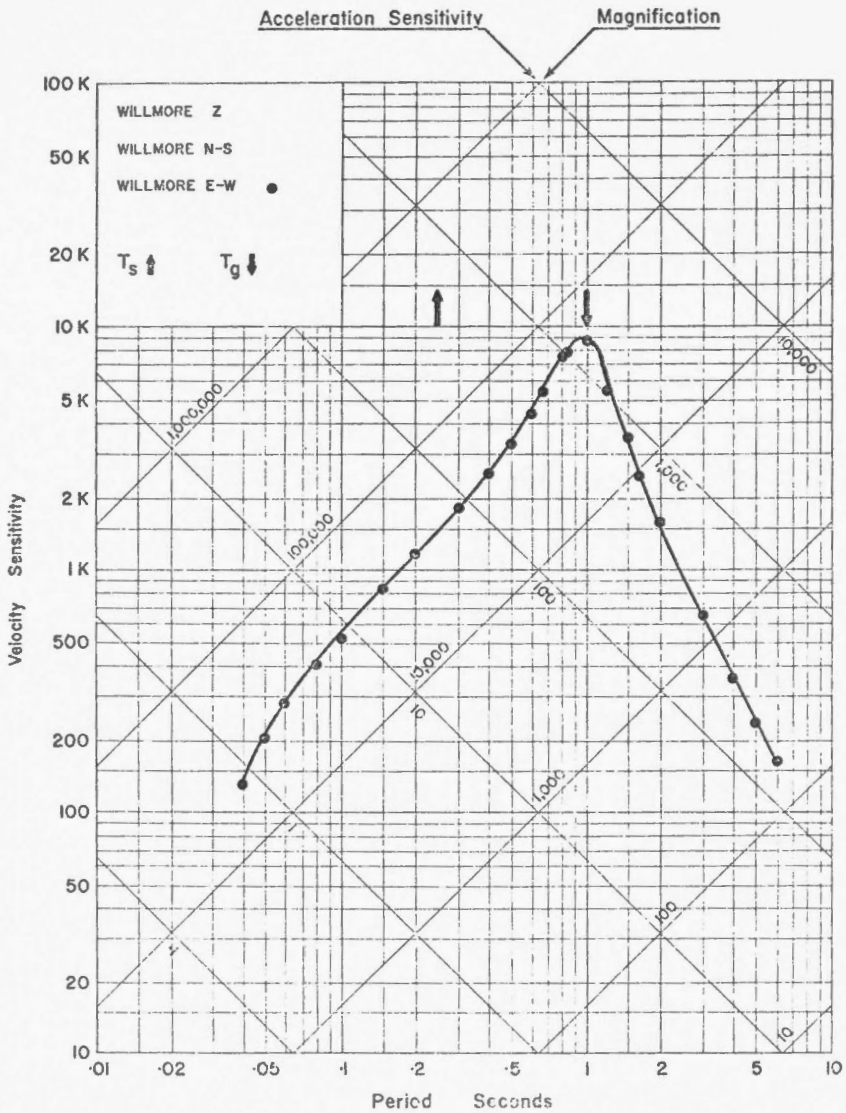
COLUMBIA N-S

COLUMBIA E-W • Mar. 2, 1969

STATION: **THUNDER BAY, ONT.** (Final) (LHC)

ϕ= 48°25'N λ= 89°16'W Altitude 196M

Foundation: Precambrian, upper gunflint, iron formation



Dates of Calibration:

WILLMORE Z

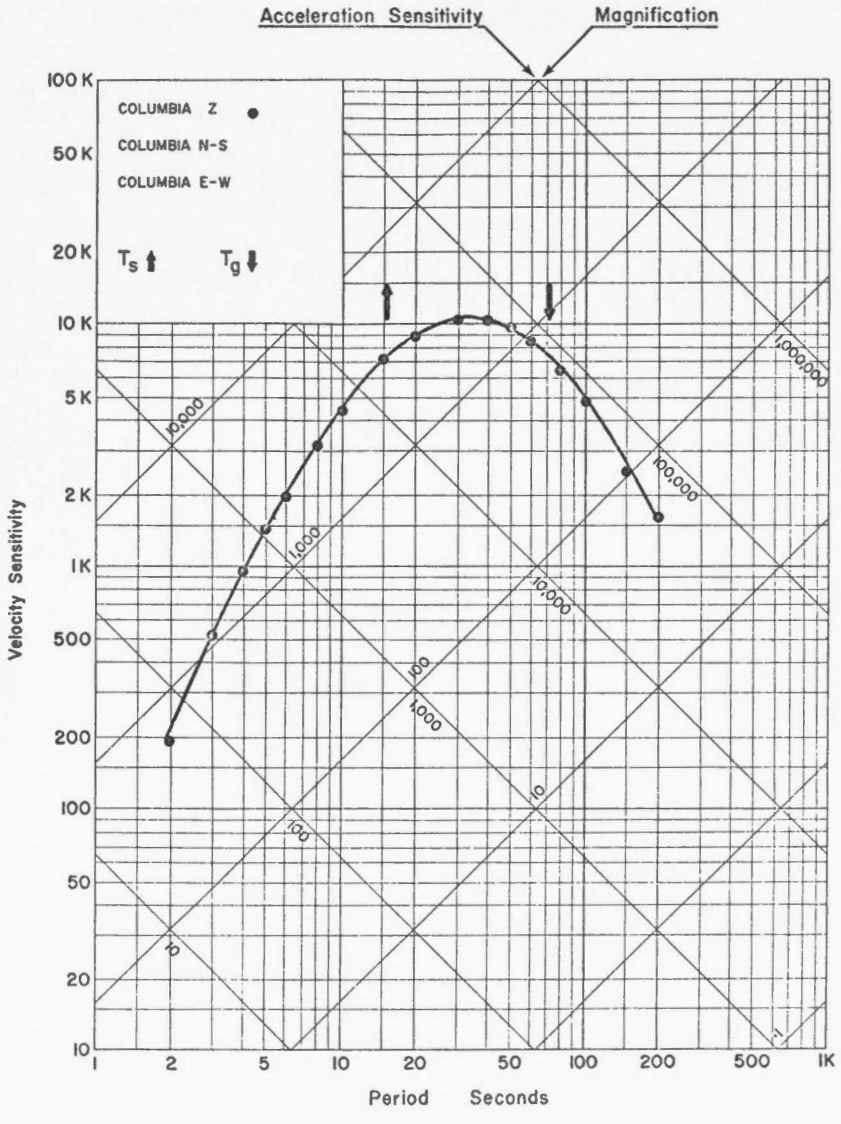
WILLMORE N-S

WILLMORE E-W • March 27, 1973

STATION: **THUNDER BAY, ONT.** (As found and left) (LHC)

ϕ= 48°25'N λ= 89°16'W Altitude 196M

Foundation: Precambrian, upper gunflint, iron formation



Dates of Calibration:

COLUMBIA Z ● March 27, 1973

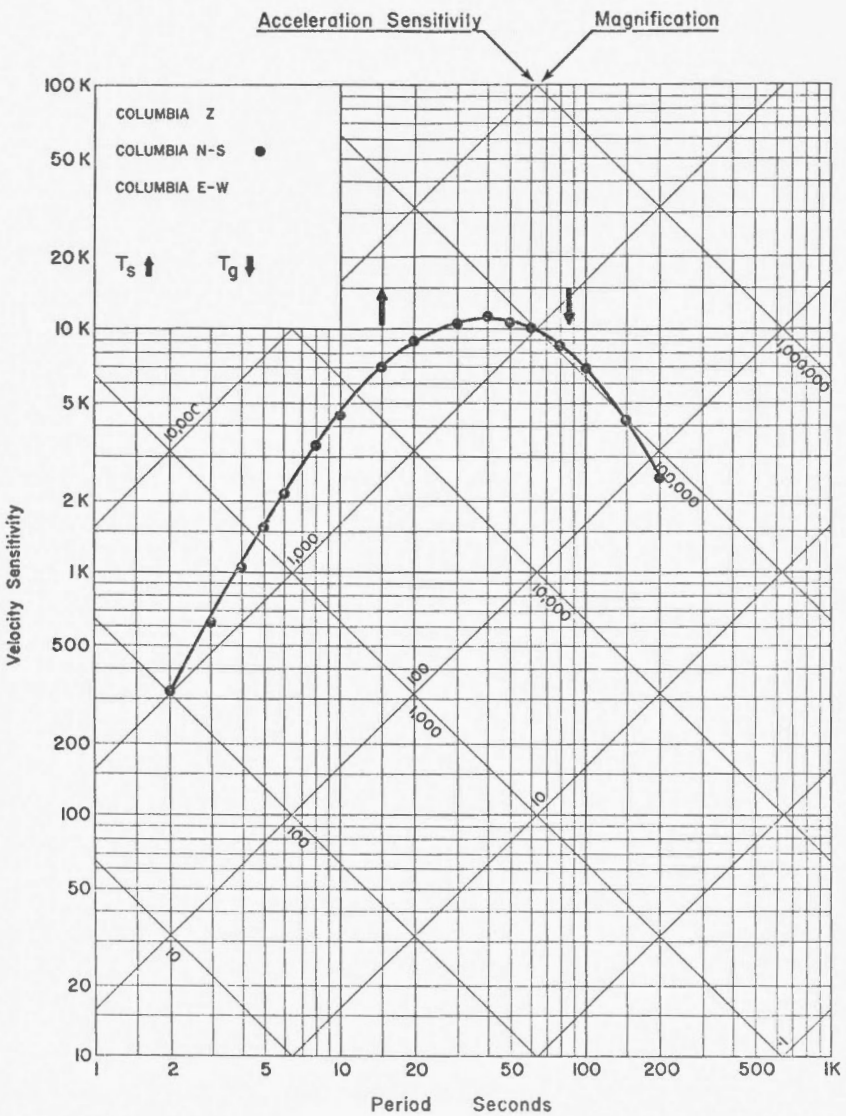
COLUMBIA N-S

COLUMBIA E-W

STATION: THUNDER BAY, ONT. (As found and left) (LHC)

ϕ= 48°25'N λ= 89°16'W Altitude 196M

Foundation: Precambrian, upper gunflint, iron formation



Dates of Calibration:

COLUMBIA Z

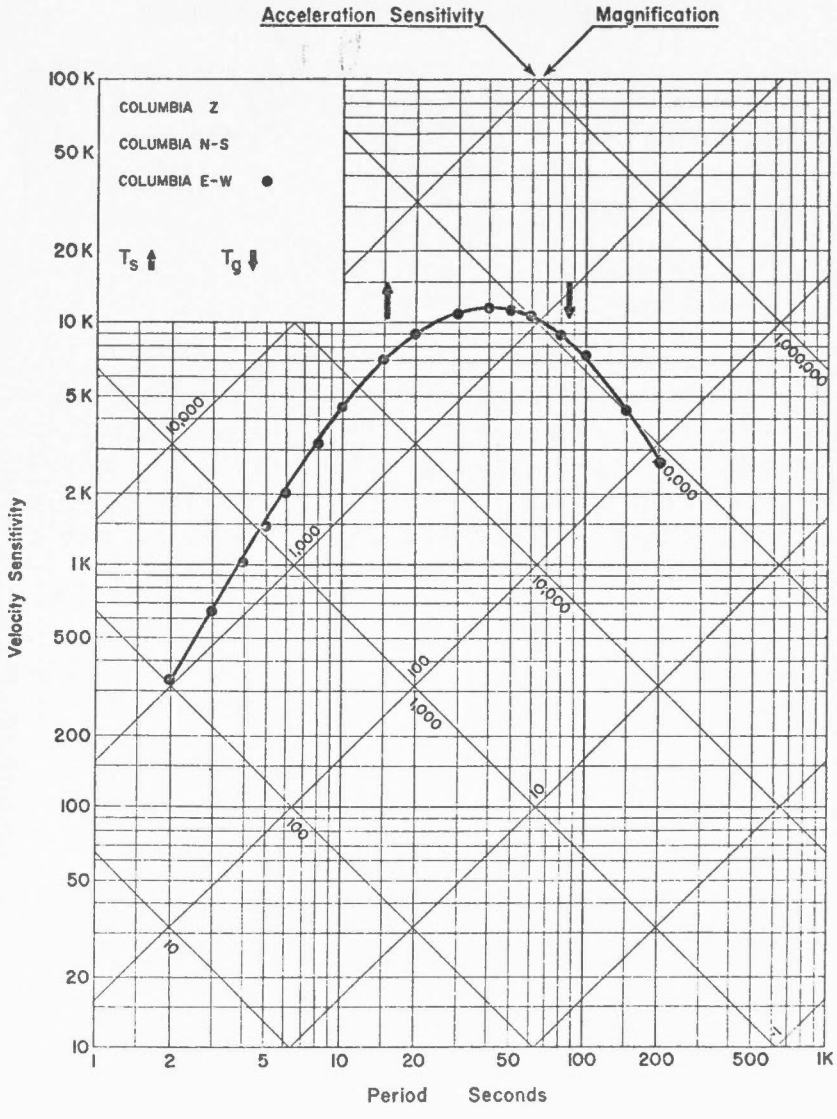
COLUMBIA N-S ● March 28, 1973

COLUMBIA E-W

STATION: **THUNDER BAY, ONT.** (As found and left) (LHC)

ϕ= 48°25'N λ= 89°16'W Altitude 196M

Foundation: Precambrian, upper gunflint, iron formation



Dates of Calibration:

COLUMBIA Z

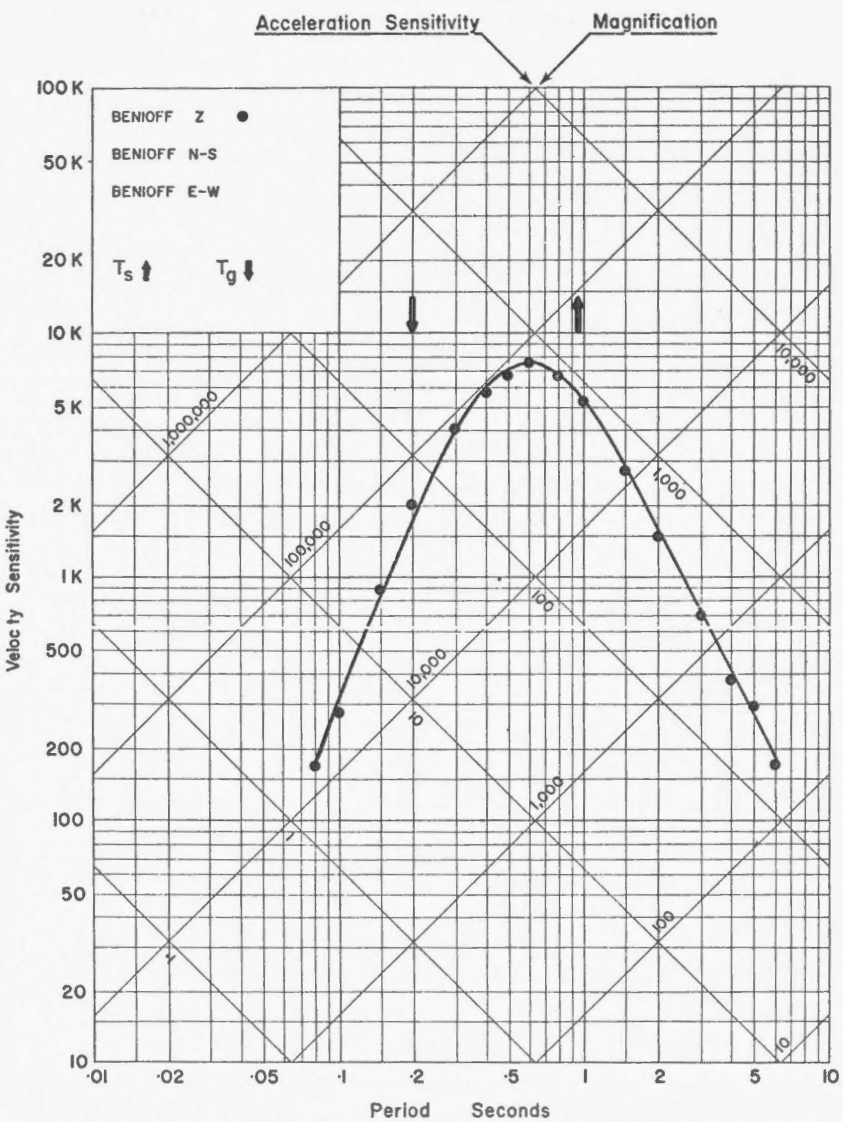
COLUMBIA N-S

COLUMBIA E-W • March 28, 1973

STATION: VICTORIA, B.C. (VIC)

ϕ= 48°31'10"N λ= 123°24'55"W Altitude 197 M

Foundation: Quartz-Diorite



Dates of Calibration:

BENIOFF Z ● Oct. 1, 1971

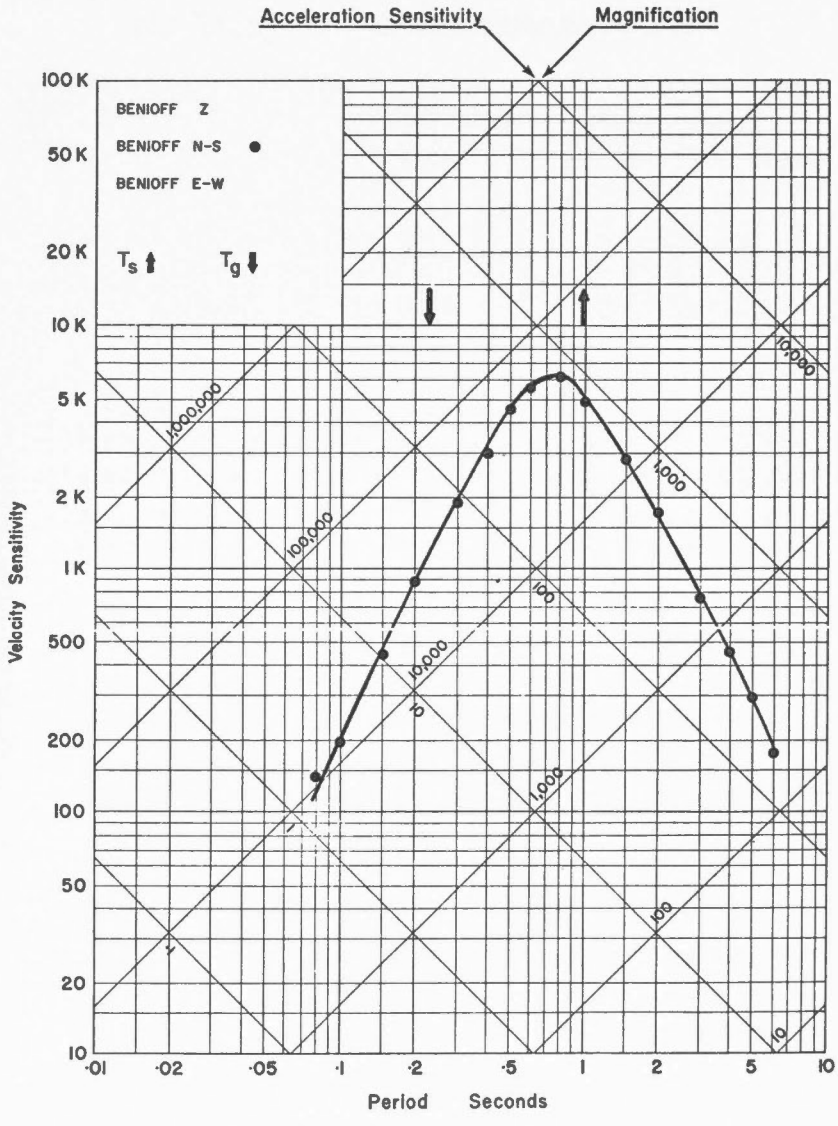
BENIOFF N-S

BENIOFF E-W

STATION: VICTORIA, B.C. (VIC)

ϕ= 48°31'10"N λ= 123°24'55"W Altitude 197 M

Foundation: Quartz Diorite



Dates of Calibration:

BENIOFF Z

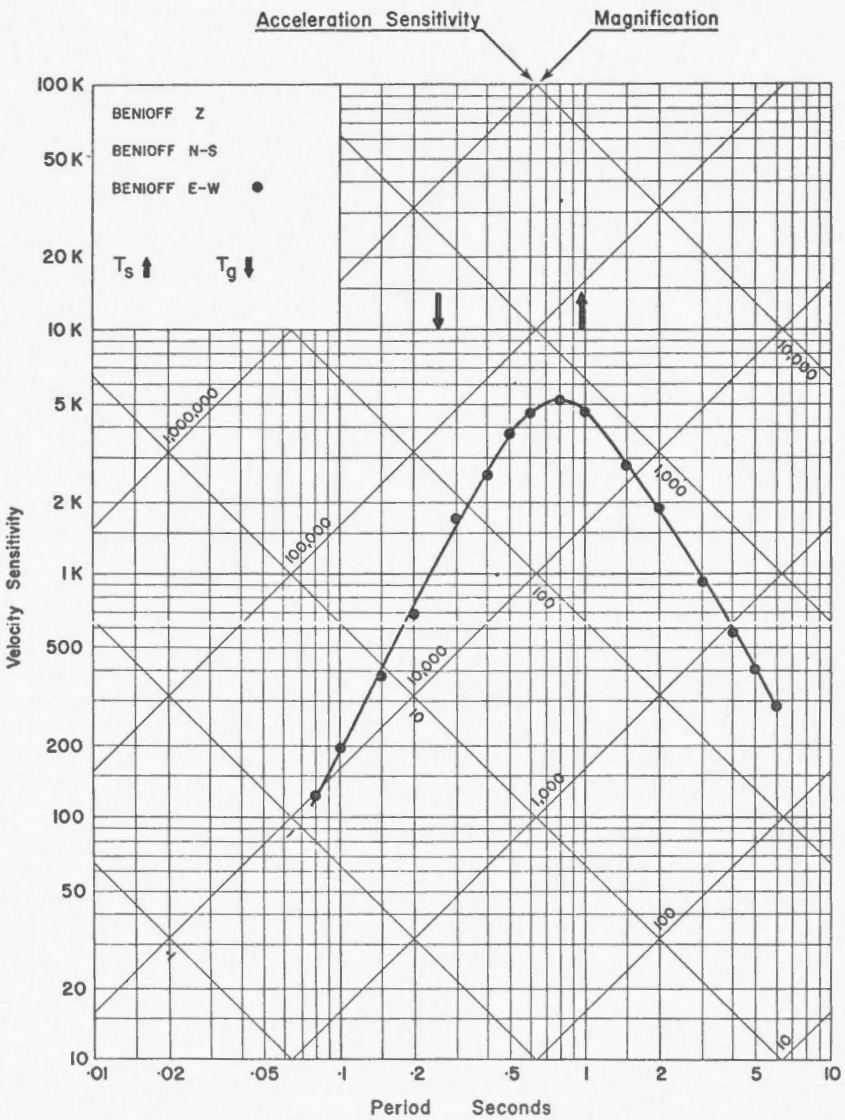
BENIOFF N-S ● Dec. 10, 1971

BENIOFF E-W

STATION: VICTORIA, B.C. (VIC)

ϕ = 48°31'10"N λ = 123°24'55"W Altitude 197 M

Foundation: Quartz Diorite



Dates of Calibration:

BENIOFF Z

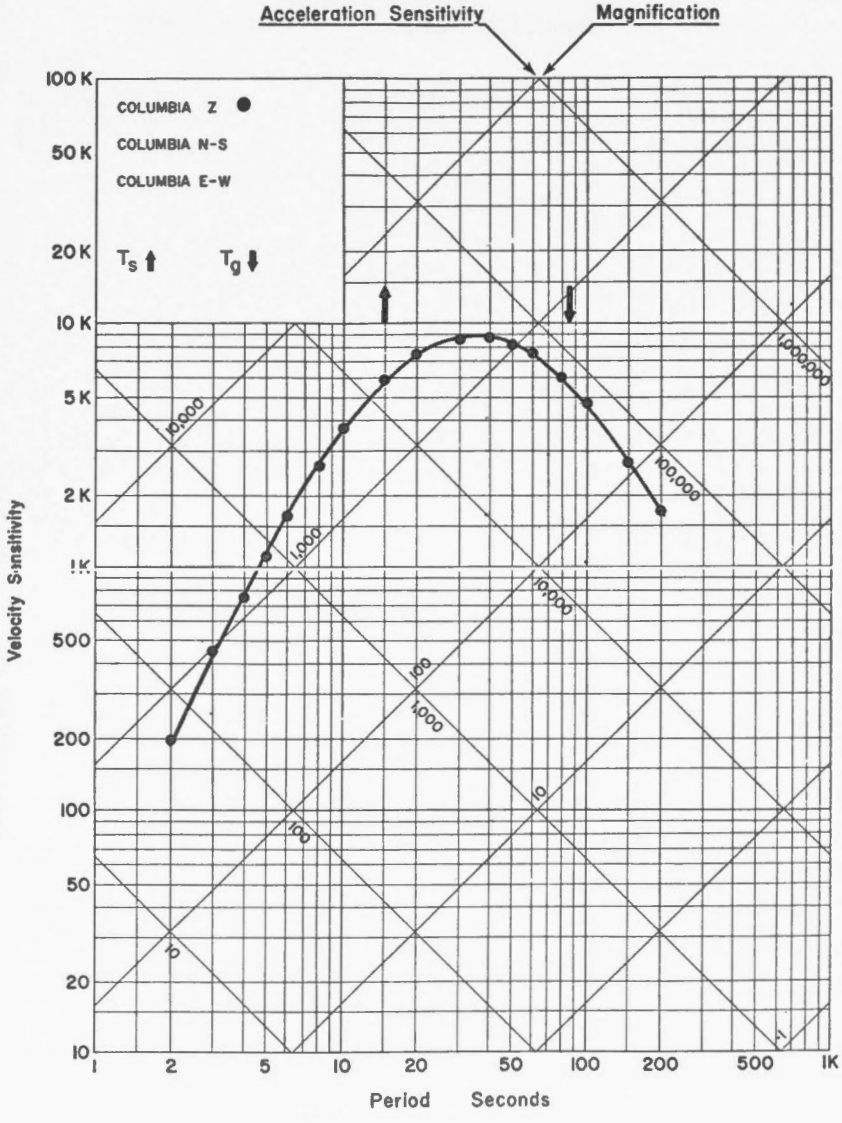
BENIOFF N-S

BENIOFF E-W ● Dec. 10, 1971

STATION: VICTORIA, B.C. (VIC)

ϕ= 48°31'10"N λ= 123°24'55"W Altitude 197 M

Foundation: Quartz Diorite



Dates of Calibration:

COLUMBIA Z ● Nov. 2, 1970

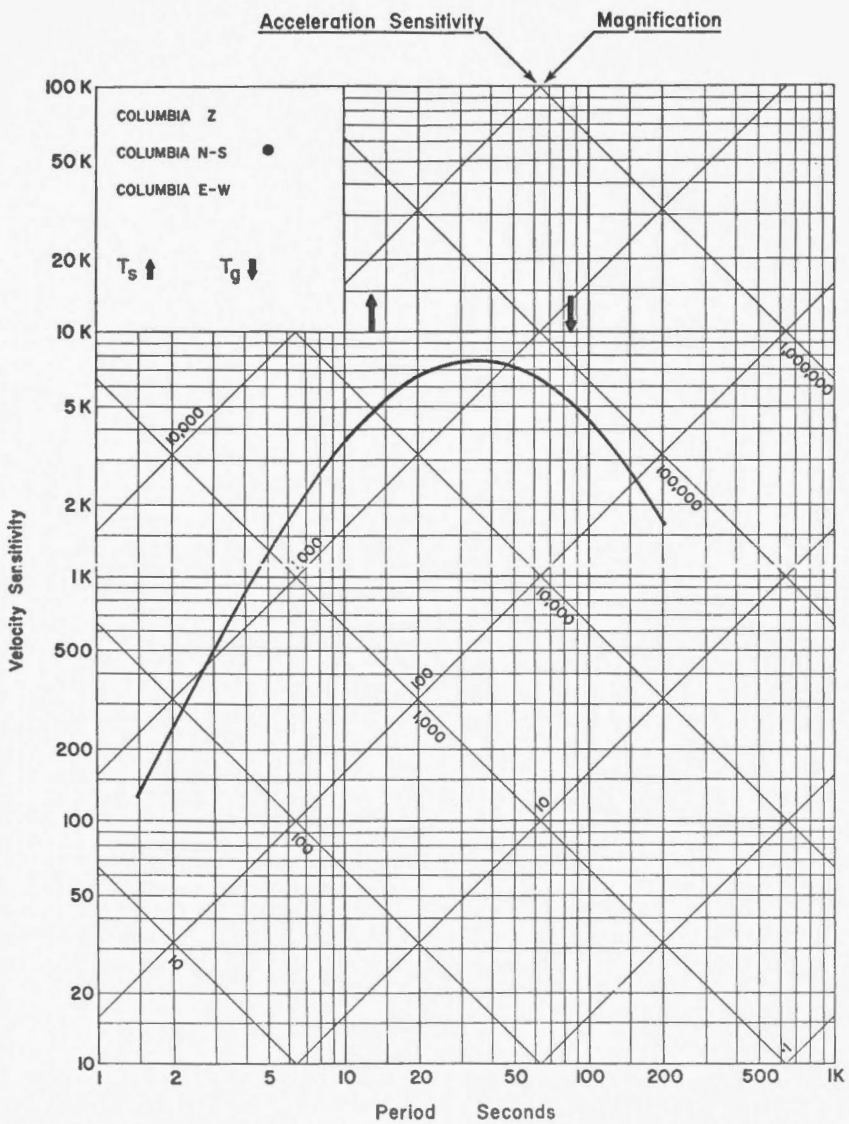
COLUMBIA N-S

COLUMBIA E-W

STATION: VICTORIA, B.C (VIC)

$\phi = 48^{o}31'10"N$ $\lambda = 123^{o}24'55"W$ Altitude 197 M

Foundation: Quartz Diorite



Dates of Calibration:

COLUMBIA Z

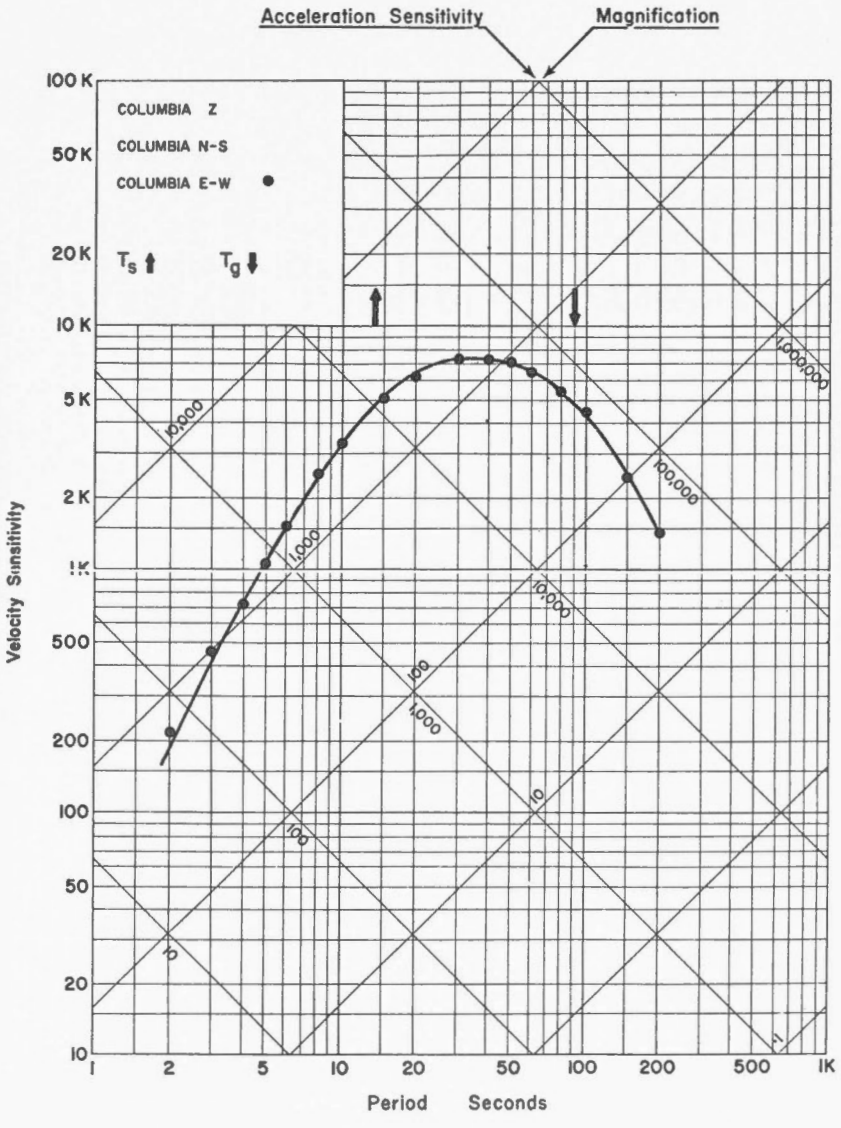
COLUMBIA N-S • Nov. 7, 1972

COLUMBIA E-W

STATION: VICTORIA, B.C. (VIC)

ϕ = 48°31'10"N λ = 123°24'55"W Altitude 197 M

Foundation: Quartz Diorite



Dates of Calibration:

COLUMBIA Z

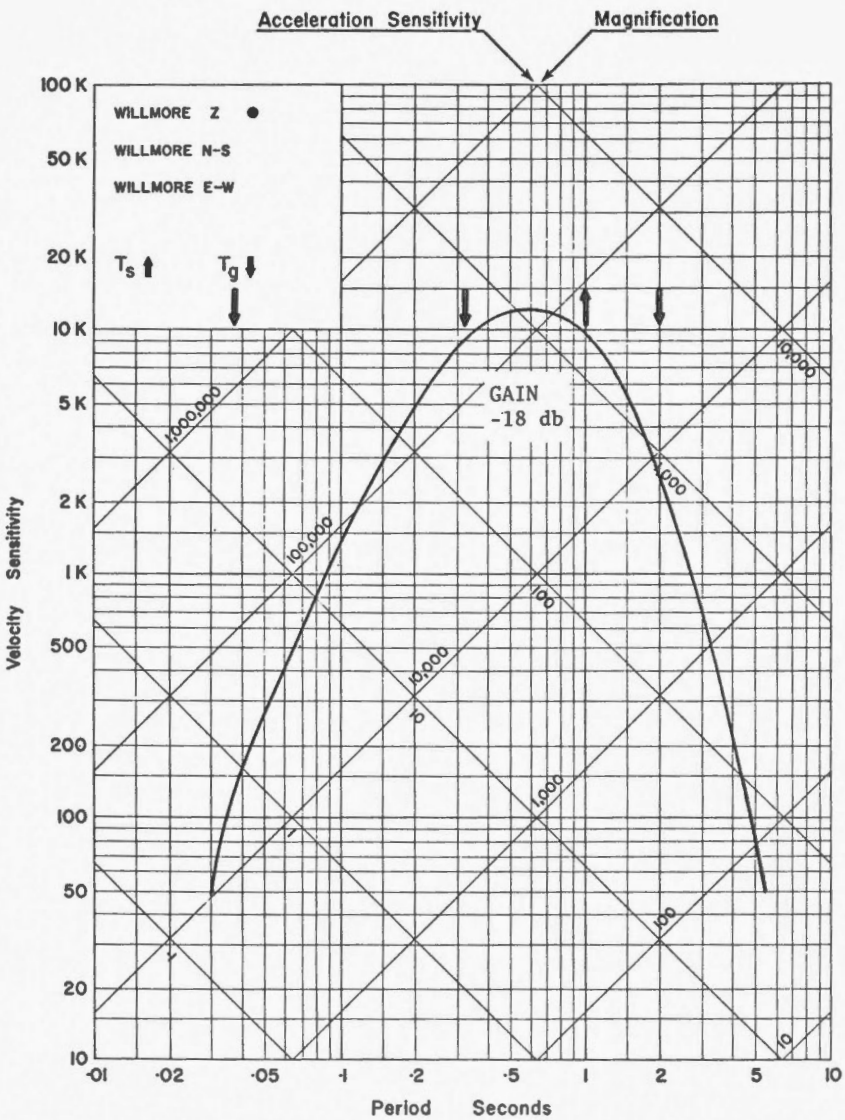
COLUMBIA N-S

COLUMBIA E-W ● Jan. 28, 1972

STATION: WHITEHORSE, Y.T. (WHC)

ϕ= 60°44.2'N λ= 135°05.9'W Altitude 732 M

Foundation: Granodiorite



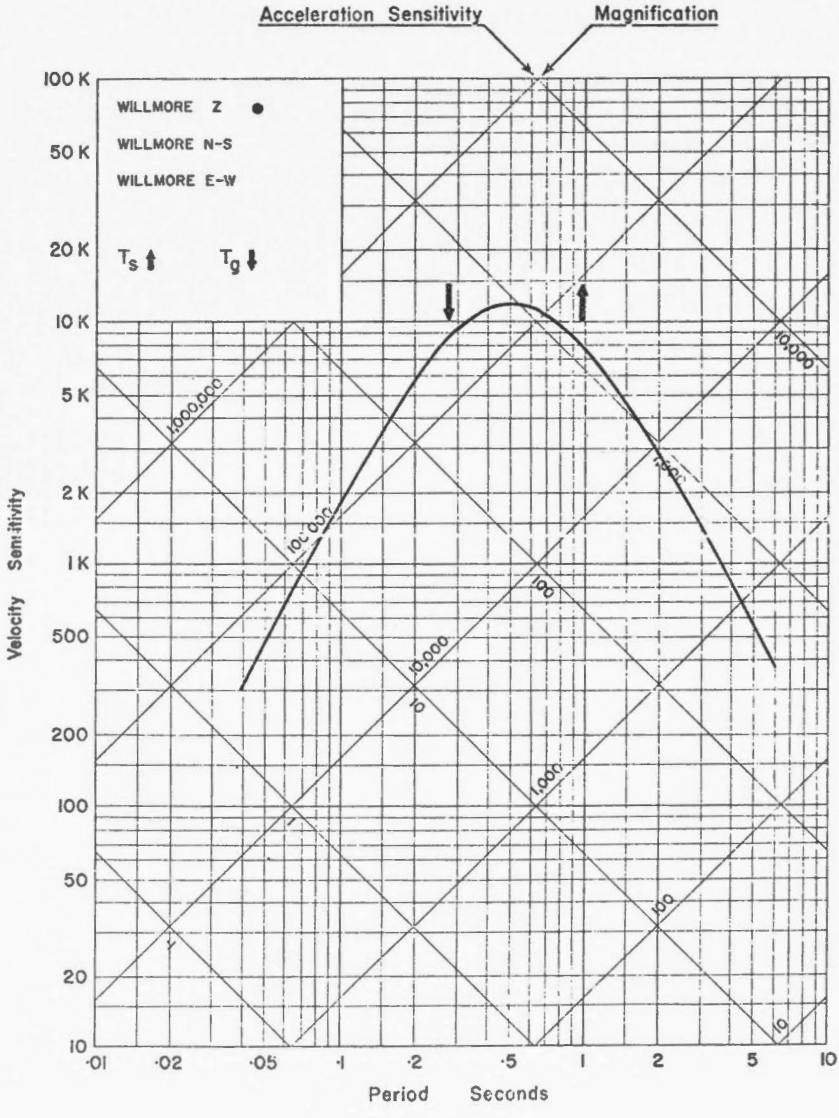
Dates of Calibration: Sept. 28, 1971

WILLMORE Z ● Operating with a Teledyne EA310 amplifier into helicorder.
WILLMORE N-S
WILLMORE E-W
Corner frequencies indicated by "T_g" arrows.

STATION: YELLOWKNIFE, N.W.T. (YKC)

ϕ= 62°28.7'N λ= 114°28.7'W Altitude 198 M

Foundation: Granite



Dates of Calibration:

WILLMORE Z ● 23 July 1971

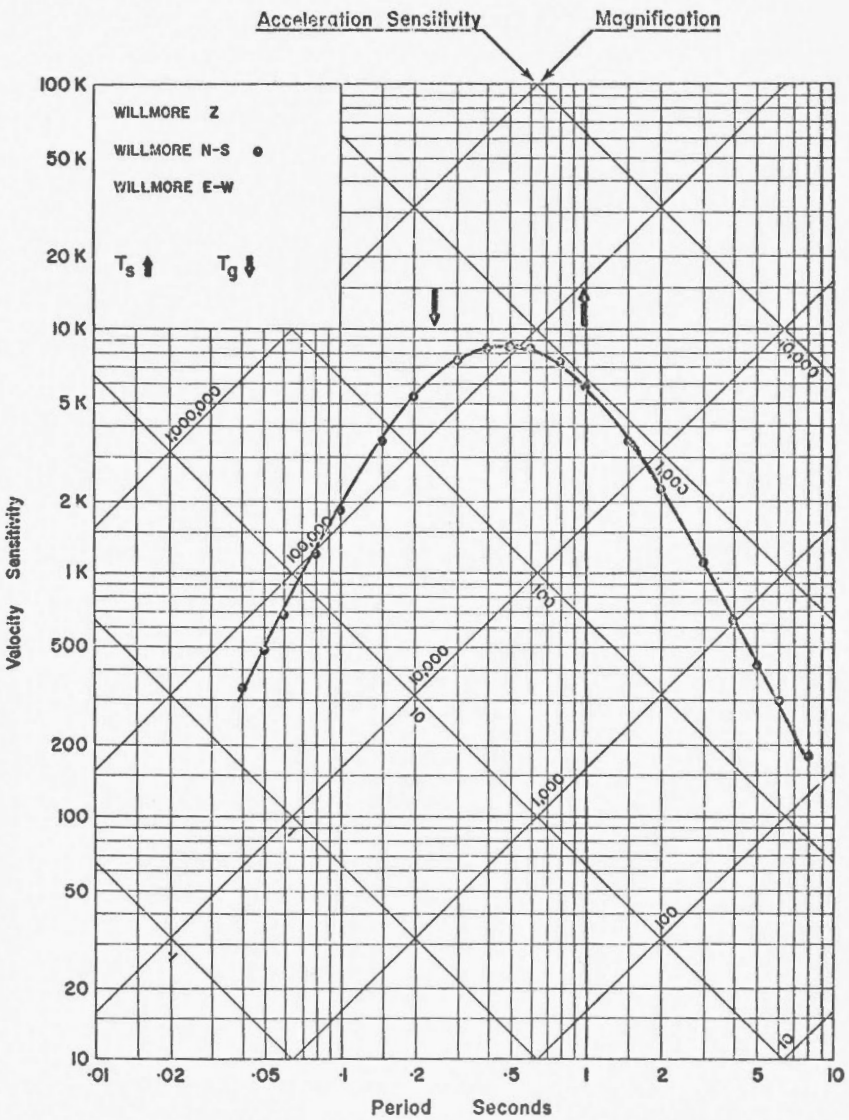
WILLMORE N-S

WILLMORE E-W

STATION: YELLOWKNIFE, N.W.T. (YKC)

ϕ= 62°28.7'N λ= 114°28.7'W Altitude 198M

Foundation: GRANITE



Dates of Calibration:

WILLMORE Z

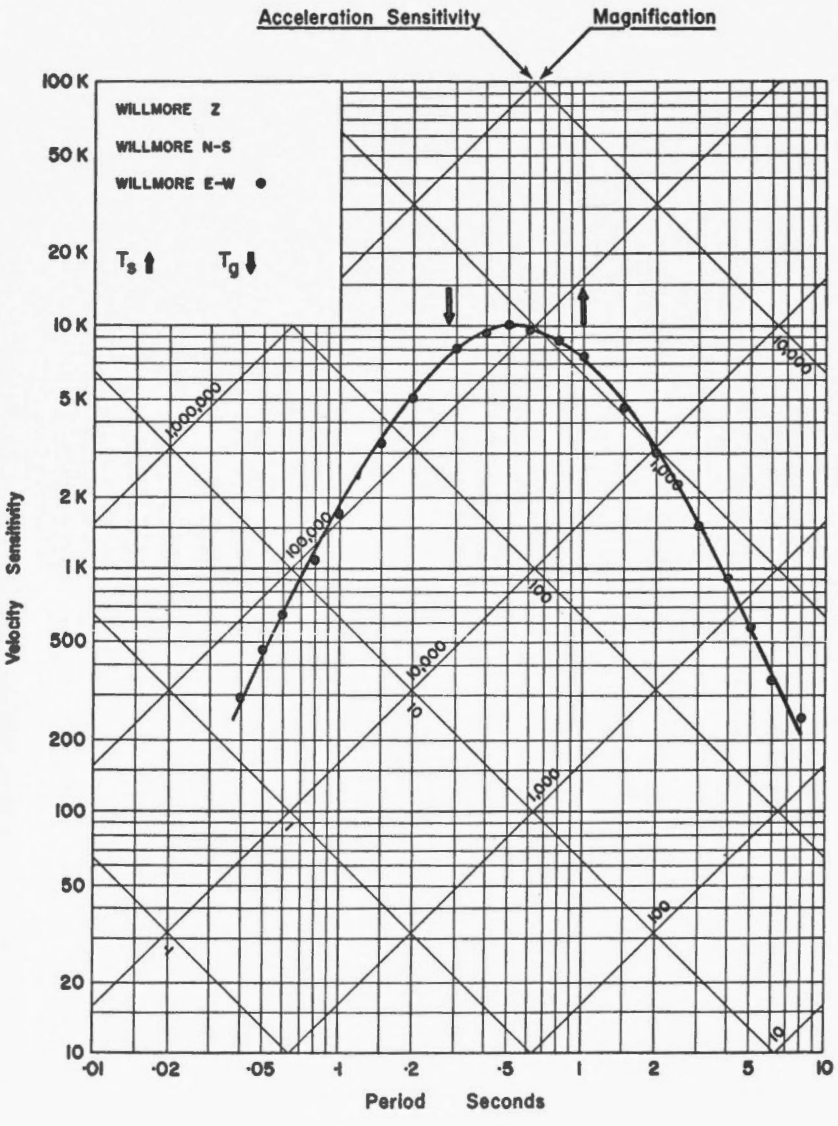
WILLMORE N-S • APRIL 17, 1969

WILLMORE E-W

STATION: YELLOWKNIFE, N.W.T. (YKC)

ϕ= $62^{O}28.7'$N λ= $114^{O}28.7'$W Altitude 198M

Foundation: GRANITE



Dates of Calibration:

WILLMORE Z

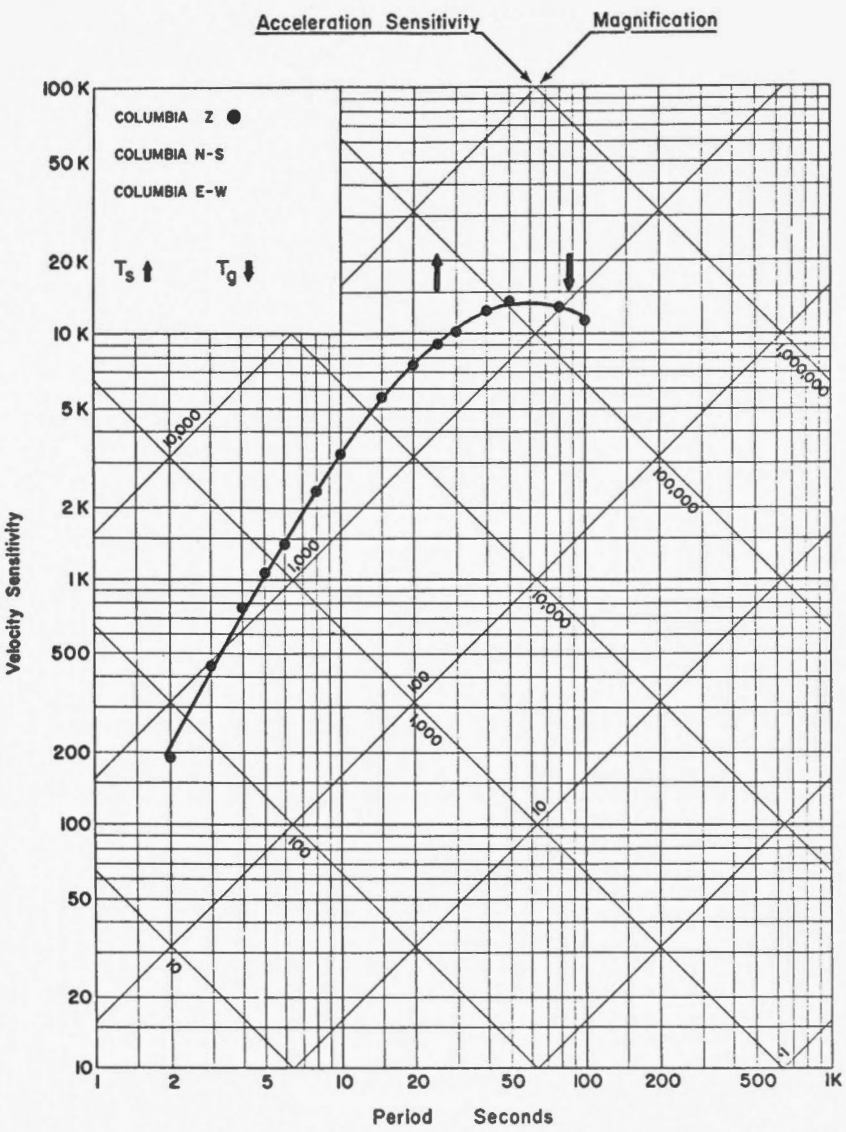
WILLMORE N-S

WILLMORE E-W • APRIL 17, 1969

STATION: YELLOWKNIFE, N.W.T. (YKC)

$\phi = 62^{o}28.7'N$ $\lambda = 114^{o}28.7'W$ Altitude 198 M

Foundation: GRANITE



Dates of Calibration:

COLUMBIA Z ● Feb. 5, 1971

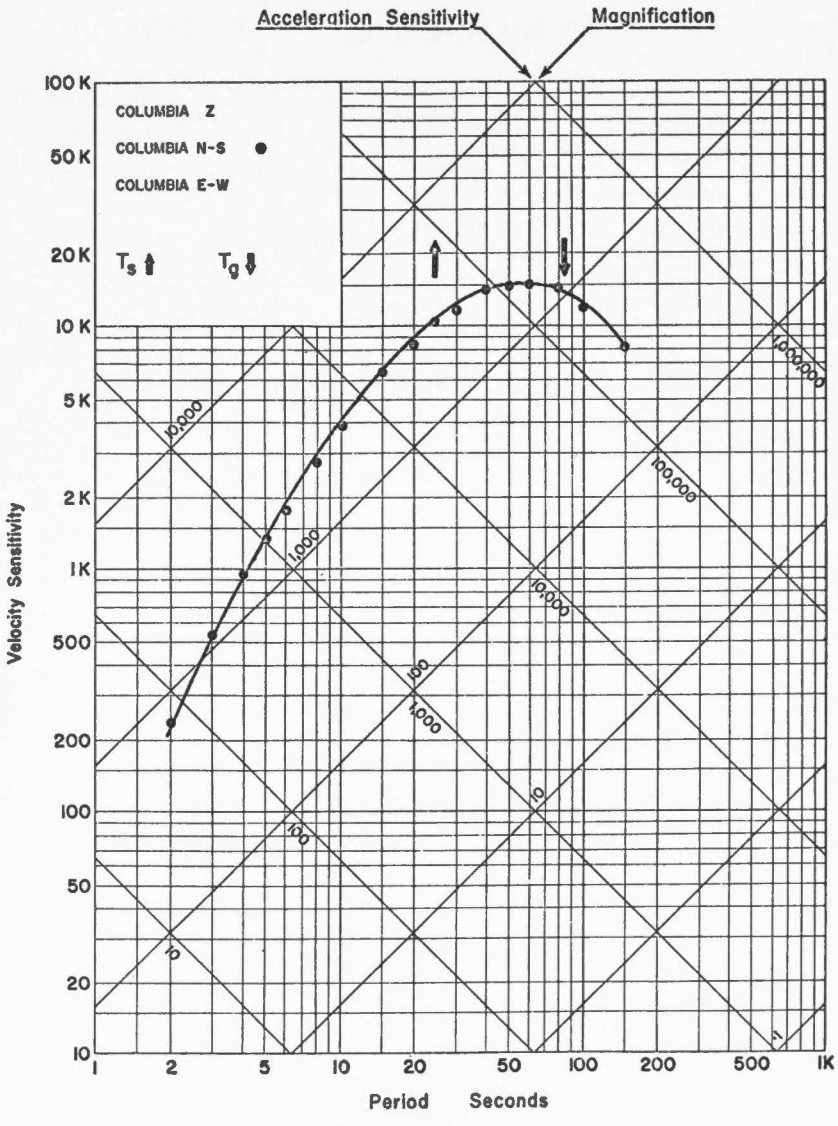
COLUMBIA N-S

COLUMBIA E-W

STATION: YELLOWKNIFE, N.W.T. (YKC)

ϕ= $62^{O}28.7'$N λ= $114^{O}28.7'$W Altitude 198M

Foundation:



Dates of Calibration:

COLUMBIA Z

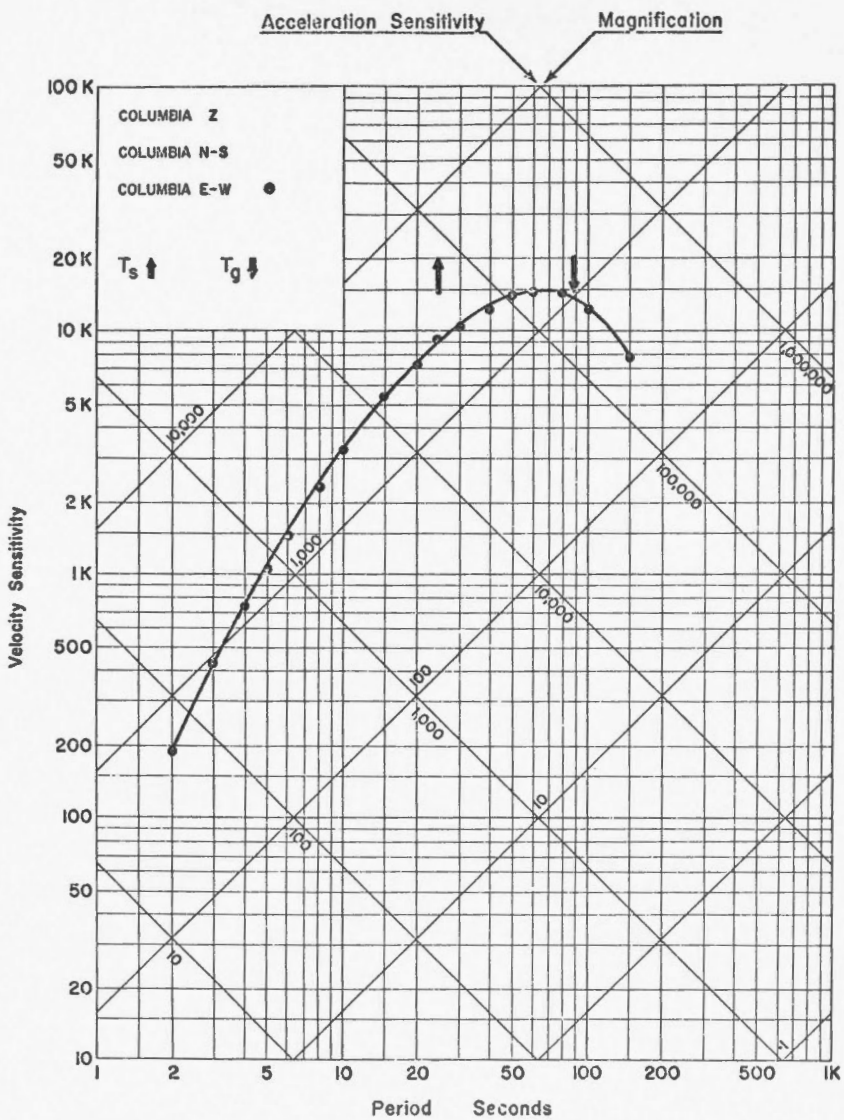
COLUMBIA N-S ● APRIL 21, 1969

COLUMBIA E-W

STATION: YELLOWKNIFE, N.W.T. (YKC)

$\phi = 62^{O}28.7'N$ $\lambda = 114^{O}28.7'W$ Altitude 198M

Foundation:



Dates of Calibration:

COLUMBIA Z

COLUMBIA N-S

COLUMBIA E-W • APRIL 22, 1969