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CHARLEVOIX GEODYNAMICS OBSERVATORY  
DATA INVENTORY (1979-1986)

by

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## 1. INTRODUCTION

The Charlevoix Geodynamics Observatory (Figure 1) was established in 1975 to study crustal processes in an intraplate seismic zone. The Observatory is located at latitude  $47.55^{\circ}$  north, longitude  $70.33^{\circ}$  west, approximately 200-km north-east of Quebec City and in the south-western part of a 150-km by 40-km seismic zone centered over the St. Lawrence River at La Malbaie.

Although the Observatory was closed in April, 1986 the continuous, long-term measurement programs carried out at the Observatory over the years have generated extensive data which will remain of interest for an indeterminate period. The present report is an inventory and location guide for the data and for the computer programs which have been used to access, reduce and interpret them, and for other related documents. Experimental programs at the Observatory (refer to Figure 1) have included: surface mounted tilt and strain measurements (in the vault); borehole-emplaced tilt measurements (BT1, BT2 and BT3); borehole water level measurements (OBS: W1, W2, W3, W4); and special-order levelling measurements (levelling array). Temperature and atmospheric pressure were also measured and recorded. The borehole-emplaced tilt measurements were carried out by Dalhousie University (Peters and Beaumont, 1987), and only a 25-hour-interval subset of these data has been retained by this Division (Section 8).

The surface tilt and strain measurements were carried out in a vault excavated to bedrock at a depth of 1 m and backfilled to a level 4 m above the ground surface. Three A.N.A.C mercury-level tiltmeters installed on two concrete piers 10 m apart recorded tilt in the azimuth N52E and in azimuth N142E. The borehole tiltmeter installation consists of the three boreholes BT1, BT2 and BT3 forming a triangle approximately 80 m on a side. BT1 and BT2 were developed in October 1979 to a depth of 47 m and were instrumented for the interval November 1981 to March 1986. BT3 was completed in July 1982 to a depth of 110 m and was instrumented from September 1983 until March 1986. The borehole tiltmeters are Bodenseewerk Gbp10 (formerly Askania) biaxial borehole tiltmeters.

Continuous water-level measurements were carried out in observation boreholes (OBS) W1, W2 and W3. These measurements are referred to as W1L, W2L and W3L respectively, and were made using capacitive-wand type transducers which were designed and built in-house.

The bulk of the numerical data and all computer programs are stored on 5 1/4" PC diskettes. Other data, identified in this report, are stored on 9-track tapes and CYBER permanent files (UPDATE files) at the Computer Service Centre, 588 Booth St. The data referred to in the Appendix, together with the PC diskettes (including backup diskettes) are currently in the custody of D. R. Bower.

2. OBSERVED TILT AND WATER LEVEL DATA

The 9-track tapes referred to in this section are stored in the tape library of the departmental Computer Service Centre, 588 Booth St.

The remaining data of this section are stored on 5 1/4" PC diskettes in ASCII code and should be usable by any IBM PC or XT compatible computer.

2.1 Copied Cassette Data on 9-Track Tapes

Reel No.	Label	Description
ER3069	CASS05279T09479	Original Cassette Data (Multi-channels)
E13110	CASS14479T19879	" " " "
E14357	CASS19979T24879	" " " "
ER2050	CASS24879T27679	" " " "
ER2059	CASS27679T02980	" " " "
ER6791	CASS02980T08580	" " " "
ER9325	CASS05279T14180 (a)	" " " "
ER9332	CASS02980T14180 (b)	" " " "
ER4201	CASSTP14780T15580	" " " "
ER1630	CASSTP12191T17781	" " " "
ER6027	CASSTP19081T24581	" " " "
E14888	CASSTP25881T35581	" " " "
E13080	CASSTP01182T08282	" " " "
ER4509	CASSTP08982T18082	" " " "
ER3776	CASSTP18782T30682	" " " "
ER3436	CASSTP30782T09283	" " " "
ER7765	CASSTP11783T28683	" " " "
ER9101	CASSTP29183T04584	" " " "
E22591	CASSTP05284T15184	" " " "
ER5250	CASSTP16584T26884	" " " "
E12915	HRW03581T30381	Hourly Water Level (W.L.) values.
ER6852	HRW03581T30381	Back-up of E12915.
ER1520	DECW29078T02480	Decimated 10-min W.L. values.
ER3859	DECW29078T02480	Back-up of ER1520
ER4026	CX1VL1DEC10430381	Decimated surface tilt data from vault.
ER1208	CX1DEC07681T23781	" " " " " "

2.2 AGOS Data on 9-Track Tapes

Reel No.	Label	Description
E18187	AGOSTP33281T32082	(back up)
ER4524	AGOSTP33281T32882	Multi-channel Data
ER6739	AGOSTP33282T31983	(back up)
ER6655	AGOSTP33282T32683	Multi-channel Data
ER4837	AGOSTP33483T31884	(back up)

E18202	AGOSTP33483T32584	Multi-channel Data
ER2216	AGOSTP33384T32485	(back up)
E23486	AGOSTP33384T33085	Multi-channel Data
E22999	AGOSTP33185T08086	(back up)
ER8047	AGOSTP33185T09286	Multi-channel Data

The period of time spanned by each of the tapes is represented in the label name. The last tape for example spans the period: day 331, 1985 through day 092, 1986.

## 2.2 Hourly Water Level Data (W1L) on PC Diskette: CHXOBSW1L

FILE NAME	SIZE	COMMENTS
=====	=====	=====
FAT28783 CYB	4608	Days 287-312. Large diameter probe used in temporarily in W1L to decrease normal draining effect of this borehole on formation.
W1L00479 CYB	30848	Days 004-269. Calibrated but no datum.
W1L00181 CYB	39680	Days 001-365. Distance to water in mm.
W1L00182 CYB	43520	Days 001-365. Distance to water in mm.
W1L00183 CYB	55296	Days 001-365. Distance to water in mm.
W1L06784 CYB	24576	Days 067-366. Distance to water in mm.
W1L00185 CYB	42752	Days 001-365. Distance to water in mm.
W1L00186 CYB	5504	Days 001-033. Distance to water in mm.

## 2.3 Hourly Water Level (W2L) and Atmos. Pressure Data: CHXOBSW2L

FILE NAME	SIZE	COMMENTS
=====	=====	=====
PCX18679 CYB	12032	Days 186-258. Atmos. Press. in mv.
PCX33781 CYB	4864	Days 337-365. Atmos. Press. in mv.
PCX00182 CYB	29568	Days 001-262. Atmos. Press. in mv.
PCX30182 CYB	10752	Days 001-262. Atmos. Press. in mv.
PCX00185 CYB	11520	Days 001-070. Atmos. Press. in mv.
PCX33085 CYB	6016	Days 330-365. Atmos. Press. in mv.
PCX00186 CYB	13056	Days 001-079. Atmos. Press. in mv.
W2L00479 CYB	9344	Days 004-063. Calibrated but no datum.
W2L11579 CYB	29440	Days 115-364. Calibrated but no datum.
W2L03881 CYB	41856	Days 038-365. Calibrated but no datum.
W2L00182 CYB	32896	Days 001-240. Calibrated but no datum.
W2L00184 CYB	54528	Days 001-366. Distance to water in mm.
W2L00185 CYB	35200	Days 001-365. Distance to water in mm.
W3L31578 CYB	6400	Days 315-362. Shallow well.
W3L33781 CYB	4864	Days 337-365. Calibrated but no datum.
W3L00182 CYB	26880	Days 001-239.
W3L06084 CYB	18304	Days 060-191. Distance to water in mm.

### 3. DATA STORED ON COMPUTER SERVICE BUREAU UPDATE DISK FILES

UPDATE is a Control Data Corporation utility described in the UPDATE Reference Manual, available from the Computer Service Centre.

#### 3.1 Data Stored in the File: UPCHXJANETDATA

The data of this section are stored also on PC diskettes (see Section 2).

File Name	Comments
=====	=====
W1LA00479	
W1LA00181	
W1LB05581	See
W1LA00182	
W1LA00183	Section
W1LB28783	
W1LA06784	2.
W1LA00185	
W1LA00186	
W2LA00479	
W2LA11579	
W2LA03881	
W2LB05581	
W2LA00182	
W2LA00184	
W2LA00185	
W3LA31578	
W3LA33781	
W3LA00182	
W3LA06084	
PCXA18679	
PCXB05581	
PCXA33781	
PCXA00182	
PCXA30182	
PCXA33085	
PCXA00186	

3.2 Data Stored in the File: ANACTILTDATAHR

Note that these data are not duplicated elsewhere.

File Name	Comments
=====	=====
T13A00180	
T13A00181	
T13A00182	
T13A00183	
T13A00184	
T14A00180	
T14A00181	
T14A00182	
T14A00183	
T14A00184	
T18A00180	
T18A00181	
T18A00182	
T18A00183	
T18A00184	



4. PROGRAMS AND DATA RELATED TO MANUALLY OBSERVED AND PREDICTED WELL LEVELS ON PC DISKETTE..

4.1 Contents of Volume Label: CHXMETWELL

FILE NAME	SIZE	COMMENTS
CXPRE79 CYB	12032	Hourly values of atmospheric pressure in millivolts.
CXPRE82 CYB	4608	Hourly values of atmospheric pressure in millivolts.
CXPRE82A CYB	6272	Hourly values of atmospheric pressure in millivolts.
CXPRE85 CYB	6016	Hourly values of atmospheric pressure in millivolts.
CXPRE86 CYB	13056	Hourly values of atmospheric pressure in millivolts. (1 mv = 1.631 Pascals) See 1986 diary for Calibration details.
CONV CYB	2503	Program which reads met data input (MET8086) and outputs CONVOLIN.
CONVOL CYB	6076	Program which reads CONVOLIN and outputs predicted water level in a file with the name: HYDW1Lnn where nn are the last two digits of the year.
CONVOLIN DAT	19109	Output from pgm CONV with DEPTHnm as input. This file contains all available data 80-86. Used as input for pgm CONVOL. See pgm listings for details.
DEPTH76 DAT	1355	Day, hour and predicted depth to water (W1L)
DEPTH77 DAT	1351	"
DEPTH78 DAT	1351	"
DEPTH79 DAT	436	Day, hour and observed depth to water (W1L).
DEPTH80 DAT	451	"
DEPTH81 DAT	826	"
DEPTH82 DAT	1066	"
DEPTH83 DAT	796	"
DEPTH84 DAT	1081	"
DEPTH85 DAT	571	"
DEPTH86 DAT	121	"
HYDW1L77 CYB	2543	Predicted depth to water for W1l determined by pgms CONV AND CONVOL (see above) from observed met data (MET8086) for the years 1977 THROUGH 1985.
HYDW1L78 CYB	2543	
HYDW1L79 CYB	2543	
HYDW1L80 CYB	2543	

HYDW1L81	CYB	2543
HYDW1L82	CYB	2543
HYDW1L83	CYB	2543
HYDW1L84	CYB	2543
HYDW1L85	CYB	2543

MET1980	DAT	23706	All MET files are of form:
MET1981	DAT	21351	I4 (Year), I2 (Month), I2 (Day)
MET1982	DAT	23507	I4,I4 (Max and Min temps in .1 deg C.)
MET1983	DAT	23376	I4 (Rain in mm), I4 (Snow in mm),
MET1984	DAT	13861	I8 (Not used), I4 (Snow on ground in cm.)
MET1985	DAT	6869	
MET1986A	DAT	3725	

MET8086	CYB	78453	The met files (MET1980 etc) arranged as a continuous stream for input to pgm CONV.
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5. COMPUTER PROGRAMS (CSB FORTRAN) STORED ON PC DISKETTES

5.1 Index of Programs on Volume Label: CHXPGMS01

FILE NAME	SIZE	ORIGIN	COMMENTS
=====	=====	=====	=====
AGOSPLOT CYB	7040	6-03-86	Plots selected data channels on standard AGOS tape and plots according to given given parameters (see calling program).
BETTAGOS CYB	39552	6-05-86	Reads data from selected channel of AGOS tape. Detects steps and isolated bad values which can then be edited in subsequent runs. There are many versions of this basic program.
BETCALLA CYB	1664	6-05-86	Calling program to use BETTYAGOS showing typical specification cards etc.
BETTDEC CYB	36255	9-11-86	Version of the basic BETTY program which reads directly from CASS tapes.
DECASSSC CYB	1792	6-03-86	Calling program to us DECIM. Shows input title cards required to activate proper channels. Preparing these title cards requires knowledge of the channels used in a particular experiment (determined for instance by SUMMARY) as well as their titles. The channel titles are given in the Experiment Descriptions included in this report.
DECIM CYB	19072	6-05-86	Reads standard 1-min data tapes (CASS tapes) and produces filtered (Kalman filter) 10-minute samples.
JANJUL10 FTN	19133	7-10-86	Source program JANET reads BETTY type input data with specifications and calculates tidal response. Several modes of use. Can subtract calculated tides from input and output residual. Used with IBM Professional Fortran Compiler.
LISTHRS CYB	3828	9-11-86	This is a version of READHRCR program above but with interesting features. It is set up to read DECW29078T02480 (ER3859) and output hourly values to a disk file which was then read by program BETTYDEC.
SHOW5 CYB	8448	6-03-86	Plots selected channels directly from standard CASS 1-min or 10-min data tapes. There are many versions of this basic program.
SUMMARY CYB	902	9-10-86	Lists names of individual records on CASS (binary) tapes and shows channel use.

PLOTAGOS CYB 1024 6-03-86 Calling program for AGOSPLOT. Shows typical input specifications.

READHRCR CYB 8192 6-03-86 This program reads a standard binary CASS tape (decimated or not), selects on-hour values and outputs, still in binary.

5.2 Index of Programs on Volume Label: CHXPGMS02

BESSEL	CYB	3584	8-06-86	10:38a
BESTEST	CYB	1536	8-06-86	10:39a
BESWANG	CYB	3712	8-06-86	10:42a
BETDEC79	CYB	2966	9-11-86	8:14p
FRAC1	CYB	11904	6-03-86	2:30p
GLOBA	CYB	53120	6-03-86	10:11a
INDEX		1043	9-18-86	11:35a
INDEX	BAK	1042	9-18-86	11:35a
LAUSTERO	CYB	384	6-03-86	12:05p
LAUTVLOG	CYB	384	6-03-86	11:57a
LISTHRS	CYB	3878	9-11-86	8:31p
MAKESIBM	CYB	896	6-03-86	9:56a
MAKESLSI	CYB	1152	6-03-86	9:57a
PLOTGEN	CYB	2560	6-03-86	11:34a
POLLARD	CYB	40576	6-03-86	11:42a
QUAKE	CYB	2176	6-03-86	11:45a
QUAKE2	CYB	2944	6-03-86	11:47a
RESWANG	CYB	5504	6-03-86	11:55a
SUMMARY	CYB	902	9-10-86	10:19p
TEMP		0	9-18-86	11:37a
TENS01	CYB	2574	8-06-86	1:49p
TENSM2	CYB	2574	8-06-86	1:49p
TENSOR	CYB	14336	6-03-86	12:10p
WANGEQN	CYB	5632	6-03-86	2:33p
WSTRESS	CYB	13696	6-03-86	12:13p

5.3 Index of Programs on Volume Label:CHXMETWELL

FILE NAME		SIZE	COMMENTS
=====		=====	=====
CONV	CYB	2503	Program which reads met data input (MET8086) and outputs CONVOLIN.
CONVOL	CYB	6076	Program which reads CONVOLIN and outputs predicted water level in a file with the name: HYDWI1nn where nn are the last two digits of the year.
CONVOLIN	DAT	19109	Output from pgm CONV with DEPTHnm as input. This file contains all available data 80-86. Used as input for pgm CONVOL. See pgm listings for details.

DEPTH76	DAT	1355	Day, hour and predicted depth to water (W1L)
DEPTH77	DAT	1351	"
DEPTH78	DAT	1351	"
DEPTH79	DAT	436	Day, hour and observed depth to water (W1L).
DEPTH80	DAT	451	"
DEPTH81	DAT	826	"
DEPTH82	DAT	1066	"
DEPTH83	DAT	796	"
DEPTH84	DAT	1081	"
DEPTH85	DAT	571	"
DEPTH86	DAT	121	"
HYDW1L77	CYB	2543	Predicted depth to water for W11 determined by pgms CONV AND CONVOL (see above) from observed met data (MET8086) for the years 1977 THROUGH 1985.
HYDW1L78	CYB	2543	
HYDW1L79	CYB	2543	
HYDW1L80	CYB	2543	
HYDW1L81	CYB	2543	
HYDW1L82	CYB	2543	
HYDW1L83	CYB	2543	
HYDW1L84	CYB	2543	
HYDW1L85	CYB	2543	
MET1980	DAT	23706	All MET files are of form:
MET1981	DAT	21351	I4 (Year), I2 (Month), I2 (Day)
MET1982	DAT	23507	I4,I4 (Max and Min temps in .1 deg C.)
MET1983	DAT	23376	I4 (Rain in mm), I4 (Snow in mm),
MET1984	DAT	13861	I8 (Not used), I4 (Snow on ground in cm.)
MET1985	DAT	6869	
MET1986A	DAT	3725	
ET8086	CYB	78453	The met files (MET1980 etc) arranged as a continuous stream for input to pgm CONV.

## 6. LAVAL LEVELLING ARRAY DATA

### 6.1 Description

Levelling of a 40m-diameter circle of eight bench marks was carried out by the Departement des Sciences Geodesiques et de Teledetection de l'Universite Laval at approximately monthly intervals from Sept. 15, 1977 to Feb. 26, 1986. The observational techniques, physical layout and analysis methods employed by the Laval Group are described in three reports: Van Chestein et al., 1979; Gagnon et al., 1985 and Plante and Gauthier, 1986. Results are given in Table 1.0.

In each survey multiple redundant measurements of the relative heights of the eight bench marks were made and mean heights of the BM's were determined. Each horizontal line in the table gives the calculated

heights of the bench marks of the survey in millimetres with respect to benchmark number five, which was held fixed at zero elevation. The column headed SD contains the standard deviation of the bench mark heights, observed during each survey, about the final mean heights determined in the survey. The column headed SH contains the mean standard deviation of the final determined bench mark heights of each survey. Tilt between two epochs is determined by taking the difference between bench mark heights of the appropriate two surveys in the table and fitting a plane to the height differences. A short basic program for carrying out the tilt calculation (excerpted from Plante and Gauthier, 1986) is listed after the table of observed heights.

It should be noted that BM #6 suffered a permanent downward displacement of 0.412 mm between surveys 4 and 5. This height increment should be artificially added to all subsequent BM #6 heights to get reasonable cumulative tilt values with respect to the first survey on 15/9/1977.

## ALTITUDES DES REPERES (MM)

OBS	DATE	1	2	3	4	5	6	7	8	SH	SO	OBS
1	77/09/15	0.510	-0.129	-0.400	-1.996	0.000	1.333	0.273	1.145	0.028	0.014	1
2	77/10/25	0.623	-0.061	-0.378	-2.108	0.000	1.253	0.314	1.219	0.041	0.042	2
3	77/11/22	0.548	-0.080	-0.362	-2.059	0.000	1.398	0.251	1.181	0.028	0.030	3
4	77/12/20	0.724	0.028	-0.250	-1.957	0.000	1.451	0.292	1.214	0.009	0.010	4
5	78/01/20	0.643	-0.119	-0.417	-2.045	0.000	1.077	0.317	1.193	0.012	0.013	5
6	78/02/15	0.656	-0.131	-0.389	-2.013	0.000	1.060	0.256	1.182	0.022	0.023	6
7	78/03/21	0.599	-0.121	-0.410	-2.069	0.000	1.137	0.199	1.075	0.040	0.042	7
8	78/05/04	0.665	-0.059	-0.410	-2.069	0.000	1.154	0.267	1.187	0.019	0.020	8
9	78/05/30	0.693	-0.041	-0.410	-2.034	0.000	1.044	0.223	1.122	0.033	0.036	9
10	78/06/27	0.616	-0.135	-0.512	-2.013	0.000	1.077	0.205	1.164	0.019	0.020	10
11	78/07/26	0.517	-0.237	-0.621	-2.086	0.000	0.999	0.187	1.142	0.028	0.030	11
12	78/08/22	0.438	-0.276	-0.655	-2.088	0.000	1.006	0.183	1.128	0.020	0.021	12
13	78/10/30	0.562	-0.257	-0.647	-2.042	0.000	1.097	0.313	1.154	0.022	0.023	13
14	78/12/20	0.483	-0.329	-0.701	-2.115	0.000	1.175	0.280	1.108	0.017	0.017	14
15	79/03/07	0.613	-0.256	-0.614	-2.111	0.000	1.143	0.269	1.133	0.043	0.046	15
16	79/06/06	0.658	-0.021	-0.519	-2.116	0.000	1.099	0.317	1.234	0.021	0.021	16
17	79/07/11	0.554	-0.179	-0.618	-2.091	0.000	1.012	0.269	1.165	0.023	0.025	17
18	79/08/08	0.435	-0.258	-0.679	-2.107	0.000	0.948	0.227	1.149	0.025	0.026	18
19	79/08/22	0.495	-0.251	-0.715	-2.118	0.000	0.953	0.275	1.160	0.012	0.013	19
20	79/10/10	0.618	-0.209	-0.678	-2.105	0.000	1.066	0.408	1.334	0.033	0.034	20
21	79/11/13	0.572	-0.189	-0.642	-2.081	0.000	1.028	0.356	1.190	0.017	0.018	21
22	79/12/17	0.577	-0.204	-0.591	-2.112	0.000	1.109	0.288	1.165	0.024	0.024	22
23	80/01/16	0.540	-0.269	-0.624	-2.079	0.000	1.181	0.260	1.043	0.020	0.021	23
24	80/02/20	0.514	-0.264	-0.637	-2.137	0.000	1.201	0.241	1.018	0.024	0.024	24
25	80/03/27	0.570	-0.192	-0.568	-2.038	0.000	1.219	0.254	1.102	0.010	0.011	25
26	80/04/21	0.698	-0.127	-0.509	-2.117	0.000	1.235	0.366	1.258	0.029	0.030	26
27	80/05/19	0.703	-0.081	-0.449	-2.064	0.000	1.185	0.276	1.217	0.025	0.026	27
28	80/06/25	0.584	-0.134	-0.518	-2.014	0.000	1.150	0.214	1.150	0.018	0.019	28
29	80/07/23	0.503	-0.213	-0.636	-2.085	0.000	1.061	0.226	1.132	0.020	0.021	29
30	80/08/26	0.459	-0.315	-0.719	-2.129	0.000	1.087	0.278	1.177	0.028	0.029	30
31	80/09/22	0.440	-0.317	-0.735	-2.110	0.000	1.065	0.280	1.114	0.014	0.014	31
32	80/10/21	0.551	-0.275	-0.688	-2.123	0.000	1.133	0.349	1.181	0.026	0.027	32
33	80/11/25	0.582	-0.234	-0.572	-2.071	0.000	1.136	0.261	1.124	0.016	0.017	33
34	80/12/17	0.530	-0.344	-0.675	-2.144	0.000	1.136	0.289	1.120	0.034	0.035	34
35	81/01/23	0.571	-0.250	-0.549	-2.049	0.000	1.108	0.281	1.121	0.017	0.018	35
36	81/02/23	0.686	0.072	-0.346	-2.065	0.000	1.212	0.414	1.277	0.030	0.031	36
37	81/03/25	0.641	-0.177	-0.468	-2.123	0.000	1.009	0.211	1.027	0.031	0.033	37
38	81/04/23	0.696	-0.008	-0.447	-2.059	0.000	1.215	0.264	1.175	0.038	0.039	38
39	81/05/27	0.641	-0.024	-0.430	-2.064	0.000	1.169	0.300	1.257	0.033	0.035	39
40	81/06/22	0.558	-0.174	-0.573	-2.071	0.000	1.071	0.186	1.117	0.018	0.018	40
41	81/07/21	0.532	-0.244	-0.686	-2.146	0.000	1.056	0.188	1.144	0.023	0.025	41
42	81/08/25	0.542	-0.240	-0.687	-2.194	0.000	1.009	0.262	1.239	0.027	0.028	42
43	81/09/22	0.496	-0.256	-0.681	-2.116	0.000	1.005	0.271	1.157	0.022	0.023	43
44	81/10/20	0.539	-0.267	-0.687	-2.132	0.000	1.071	0.337	1.231	0.021	0.022	44
45	81/11/24	0.600	-0.248	-0.647	-2.095	0.000	1.129	0.248	1.179	0.030	0.032	45
46	81/12/21	0.565	-0.292	-0.566	-2.036	0.000	1.131	0.235	1.107	0.036	0.037	46
47	82/01/27	0.503	-0.334	-0.654	-2.131	0.000	1.114	0.162	1.042	0.031	0.034	47
48	82/02/24	0.519	-0.249	-0.509	-2.026	0.000	1.088	0.103	1.053	0.037	0.038	48
49	82/03/23	0.497	-0.309	-0.628	-2.107	0.000	1.121	0.116	1.030	0.023	0.024	49
50	82/05/04	0.719	0.093	-0.365	-2.074	0.000	1.218	0.251	1.219	0.023	0.024	50

SOMMAIRE DES RESULTATS  
 ALTITUDES DES REPERES (MM)

OBS	DATE	1	2	3	4	5	6	7	8	SH	SO	OBS
51	82/05/25	0.598	-0.119	-0.475	-2.074	0.000	1.108	0.155	1.146	0.022	0.024	51
52	82/06/30	0.515	-0.284	-0.610	-2.147	0.000	1.042	0.155	1.045	0.018	0.019	52
53	82/07/22	0.473	-0.320	-0.658	-2.061	0.000	1.026	0.146	1.075	0.027	0.028	53
54	82/08/26	0.429	-0.389	-0.736	-2.154	0.000	1.012	0.159	1.040	0.019	0.020	54
55	82/09/22	0.436	-0.323	-0.700	-2.067	0.000	1.081	0.228	1.113	0.020	0.022	55
56	82/10/26	0.519	-0.297	-0.630	-2.071	0.000	1.104	0.243	1.152	0.029	0.030	56
57	82/12/01	0.586	-0.268	-0.659	-2.127	0.000	1.136	0.297	1.165	0.016	0.017	57
58	82/12/21	0.542	-0.297	-0.682	-2.096	0.000	1.087	0.260	1.040	0.018	0.018	58
59	83/01/26	0.501	-0.310	-0.677	-2.128	0.000	1.103	0.238	1.096	0.020	0.021	59
60	83/02/25	0.570	-0.208	-0.561	-2.022	0.000	1.152	0.244	1.088	0.017	0.017	60
61	83/05/24	0.747	-0.087	-0.459	-2.057	0.000	1.165	0.259	1.188	0.026	0.028	61
62	83/06/28	0.509	-0.249	-0.588	-2.079	0.000	1.028	0.165	1.120	0.014	0.014	62
63	83/07/27	0.429	-0.299	-0.695	-2.180	0.000	0.997	0.159	1.067	0.023	0.025	63
64	83/08/30	0.461	-0.354	-0.721	-2.135	0.000	0.983	0.229	1.098	0.013	0.013	64
65	83/09/28	0.381	-0.472	-0.796	-2.115	0.000	0.947	0.210	1.070	0.041	0.044	65
66	83/10/28	0.494	-0.320	-0.713	-2.111	0.000	1.036	0.279	1.161	0.034	0.035	66
67	83/12/19	0.622	-0.282	-0.620	-2.053	0.000	1.059	0.344	1.220	0.019	0.021	67
68	84/01/25	0.570	-0.294	-0.622	-2.043	0.000	1.077	0.242	1.089	0.025	0.026	68
69	84/02/23	0.464	-0.429	-0.679	-2.128	0.000	1.046	0.199	1.081	0.029	0.031	69
70	84/03/27	0.634	-0.290	-0.623	-2.098	0.000	1.114	0.153	1.123	0.028	0.029	70
71	84/04/26	0.768	0.090	-0.311	-1.997	0.000	1.234	0.380	1.253	0.014	0.015	71
72	84/05/24	0.648	-0.093	-0.458	-2.111	0.000	1.072	0.200	1.135	0.016	0.016	72
73	84/06/27	0.650	-0.184	-0.541	-2.041	0.000	1.044	0.277	1.169	0.021	0.022	73
74	84/07/25	0.439	-0.347	-0.714	-2.154	0.000	0.969	0.227	1.115	0.016	0.016	74
75	84/08/21	0.390	-0.420	-0.780	-2.187	0.000	0.943	0.227	1.086	0.027	0.029	75
76	84/09/25	0.382	-0.406	-0.742	-2.153	0.000	0.954	0.235	1.072	0.007	0.008	76
77	84/10/26	0.471	-0.326	-0.690	-2.020	0.000	1.066	0.263	1.137	0.035	0.038	77
78	84/11/26	0.420	-0.456	-0.755	-2.154	0.000	0.987	0.215	1.023	0.023	0.023	78
79	84/12/10	0.518	-0.317	-0.647	-2.065	0.000	1.077	0.261	1.064	0.019	0.020	79
80	85/01/30	0.448	-0.466	-0.752	-2.157	0.000	1.114	0.188	1.031	0.024	0.024	80
81	85/02/28	0.402	-0.432	-0.690	-2.066	0.000	1.124	0.087	1.012	0.025	0.027	81
82	84/03/28	0.582	-0.307	-0.573	-2.060	0.000	1.235	0.212	1.153	0.030	0.031	82
83	85/04/24	0.617	-0.298	-0.743	-2.198	0.000	1.245	0.356	1.236	0.025	0.027	83
84	85/05/21	0.770	0.007	-0.393	-2.026	0.000	1.168	0.307	1.267	0.033	0.034	84
85	85/06/26	0.595	-0.204	-0.574	-2.103	0.000	1.063	0.231	1.185	0.012	0.013	85
86	85/07/23	0.508	-0.321	-0.643	-2.124	0.000	0.998	0.189	1.124	0.013	0.013	86
87	85/08/22	0.442	-0.356	-0.735	-2.086	0.000	0.979	0.265	1.145	0.026	0.027	87
88	85/09/26	0.345	-0.507	-0.790	-2.153	0.000	0.924	0.201	1.020	0.022	0.023	88
89	85/10/22	0.449	-0.448	-0.796	-2.179	0.000	1.023	0.288	1.112	0.021	0.022	89
90	85/11/28	0.558	-0.326	-0.634	-2.129	0.000	1.132	0.348	1.221	0.043	0.044	90
91	85/12/17	0.604	-0.313	-0.576	-2.008	0.000	1.249	0.391	1.199	0.020	0.021	91
92	86/01/31	0.549	-0.356	-0.579	-2.112	0.000	1.315	0.293	1.091	0.051	0.052	92
93	86/02/26	0.497	-0.363	-0.651	-2.159	0.000	1.208	0.064	1.044	0.019	0.020	93



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010 REM***PROGRAM BASCULE***
020 REM**CALCULATES TILT BETWEEN TWO SURVEYS OF THE LAVAL ARRAY**
030 REM**SET UP VARIABLES**
040 DIM F(8),S(8),D(8),TH(8),R(8)
050 REM*****
060 REM**INPUT SURVEY HEIGHTS**
070 PRINT"FIRST SURVEY HEIGHTS IN MM"
071 INPUT"BM#1";F(1)
072 INPUT"BM#2";F(2)
073 INPUT"BM#3";F(3)
074 INPUT"BM#4";F(4)
075 INPUT"BM#5";F(5)
076 INPUT"BM#6";F(6)
077 INPUT"BM#7";F(7)
078 INPUT"BM#8";F(8)
080 PRINT"SECOND SURVEY HEIGHTS IN MM"
081 INPUT"BM#1";S(1)
082 INPUT"BM#2";S(2)
083 INPUT"BM#3";S(3)
084 INPUT"BM#4";S(4)
085 INPUT"BM#5";S(5)
086 INPUT"BM#6";S(6)
087 INPUT"BM#7";S(7)
088 INPUT"BM#8";S(8)
090 REM*****
100 REM**INITIALIZE STATION POSITIONS & INVERSE OF NORMAL MATRIX**
102 DATA 100,120.05,113.99,114.34,119.95,100.20,113.76,85.55,99.21,80.07
104 DATA 85.27,86.52,79.91,100.65,85.91,114.32
106 FOR I=1 TO 8 : READ X(I),Y(I) : NEXT I
110 G1= -.06200471 : G2= .000623874 : G3= -.000002273
120 G4= -.06239752 : G5=G3 : G6= .000624910
130 G7= 12.56312 : G8=G1 : G9=G4
140 REM*****
150 REM**CALCULATE R.H.S. OF NORMAL EQUATIONS**
160 FOR I=1 TO 8 : D(I)=(S(I)-F(I))/1000 : NEXT I
170 Q1=D(1)+D(2)+D(3)+D(4)+D(5)+D(6)+D(7)+D(8)
180 Q2=100*D(1)+113.99*D(2)+119.95*D(3)+113.76*D(4)+99.21*D(5)
190 Q2=Q2+85.27*D(6)+79.91*D(7)+85.91*D(8)
200 Q3=120.05*D(1)+114.34*D(2)+100.20*D(3)
210 Q3=Q3+85.55*D(4)+80.07*D(5)+86.52*D(6)+100.65*D(7)+114.32*D(8)
220 REM*****
230 REM**CALCULATE COEFFICIENTS OF PLANE**
240 Q4=G1*Q1+G2*Q2+G3*Q3
250 Q5=G4*Q1+G5*Q2+G6*Q3
260 Q6=G7*Q1+G8*Q2+G9*Q3
270 REM*****
280 REM**CALCULATE AMPLITUDE AND AZIMUTH OF TILT IN M & DEGREES**
290 A=20000*SQR(Q4*Q4+Q5*Q5)
300 IF Q5>=0 THEN P=270+57.29577*ATN(Q4/Q5) : GO TO 340
310 IF Q5<0 THEN P=57.29577*ATN(Q4/Q5)+90 : GO TO 340
320 REM*****
330 REM**CALCULATE VERTICAL DISPLACEMENT OF CENTRE POINT**
340 V=(100*Q4+100*Q5+Q6)*1000
341 REM*****
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342 REM**CALCULATE COMPONENTS**
343 AA=A*50
344 C1=AA*COS((P+90)/57.29577)
345 C2=AA*COS((P+225)/57.29577)
346 C3=AA*SIN((P+270)/57.29577)
347 C4=AA*SIN((P+225)/57.29577)
350 REM*****
360 REM**OUTPUT RESULTS**
380 PRINT
390 PRINT TAB(23);"TILT PARAMETERS"
400 PRINT TAB(46);"COMPONENTS(microradian)"
410 PRINT A; TAB(14); ":AMPLITUDE(mm)"; TAB(46) ; C1 ; TAB(60) ; ":SOUTH TILT"
415 PRINT P; TAB(14);":ORIENTATION OF AXIS(degrees)" ; TAB(46) ; C2 ; TAB(60)
417 PRINT ":NEAST TILT"
420 PRINT V; TAB(14); ":VERTICAL DISPLACEMENT(mm)" ; TAB(46) ; C3 ; TAB(60) ;
422 PRINT ":EAST TILT"
425 PRINT TAB(46); C4 ; TAB(60) ; ":SEAST TILT" : PRINT
430 PRINT TAB(8);"STATIONS";TAB(28);"DISPLACEMENTS(mm)";TAB(56);
435 PRINT "RESIDUAL"
440 PRINT TAB(26);"OBSERVED          FITTED" : PRINT : VA=0
450 FOR I=1 TO 8
460 D(I)=D(I)*1000 : TH(I)=(Q4*X(I)+Q5*Y(I)+Q6)*1000
470 R(I)=D(I)-TH(I)
480 PRINT TAB(8);I;TAB(26);D(I);TAB(39);TH(I);TAB(54);R(I)
490 VA=VA+R(I)*R(I)
500 NEXT I
510 PRINT : SD=SQR(VA/5) : SD=SD*0.249
520 SR=SD*50
530 PRINT SD;" : STANDARD ERROR OF TILT MODEL(mm)"
540 PRINT SR;" : STANDARD ERROR OF TILT MODEL(microradian)" : PRINT
550 END
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7. INVENTORY OF ANALOG CHARTS IN BOXES

7.1 Chart Boxes #80 - #120

BOX #	TITLE	STARTS	ENDS
80	WSM	781019	781109
81	T13,T18,T14,QSM	781103	781129
82	CLINO LAB T19	781108	781130
83	WSM	781109	781128
84A	T13,T18,T14,QSM	781129	781218
85	T14,WSM	781131	790104
86A	QSM,WSM,T13,T18	781218	790104
87	T14, WSM	781131	790104
88	CLINOLAB	781130	790104
89	T19, CLINOLAB	781130	790104
90	T13,T18,T14,QSM,WSM	790104	790112
91	CLINO LAB	790104	790209
92	T13,T18,T14,QSM,WSM	790112	790129
93	T14,QSM,WSM	790129	790209
94			
95	T19	790104	790208
96	T13,T18,T14,QSM,WSM	790209	790301
97	T19,CLINO LAB	790209	790228
98			
99	T13,T18,T14,QSM,WSM,T19,CLD	790301	790308
100	T13,T18,T14,QSM,WSM	790307	790314
101	T13,T18,T14,T19,QSM,WSM,CLD	790314	790321
102	T13,T18,T14,T19,QSM,WSM,CLD	790321	790329
103	T13,T18,T14,T19,QSM,WSM CLD,WELL	790326	790406
104	T13,T18,T14,QSM,WSM,CLD	790406	790415
105	T13,T18,T19,T14,QSM,WSM,CLD	790415	790427
106	T14,T18,T13,QSM,WSM,WELL2,T19	790427	790507
107A	T14,T18,T13,QSM,WSM,WELL	790508	790525

107B	T19 CLD,CLS	790507 790525
108	T13,T18,T14,QSM,WSM,WELL	790525 790604
109	CLDA,CLDB,CLS	790605 790622
110	T14,T13,T18,QSM,WSM,WELL	790604 790622
111	CLDA,CLDB,CLS	790622 790710
112	T14,T13,T18,QSM,WSM	790622 790713
113	CLDA,CLDB	790710 790724
114	T13,T18,QSM,WSM	790713 790810
115	T14	790704 790829
116	T13,T18,QSM,WSM	790810 790827
117	CLINOLAB (A&B)	790724 790827
118	CLINOLAB (A&B)	790828 790917
119	T13	790827 790928
120	QSM,WSM,T14,TEMP	790827 790928

7.2 Chart Boxes #121 - #160

BOX #	TITLE	STARTS	ENDS
121	CLS,CLD	790920	790925
122	T13&T18	790928	791025
123	T14,TEMP,QSM,WSM	790928	791025
124	CLS,KINO	791023	791122
125	T13,T18,T14,QSM,WSM,TEMP	791025	791105
126	T13,T18,T14,QSM,WSM,TEMP	791105	791122
127	CLS(MK2),CLDA,CLDB	791122	791210
128	T13,T18,T14,QSM,WSM,TEMP	791122	791207
129	T13,T18,T14,QSM,WSM,TEMP	791207	791220
130	T13,T18,T14,TEMP	791220	800121
131	QSM,WSM	791220	800121
132	CLDB	800104	800122
133	T13,T18,T14,TEMP,QSM,WSM	800121	800211
134	CLDB,EX.TEMP	800123	800228
135	T13,T18,T14,QSM,WSM,TEMP	800211	800228
136	CLDB,OUTS.TEMP	800228	800314
137	T19	800227	800327
138	T13,T18	800228	800327
139	QSM,WSM	800228	800327
140	T19	800327	800423
141	CLDB,KINO(X)	800314	800424
142	QSM,WSM	800327	800604
143	T14,T19	800327	800424
144	T13,T18	800327	800605
145	CLDB,KINO(X)	800424	800606
146	QSM,WSM,T14,T19,T18,T13	800604	800703
147	QSM,WSM,T13,T18,T14,T19	800703	800720
148	T14,T19,T13,T18	800725	800821
149	QSM,WSM	800725	800926
150	T13,T18,T14,T19	800821	800926

151	T14,T19,T18,T13,QSM,WSM	800926	801015
152	QSM,WSM,T14,T19,T13,T18	801102	801120
153	T14,T19,T13,T18,QSM,WSM	801120	801211
154	T14,T19,QSM,T13,T18	801211	810128
155	T13,T18	801211	810128
156	QSM,T14,T18,T13,WELL 2,SHALLOW	810122	810219
157	WELL 1,WELL 2	810219	810319
158	T13,T18,T14,QSM	810219	810401
159	WELL 1,SHALLOW,WELL 2	810319	810430
160	QSM,T14,T13,T18	810401	810424

7.3 Chart Boxes #161 - 200

BOX #	TITLE	STARTS	ENDS
161	WELL 2	810319	810423
162	T13,T18	810420	810513
163	T14,T19	810425	810513
164	WELLS 1,2	810419	810515
165	T13,T18	810524	810619
166	T14,T19	810601	810619
167	T14,T19,T13,T18	810513	810601
168	WELLS 1,2	810515	810619
169	WELL 1,CLINO	810619	810703
170	T14,T19,T13,T18	810619	810630
171	T13,T18	810630	810722
172	T13,T18	810722	810807
173	T14	810630	810726
174	WELL 1,CLINO	810704	810804
175	T14	810726	810807
176	T13,T18,T14	810807	810827
177	CLINO	810807	810915
178	T13,T18,T14	810827	810915
179	WELLS 1,2	810804	811001
180	T13,T18,T14,CLINO	810915	811001
181	WELLS 1,2,3	811002	811030
182	T14,CLINO	811001	811023
183	T13,T18,T14,CLINO	811001	811110
184	T13,T18,T14,CLINO	811001	811110
185	T14,T18,T13,CLINO	811010	811126
186	T13,T18,T14,CLINO	811126	811217
187	T13,T14,T18	811217	820101
188	T13,T18,T14	820101	820118
189			
190	T14,T13,T18,TVL1	820208	820224

191	T13,T18,T14	820224	820329
192	WELLS 1,2	820222	820331
193	WELLS 1,4	820331	820418
194	T13,T18,T14	820329	820418
195	T13,T18,WELLS 1,2,4	820418	820610
196	T14,T13,T18,TVL1	820418	820528
197	WELLS 1,2,4	820427	820528
198	T13,T18	820522	820624
200	WELLS 1,2,4	820525	820622



7.4 Chart Boxes #201 - 240

BOX #	TITLE	STARTS	ENDS
=====	=====	=====	=====
201	T13,T18,T14	820610	820708
202	WELLS 1,2	820624	820813
203	T13,T18,T14	820729	820805
204	WELLS 1,2	820813	820831
205	T13,T18	820810	820831
206	T14,TVL1	820729	820831
207	T13,T18,T14 WELL 3,2,4	820831	820921
208	T13,T18	820918	821025
209	T14,TVL1	820920	821112
210	WELLS 1,2	820831	821028
211	WELLS 3,4	820930	821028
212	WELLS 1,2	821016	821111
213	WELLS 1,2	821111	821219
214	WELLS 3,4	821111	821226
215	T14	821112	830113
216	T13,T18	821112	830109
217	T13,T18	830109	830217
218	T13,T18	830217	830329
219	T14,TVL1	830113	830217
220	T14,TVL1	830217	830329
221	WELLS 3,2,4	830209	830317
222	WELLS 1,2	830110	830225
223	WELLS 1,2,3	830225	830328
224	WELLS 3	830317	830329
225	WELLS 1,2	830329	830519
226	WELLS 3,2,4	830329	830519
227			
228	T13,T18	830509	830716
229	T14,TVL1	830329	830519
230	T13,T18	830329	830508

231	T14,TVL1	830519	830716
232	T13,T18,T14 TVL1	830716	830818
233	T13,T18,T14	830811	830920
234	T13,T18,T14,B106Y,SHALLOW	830920	830925
235	T13,T18	831019	831212
236	T14,TVL1	831019	831211
237	T13,T18	831212	840119
238	T14,T13	831212	840119
239	WELLS 1,2,3 & FAT BROAD(2)	830616	830811
240	WELLS 1,3	830801	831011

7.5 Chart Boxes #241 - 280

BOX #	TITLE	STARTS	ENDS
241	WELLS 1,2,3 (SH)	830619	830810
241B	WELL 2	830613	830715
242	WELLS 1,3	830811	830916
243	WELL 2	830715	830823
244	WELL 2,3 ASK.AIRPRES	830823	830916
245	WELL 1,2,3 BIOGY.	831019	831109
246	WELL 1,3	831123	831213
247	WELL 1,2	831215	840112
248	T13,T18	840119	840312
249	T14,T13	840119	840228
250	WELL 1,2	840207	840313
251	WELL 1,2,3	840119	840207
252	WELL 1, SHALLOW	840207	840314
253A	WELL 1	840303	840417
253B	WELL 2	840314	840412
254			
255	T13,T18	840312	840416
256	T14,T13	840228	840406
257	T13,T14,T18	840406	840515
258	T14,T13	840514	840620
259	T13,T18	840514	840620
260			
261			
262			
263	WELL 1	840619	840820
264	WELL 1	840821	840926
265	WELL 2,4	840618	840819
266	WELL 2	840620	840926
267			
268			

269	T13,T18	840620	840802
270	T14,T13	840620	840729
271	T13,T18	840802	840925
272	T14,T13	840727	840925
273	T13,T18,T14	840925	841019
274	WELL 1	840926	841102
275	WELL 2	840926	841103
276			
277	T13,T18	841019	841218
278	T14	841019	841218
279	WELL 1	841103	841204
280	WELL 2	841103	841204

7.6 Chart Boxes #281 - 320

BOX #	TITLE	STARTS	ENDS
281			
282	WELL 1	841204	850112
283	WELL 2	841204	850112
284			
285			
286	T13,T18,T14	841218	850110
287	T13,T18	850110	850221
288			
289			
290	WELL 1	850112	850220
291	WELL 2	850112	850220
292	WELL 1	850220	850331
293	T14	850122	850221
293B	WELL 2	850220	850331
294	T13,T14,T18	850331	850425
295	T14,T18	850313	850420
295B	WELL 2	850331	850425
296	T13,T18	850221	850405
297	T14,T13	850220	850331
298	T14,T18	850225	850313
299	WELL 1	850331	850509
300	T14,T13	850425	850511
301	WELL 2	850425	850514
302	WELL 1	850509	850616
303	T18,T14	850420	850528
304	T14,T18,T13	850514	850620
305	T18,T13	850518	850620
306	T13,T18	850425	850518
307	WELL 4	850407	850518
308	T13,T18	850620	850731

309	T18,T14,T13	850715	850731
310	WELL 1	850616	850715
311	WELL 2	850514	850731
312	T13,T18	850731	850906
313	T14,T13	850730	850906
314	T18	850731	850825
315	WELL 2	850731	850905
316	WELL 1	850731	850905
317	T13,T18	850906	850917
318	WELL 1	850905	851016
319	WELL 2	850905	851016
320	T14,T13,T18	850917	851019

7.7 Chart Boxes #321 - 335

BOX #	TITLE	STARTS	ENDS
321	T14,T13,T18	850917	851114
322	T13,T18	850917	851129
323	WELL 2	851019	851122
324	T14	851019	851127
325	WELL 1	851017	851122
326	T13,T18,T14	851114	851223
327	WELL 2	851124	860119
328	WELL 1	851129	860119
329	T14	851127	860119
330	T13,T18	851127	860119
331	T13,T18	860119	860226
332	T18,T14	860119	860226
333	T14,T18	860223	860407
334	T13,T18	860226	860408
335	T13,T18,T14	860226	860421

8. BOREHOLE TILTMETER DATA ON PC DISKETTES

8.1 Contents of Volume Label: CHXBHTILT01

This volume lists the tilt in nanoradians measured by borehole tiltmeters 106S, 106E, 107S, 107E and 105X at 25-hour intervals. The period covered is from day 002, 1983 through day 362, 1985. Explanatory notes are included in the preamble to the data.

8.2 Contents of Volume Label: CHXBHTILT02

This volume list tiltmeter data from tiltmeters 106 and 107 resolved along the azimuths 052@ and 322@. Symphony worksheets are also included in the volume.

9. COSEISMIC WATER LEVEL AND ATMOSPHERIC PRESSURE DATA

9.1 Contents of Volume Label: CHXCOSEIS01

File Name	Size	Comments
=====	=====	-----
W1L11083 OUT	17196	
W1L11083 JAN	14868	
W3L18679 JAN	10932	
W1L18679 OUT	11100	
W1L30182 JAN	10440	
W1L00186 OUT	6796	
PCX18679 JAN	11419	
PCX30182 JAN	10764	
PCX00186 JAN	12893	
W3L18679 OUT	12057	
W1L30182 OUT	12507	
W1L00186 JAN	5520	



W1L18679	JAN	9289
W2L05581	OUT	8226
W2L05581	JAN	6669
W1L05581	OUT	8226
PCX05581	JAN	6666
W1L05581	JAN	6669

19 File(s) 168960 bytes free

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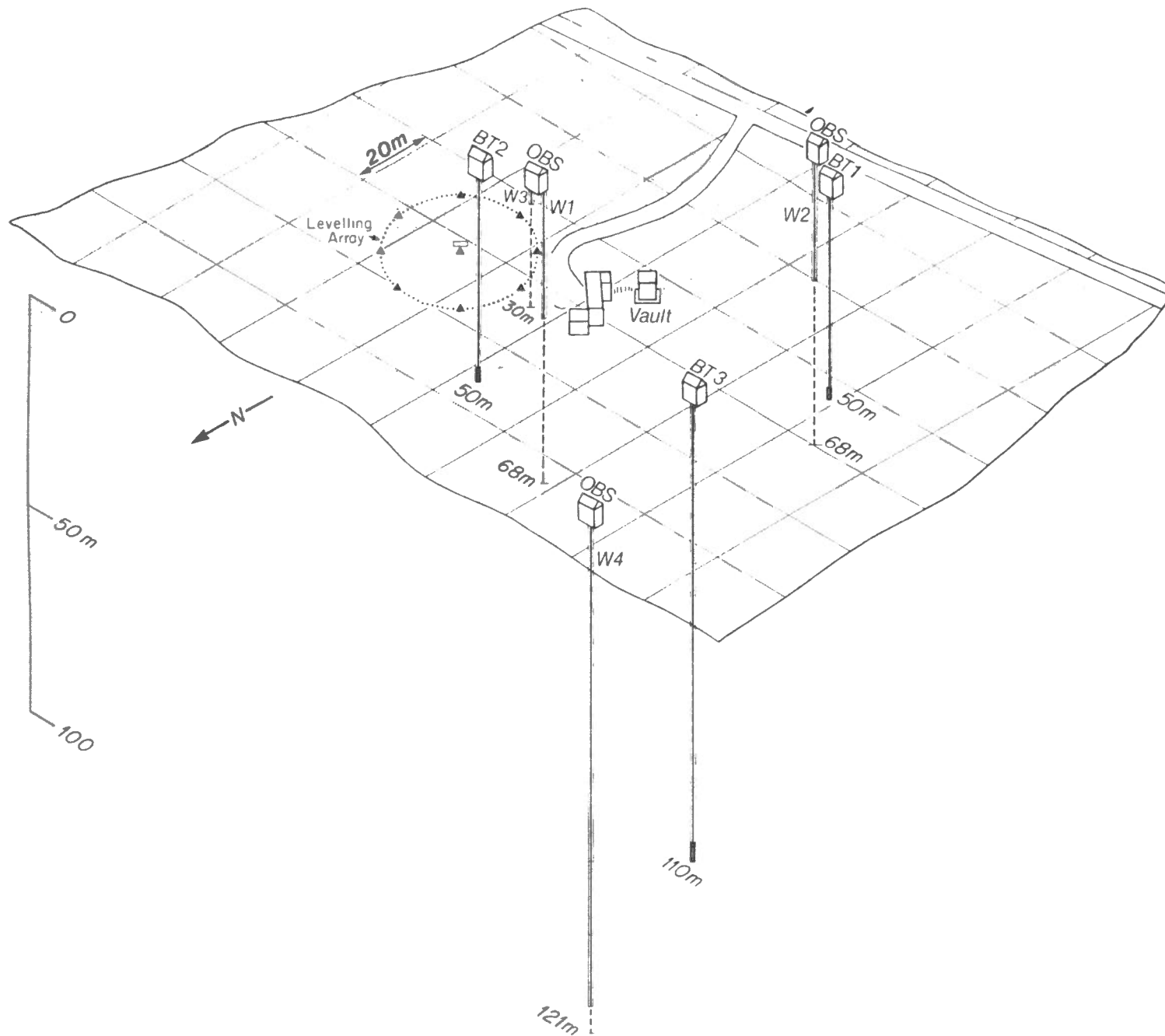


FIGURE 1. The Charlevoix Geodynamics Observatory

