13. *Undulatory Deformation of the Earth's Crust along the Coast of the Japan Sea.*

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The distance of more than 1000 km. along the Japan Sea coast between Hamada (B. M. 6) and Sibata (B. M. 4410) was first levelled in 1887–1899 by the Imperial Japanese Military Land Survey. The section of the line between Takaoka (B.M. 12) and Itoigawa (B.M. 2928) was re-levelled in 1921 and the remaining sections in 1927–1930, all by the same survey, at the requests, singly or jointly, of Professor A. Imamura,[1] the late Professor N. Yamasaki,[2] and the Earthquake Research Institute.[3] As the result we have now the necessary data from which to discuss the slow deformation of the earth's crust that took place within the last 30 or 40 years along three quarters of the coast of the Japan Sea.

The years in which the old and new surveys were made in different

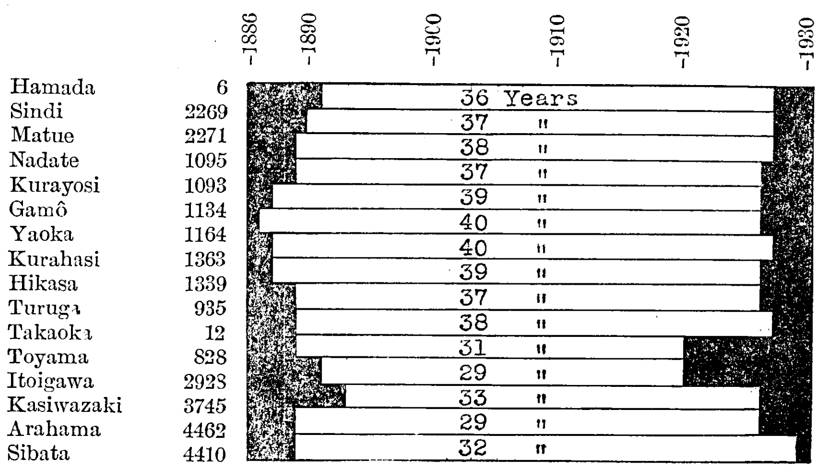


Fig. 1.

1) A. IMAMURA, *Pub. Earthq. Inv. Comm.*, 25 (1930).
2) N. YAMASAKI, *Proc. Imp. Acad*, 4 (1928), 60.
3) C. TSUBOI, *Jap. Journ. Astr. Geophys.*, 10 (1933), 93.

sections of the level lines are shown in Fig. 1. Although the time intervals separating the old and new surveys range in length from 29 to as much as 40 years according to the section of the line, these differences will not be considered in this discussion which is merely of a qualitative nature. In Table I, the differences in the heights of the bench marks on the line as determined by the old and new surveys are given under the heading, Δh. The values of Δh are plotted with small dots in Fig. 2A, the vertical scale of which has been greatly elongated in comparison with the horizontal in order to exaggerate the very small deformation of the earth's crust in the regions through which the line passes. As will be noticed at a glance from the Figure, the deformation here is generally undulatroy, though there are small and irregular fluctuations in the undulations. To smooth them out, the following overlapping mean values were calculated

$$\frac{1}{11}\sum_{n=1}^{11}\Delta h,\ \frac{1}{11}\sum_{n=2}^{12}\Delta h,\ \ldots,\ \frac{1}{11}\sum_{n=m}^{m+10}\Delta h\ldots,$$

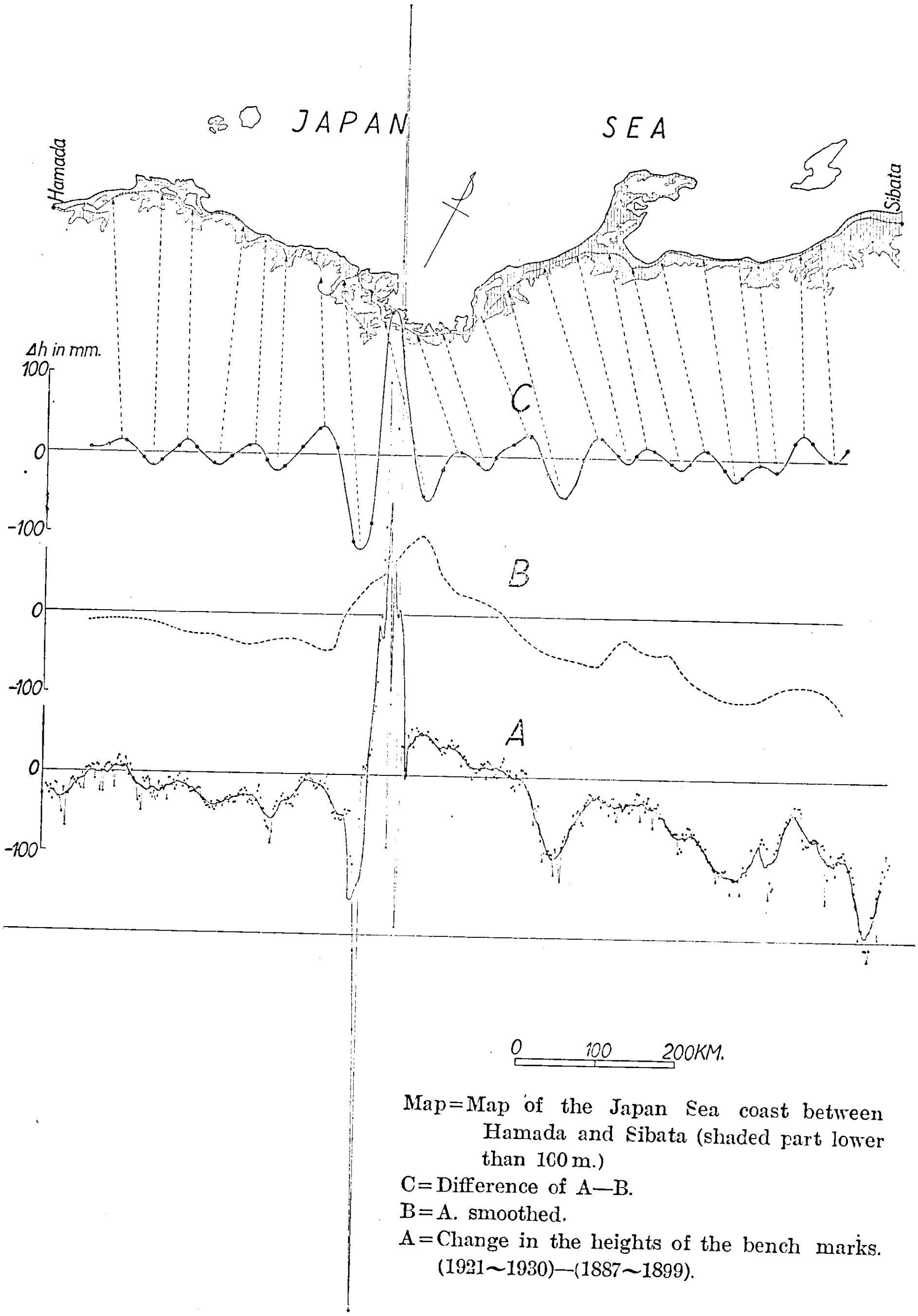
n being counted eastward from Hamada for every bench mark. The mean values, which are also given in Table I, are plotted in Fig. 2A, the first mean being assigned to point $n=6$, the second to $n=7$, and the mth to $n=m+5$, and so on. As curve A in Fig. 2, which was obtained in this manner, presumably consists of two quasi-periodic curves, the one with a longer period and the other with a shorter, the following mean values were calculated in order to eliminate the latter component:

$$\frac{1}{55}\sum_{n=1}^{55}\Delta h,\ \frac{1}{55}\sum_{n=12}^{66}\Delta h,\ \ldots,\ \frac{1}{55}\sum_{n=1+11(m-1)}^{11(m+4)}\Delta h,\ \ldots\ldots$$

The mean values that are also given in Table I are plotted in Fig. 2B, the first mean being assigned to point $n=28$, the second to $n=39$, and the mth to $n=11m+17$, and so on.

Curve B in Fig. 2, which was obtained in this manner, shows therefore a general form of the deformation of the earth's crust in the regions concerned. On curve B, which reveals on the whole an eastward inclination on a very large scale, is superposed a quasi-periodic deformation with a period of 250 km. The remarkable amplitude seen in the curve about its middle part is due to deformation of the earth's crust connected with the Tango destructive earthquake of 1927.

The second bulge to the east of it lies at the neck of the Noto Peninsula, which is the only peninsula that projects into the Japan Sea from the otherwise regular coast line of Honsyû along this Sea.



Map=Map of the Japan Sea coast between Hamada and Sibata (shaded part lower than 100 m.)
C=Difference of A—B.
B=A. smoothed.
A=Change in the heights of the bench marks. (1921~1930)—(1887~1899).

Fig. 2.

The differences

$$\frac{1}{11}\sum_{n=23}^{33}\Delta h-\frac{1}{55}\sum_{n=1}^{55}\Delta h,\quad \frac{1}{11}\sum_{n=34}^{44}\Delta h-\frac{1}{55}\sum_{n=12}^{66}\Delta h,\quad \ldots\ldots,$$

were then calculated. These, besides being given in Table I, are also shown in Fig. 2C. Curve C, which therefore is the difference between B and A (smoothed), shows marked regularity in its undulation, indicating that the areas of upheaval and depression of the earth's crust are arranged along the regions in question with a certain degree of periodicity. The mean distance between a point of maximum upheaval or depression and the next maximum, or the wave-length if there be such, is 78 km.[4)]

The geographical positions of the points of maximum upheaval or depression are shown by arrows in the map in Fig. 2, in which all land surface lower than 100 m. is shaded. Although there are several exceptions, the maximum depressions are generally in the coastal Alluvial plains and the maximum upheavals about the mountains. It is worth mentioning that there is therefore a certain periodicity in the way large cities and towns arrange themselves as they develop on these plains, at any rate along the coast in question.

As to what is the areal distribution of these crustal deformations in this region, our data provide no answer; or stated in another way, the question admits of more than one answer in that there are a number of ways all resulting in the same changes in the heights of bench marks along one and the same line of levels, see Figs. 3 and 4.

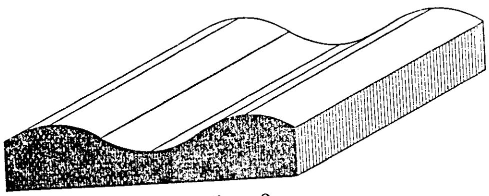


Fig. 3.

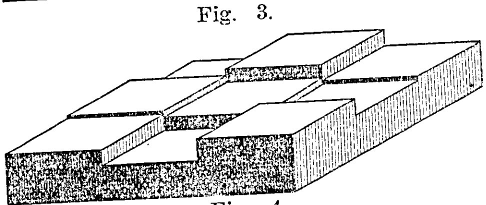


Fig. 4

One possible explanation is to assume the existence of series of parallel wave-like deformation like that shown in Fig. 3. Another is to assume a mosaic distribution of areas of upheaval or depression in the manner shown schematically in Fig. 4. Whichever alternative be true, it is certain that it must be assumed that a somewhat abrupt change occurs in the mechanical properties of material lying beneath the earth's surface

4) *cf.* T. Terada, *Proc. Imp. Acad.*, 10 (1934), 65; 147.

at depths that are of the same order of magnitude as the mean wave-length of the deformation. The writer however reserves for the present any theories concerning the "wave" but merely calls attention to the existence of such a kind of crustal deformation as an indisputable physical fact.

The writer here expresses his best thanks to Professor T. Terada for interest shown in this study.

Table I. Changes in the Heights of Bench Marks along the Coast of the Japan Sea, and their Overlapping Means.

	B.M.	Δh	$\frac{1}{11}\Sigma\Delta h$	$\frac{1}{55}\Sigma\Delta h$	$\frac{1}{11}\Sigma\Delta-\frac{1}{55}\Sigma\Delta h$
		mm.	mm.	mm.	mm.
1	6	−28·4			
2	3028	(−147·8)			
3	3027	−17·9			
4	3026	−21·5			
5	3025	−29·4			
6	3024	−19·2	−24.3		
7	3023	−36·9	−25·1		
8	3022	−24·5	−27·5		
9	3021	−14·7	−27·8		
10	3020	−17·0	−32·2		
11	3019	−33·4	−32·1		
12	3018	−36·0	−33·0		
13	3017	−52·2	−32·6		
14	3016	−21·8	−31.3		
15	3015	−69·3	−30·7		
16	3014	−28·3	−30·3		
17	3013	−29·2	−28·6		
18	3012	(+90·2)	−26·1		
19	3011	−11·2	−22·7		
20	3010	− 8·8	−22·7		
21	3009	−12·4	−16·1		
22	3008	−16·7	−15·6		
23	3007	−10·6	−12·3		
24	3006	−18·3	−10·9		
25	3005	−22·4	− 9·5		
26	3004	− 3·2	− 8·3		
27	3003	−23·2	− 8·4		
28	3002	+ 3·4	− 4·4		
29	3001	+ 3·6	− 4·3	−10·5	+ 6·1
30	3000	+ 4·6	− 2·0		
31	2999	+ 3·8	+ 0·8		

(*to be continued.*)

Table I. (*continued.*)

	B.M.	Δh	$\frac{1}{11}\Sigma\Delta h$	$\frac{1}{55}\Sigma\Delta h$	$\frac{1}{11}\Sigma\Delta-\frac{1}{55}\Sigma\Delta h$
		mm.	mm.	mm.	mm.
32	2998	+ 7·1	− 1·2		
33	2997	+ 6·6	+ 0·9		
34	2996	− 9·7	− 1·7		
35	2995	+ 8·1	− 1·7		
36	2994	+ 7·3	− 1·5		
37	2993	−25·0	− 1·0		
38	2992	+ 0·1	− 0·8		
39	2991	−25·7	− 0·8	− 8·9	+ 8·1
40	2990	+ 3·9	0		
41	2989	+ 7·5	− 2·6		
42	2988	+ 9·2	− 2·5		
43	2987	+ 9·3	+ 1·2		
44	2986	+ 6·3	+ 2·9		
45	2985	− 0·9	+ 6·2		
46	2984	−20·3	+ 6·3		
47	2983	+ 8·2	+ 6·2		
48	2982	+15·1	+ 6·8		
49	2981	+19·0	+ 6·7		
50	2980	+10·6	+ 5·6	− 7·7	+13·3
51	2979	+ 5·7	+ 6·4		
52	2978	+ 5·5	+ 8·3		
53	2977	+16·3	+ 6·7		
54	2976	+ 7·7	+ 4·2		
55	2975	− 5·2	+ 1·1		
56	2974	+ 8·2	− 3·2		
57	2973	+ 0·3	− 6·7		
58	2972	− 9·5	−11·6		
59	2971	−12·7	−13·9		
60	2970	−15·1	−15·8		
61	2969	−36·9	−16·2	− 9·6	− 6·6
62	2968	−32·1	−17·6		
63	2271	−48·6	−18·6		
64	2270	− 9·1	−20·3		
65	2269	−13·4	−22·2		

(*to be continued.*)

Table I. (*continued.*)

	B.M.	Δh	$\frac{1}{11}\Sigma\Delta h$	$\frac{1}{55}\Sigma\Delta h$	$\frac{1}{11}\Sigma\Delta-\frac{1}{55}\Sigma\Delta h$
		mm.	mm.	mm.	mm.
66	2280	− 9.6	−23·1		
67	2279	− 7·0	−23·0		
68	2278	−10·6	−23·0		
69	2277	−28·0	−19·7		
70	2276	−33·8	−20·9		
71	2275	−24·7	−21·3		
72	2274	−36·6	−22·5	−13·3	− 9·2
73	2273	−31·6	−23·6		
74	2272	−12·3	−25·9		
75	2268	−22·0	−24·0		
76	2267	−18·1	−21·6		
77	2266	−23·2	−20·8		
78	2265	−18·9	−18·4		
79	2264	−35·2	−17·6		
80	2263	− 7·9	−18·0		
81	2262	− 7·0	−16·5		
82	2261	−16·1	−15·1		
83	2260	−10·3	−14·3	−22·2	+ 7·9
84	2259	−22·1	−14·2		
85	2258	−17·4	−11·9		
86	2257	− 5·4	−12·6		
87	2256	− 2·8	−12·8		
88	2255	(−86·1)	−13·3		
89	2254	−18·1	−14·8		
90	2253	−11·7	−15·0		
91	1120	−15·4	−15·6		
92	1119	− 8·8	−17·6		
93	1118	−21·3	−19·4		
94	1117	−25·2	−19·3	−26·0	+ 6·7
95	1116	−24·1	−19·5		
96	1115	−23·2	−21·4		
97	1114	−25·1	−23·2		
98	1113	−20·6	−25·9		
99	1112	−19·3	−27·8		

(*to be continued.*)

Table I. (*continued.*)

	B.M.	Δh	$\frac{1}{11}\Sigma\Delta h$	$\frac{1}{55}\Sigma\Delta h$	$\frac{1}{11}\Sigma\Delta-\frac{1}{55}\Sigma\Delta h$
		mm.	mm.	mm.	mm.
100	1111	−20·3	−29·3		
101	1110	−32·1	−31·2		
102	1109	−35·4	−32·4		
103	1108	−38·2	−34·1		
104	1107	−42·1	−36·5		
105	1106	−41·8	−38·6	−27·0	−11·6
106	1105	−44·7	−40·0		
107	1104	−36·8	−40·4		
108	1103	−43·9	−40·6		
109	1102	−46·8	−41·0		
110	1101	−42·1	−40·5		
111	1100	−35·7	−39·7		
112	1099	−36·9	−38·3		
113	1098	−38·1	−38.4		
114	1097	−42·0	−37·1		
115	1096	−36·4	−35·8		
116	1095	−33·1	−35·3	−32·8	− 2·5
117	1094	−31.0	−35·4		
118	1093	−37·8	−34·8		
119	1092	−28·9	−33·8		
120	1091	−31·5	−32·0		
121	1090	−37·8	−30·7		
122	1089	−36·7	−30·3		
123	1088	−29·9	−29·2		
124	1087	−26·2	−27·9		
125	1086	−23·5	−28·6		
126	1085	−21·7	−27·9		
127	1084	−28·2	−27·7	−37·9	+10·2
128	1083	−19·4	−27·9		
129	1082	−22·6	−27·7		
130	1081	−37·2	−28·6		
131	1080	−23·4	−28·5		
132	1079	−35·6	−27·9		
133	1078	−39·3	−28·3		

(*to be continued.*)

Table I. (*continued.*)

	B.M.	Δh	$\frac{1}{11}\Sigma\Delta h$	$\frac{1}{55}\Sigma\Delta h$	$\frac{1}{11}\Sigma\Delta-\frac{1}{55}\Sigma\Delta h$
		mm.	mm.	mm.	mm.
134	1077	(−205·5)	−30·8		
135	1076	−34·7	−33·0		
136	1075	−22·9	−35·0		
137	1074	−15·8	−39·6		
138	1073	−31·9	−42·9	−34·5	− 8·4
139	1072	−44·5	−47·7		
140	1071	−44·2	−50·1		
141	1070	−49·9	−51·1		
142	1069	−66·7	−52·7		
143	1068	−68·9	−54·5		
144	1067	−87·7	−56·7		
145	1121	−73·6	−56·2		
146	1122	−45·5	−54·7		
147	1123	−41·3	−51·3		
148	1124	−35·1	−48·0		
149	1125	——	−44.9	−29·6	−15·3
150	1126	−39·2	−39·2		
151	1127	−28·8	−35·7		
152	1128	−25·8	−34·9		
153	1129	−33·7	−35·0		
154	1130	−38·1	−33·3		
155	1131	−31·0	−32·2		
156	1132	−38·0	−31·0		
157	1133	−38·4	−29·2		
158	1134	−41·4	−27·3		
159	1135	−18·4	−24.6		
160	1136	−21·3	−21·9	−30·8	+ 8·9
161	1137	−26·5	−19·6		
162	1138	− 8·5	−17·4		
163	1139	− 4·8	−13·5		
164	1140	− 5·3	− 9.9		
165	1141	− 6·8	− 8·8		
166	1142	− 2·1	− 8·2		
167	1143	——	− 7·4		

(*to be continued.*)

Table I. (*continued.*)

	B.M	Δh	$\frac{1}{11}\Sigma\Delta h$	$\frac{1}{55}\Sigma\Delta h$	$\frac{1}{11}\Sigma\Delta-\frac{1}{55}\Sigma\Delta h$
		mm.	mm.	mm.	mm.
168	1144	+ 0·4	− 8·3		
169	1145	− 5·7	− 9·3		
170	1146	− 6·9	− 9·6		
171	1147	− 15·3	− 10·5	− 42·3	+ 31·8
172	1148	− 19·2	− 11·9		
173	1149	− 17·5	− 11·9		
174	1150	− 14·7	− 12·2		
175	1151	− 8·4	− 13·3		
176	1152	− 15·1	− 15·3		
177	1153	− 16·5	− 17·2		
178	1154	− 11·7	− 19·9		
179	1155	− 2·7	− 22·6		
180	1156	− 18·7	− 26·3		
181	1157	− 28·4	− 30·1		
182	1158	− 36·0	− 33·8	− 42·5	+ 8·7
183	1159	− 48·8	− 37·5		
184	1160	− 47·5	− 41·5		
185	1161	− 55·7	− 44·2		
186	1162	− 49·8	− 48·3		
187	1163	− 55·5	− 50·2		
188	1164	− 57·5	− 51·1		
189	1202	− 56·4	− 50·8		
190	1203	− 51·4	− 55·8		
191	1204	− 43·9	− 61·1		
192	1205	− 49·8	− 76·6		
193	1206	− 45·4	−100·6	+ 7·7	−108·3
194	1207	− 46·0	−157·8		
195	1208	−102·8	−157·7		
196	1209	−113·3	−153·3		
197	1210	−220·8	−148·3		
198	1211	−319·6	−143·2		
199	1212	−686·1	−137·9		
200	1213	− 55·7	−134·5		
201	1214	− 3·2	−123·0		

(*to be continued.*)

Table I. (*continued.*)

	B.M.	Δh	$\frac{1}{11}\Sigma\Delta h$	$\frac{1}{55}\Sigma\Delta h$	$\frac{1}{11}\Sigma\Delta-\frac{1}{55}\Sigma\Delta h$
		mm.	mm.	mm.	mm.
202	1215	+ 10·1	−109·8		
203	1216	+ 7·8	− 82·5		
204	1217	+ 12·3	− 45·7	+ 39·0	− 84·7
205	1218	− 8·4	+ 27·3		
206	1219	+ 24·2	+ 47·7		
207	1220	+ 31·9	+ 66·0		
208	1221	+ 79·2	+ 89·5		
209	1222	+ 85·5	+117·0		
210	1223	+116·3	+160·5		
211	1224	+168·9	+186·2		
212	1225	+197·9	+175·6		
213	1226	+269·2	+171·7		
214	1227	+310·0	+189·3		
215	1228	+490·5	+229·0	+ 55·7	+174·3
216	1229	+274·2	+268·7		
217	1230	− 91·8	+340·8		
218	1231	+ 88·3	+105·4		
219	1232	+172·8	+261·0		
220	1233	+434·1	+265·8		
221	1234	+642·1	+220·4		
222	1235	+961·1	+196·6		
223	1236	−191.2	+206·6		
224	1237	−122·1	+177·8		
225	1238	——	+185·5		
226	1239	+ 36·6	+145·9	+ 83·7	+ 62·2
227	1240	+ 35·8	+ 87·5		
228	1241	+ 8·7	− 5·1		
229	1376	+ 0·1	+ 18·5		
230	1375	+ 50·0	+ 36·6		
231	1374	+ 37·7	+ 38·3		
232	1373	+ 58·0	+ 39·8		
233	1372	+ 35·5	+ 41·3		
234	1371	+ 44·6	+ 45·2		
235	1370	+ 59·4	+ 49·7		

(*to be continued.*)

Table I. (*continued.*)

	B.M.	Δh	$\frac{1}{11}\Sigma\Delta h$	$\frac{1}{55}\Sigma\Delta h$	$\frac{1}{11}\Sigma\Delta-\frac{1}{55}\Sigma\Delta h$
		mm.	mm.	mm.	mm.
236	1369	+ 55·4	+ 49·8	+ 99·7	− 49·9
237	1368	+ 52·3	+ 51·6		
238	1367	+ 52·9	+ 50·3		
239	1366	+ 50·9	+ 51·9		
240	1365	——	+ 51·6		
241	1364	+ 51·2	+ 50·7		
242	1363	+ 55·7	+ 49·6		
243	1362	+ 44·9	+ 48·6		
244	1361	——	+ 46·3		
245	1360	+ 41·9	+ 43·9		
246	1359	——	+ 41·9		
247	1358	+ 46·8	+ 39·5	+ 56·4	− 16·9
248	1357	+ 44·8	+ 36·5		
249	1356	+ 33·8	+ 35·5		
250	1355	+ 31·8	+ 35·8		
251	1354	+ 26·2	+ 35·4		
252	1353	+ 29.9	+ 36·2		
253	1352	+ 28·7	+ 35·4		
254	1351	+ 35·4	+ 34·6		
255	1350	+ 38·3	+ 36·7		
256	1349	+ 37·8	+ 35·5		
257	1348	+ 44·4	+ 35·7		
258	1347	+ 38·5	+ 34·2	+ 29·4	+ 4·8
259	1346	+ 35·9	+ 33·7		
260	1345	+ 37·2	+ 32·8		
261	1344	+ 38·4	+ 31·3		
262	1343	+ 28·4	+ 29·2		
263	1342	+ 13·5	+ 26·6		
264	1341	+ 23·0	+ 24·2		
265	1340	+ 25·2	+ 20·6		
266	1339	+ 21·7	+ 18·1		
267	954	+ 14·6	+ 15·1		
268	953	+ 16·1	+ 13·0		
269	952	+ 11·7	+ 12·5	+ 20·5	− 8·0

(*to be continued.*)

Table I. (*continued.*)

	B.M.	Δh	$\frac{1}{11}\Sigma\Delta h$	$\frac{1}{55}\Sigma\Delta h$	$\frac{1}{11}\Sigma\Delta-\frac{1}{55}\Sigma\Delta h$
		mm.	mm.	mm.	mm.
270	951	− 3·0	+ 11·1		
271	950	+ 10·0	+ 10·3		
272	949	+ 5·4	+ 9·7		
273	948	+ 4·4	+ 9·9		
274	947	+ 8·2	+ 8·2		
275	946	+ 8·2	+ 9·0		
276	945	+ 16·5	+ 10·8		
277	944	+ 14·5	+ 11·3		
278	943	+ 16·9	+ 11·7		
279	942	− 2·3	+ 11·4		
280	941	+ 19.7	+ 11·0	+ 11·7	− 0·7
281	940	+ 17·5	+ 10·2		
282	939	+ 15·1	+ 9·6		
283	938	+ 10·2	+ 9·5		
284	937	+ 1·1	+ 9·7		
285	936	+ 3·8	+ 12·4		
286	935	− 0·9	+ 10·7		
287	934	——	+ 9·8		
288	933	+ 13·7	+ 8·4		
289	932	+ 19·5	+ 8·2		
290	931	+ 23·9	+ 6·8		
291	930	+ 3·4	+ 5·4	− 8·0	+ 13·4
292	929	+ 8·1	+ 3·7		
293	928	+ 0·8	+ 3·7		
294	927	+ 8·4	+ 2·7		
295	926	− 12·7	− 0·1		
296	925	− 10·6	− 1·6		
297	924	− 16·9	− 1·0		
298	923	+ 3·3	− 1·3		
299	922	——	− 0·8		
300	921	− 8·5	− 1·8		
301	920	+ 9·0	− 2·7		
302	919	+ 8·8	− 4·4	− 30·2	+ 25·8
303	918	+ 5·9	− 6·2		

(*to be continued.*)

Table I. (*continued.*)

	B.M.	Δh	$\frac{1}{11}\Sigma\Delta h$	$\frac{1}{55}\Sigma\Delta h$	$\frac{1}{11}\Sigma\Delta h-\frac{1}{55}\Sigma\Delta h$
		mm.	mm.	mm.	mm.
304	917	+ 5·6	− 13·1		
305	916	—	− 15·6		
306	915	− 20·8	− 18·8		
307	914	− 25·9	− 23·3		
308	913	− 33·2	− 30·1		
309	912	− 58·8	− 39·1		
310	911	− 38·1	− 50·1		
311	910	− 40·9	− 54·2		
312	909	− 35·1	− 57·5		
313	908	− 63·9	− 64·5	− 43·9	− 20·6
314	907	− 79·5	− 70·4		
315	906	−104·9	− 74·1		
316	905	− 94·7	− 80·0		
317	904	——	− 88·1		
318	903	− 95·9	− 93·5		
319	5258	− 91·7	− 97·2		
320	902	− 96·7	−100·7		
321	901	− 96·4	−103·2		
322	900	−122·1	−102·5		
323	899	− 89·4	−100·4		
324	898	−100·4	− 98·4	− 49·8	− 48·6
325	897	−115·0	− 97·0		
326	896	−130·1	− 94·8		
327	895	− 87·5	− 91·9		
328	894	− 79·6	− 86·5		
329	893	− 73·1	− 82·5		
330	892	− 77.0	− 78·6		
331	891	− 72·4	− 72·2		
332	890	− 63·8	− 64·0		
333	889	− 63·0	− 59·9		
334	888	− 45·9	− 57.7		
335	887	− 57·7	− 56·4	− 55·6	− 0·8
336	886	− 44·0	− 52·3		
337	885	− 40·4	− 48·4		

(*to be coutinued.*)

Table I. (*continued.*)

	B.M.	Δh	$\frac{1}{11}\Sigma\Delta h$	$\frac{1}{55}\Sigma\Delta h$	$\frac{1}{11}\Sigma\Delta h-\frac{1}{55}\Sigma\Delta h$
		mm.	mm.	mm.	mm.
338	884	− 42·5	− 45·0		
339	883	− 54·7	− 41.0		
340	882	− 58·6	− 38·8		
341	881	− 32·4	− 35·7		
342	880	− 29·8	− 33·6		
343	879	− 26·1	− 32·2		
344	878	− 18.8	− 30·4		
345	877	− 21·3	− 27·5		
346	876	− 24·1	− 25·3	− 59·3	+ 24·0
347	875	− 21·2	− 26·6		
348	874	− 24·4	− 24·7		
349	873	− 23.5	− 24·8		
350	872	− 21·8	− 25·9		
351	871	− 35·4	− 28·1		
352	870	− 26.2	− 28·8		
353	869	− 28·9	− 29·1		
354	868	− 27·1	− 29·0		
355	867	− 31·2	− 30·7		
356	866	− 45·3	− 33·5		
357	865	− 31·7	− 33·3	− 36·4	+ 3·1
358	864	− 24·2	− 33·7		
359	863	− 24·1	− 34·1		
360	862	− 41·6	− 35·4		
361	861	− 52·4	− 35·6		
362	860	——	− 34·2		
363	859	− 30·7	− 34·2		
364	858	− 33·0	− 36·0		
365	857	− 39·3	− 37·3		
366	856	− 34·1	− 36.8		
367	855	− 31·3	− 34·2		
368	11	− 31.6	− 33·2	− 34·7	+ 1·5
369	854	− 41·9	− 31·9		
370	853	——	− 30.5		
371	852	− 37·1	− 31·7		

(*to be continued.*)

Table I. (*continued.*)

	B.M.	Δh	$\frac{1}{11}\Sigma\Delta h$	$\frac{1}{55}\Sigma\Delta h$	$\frac{1}{11}\Sigma\Delta h-\frac{1}{55}\Sigma\Delta h$
		mm.	mm.	mm.	mm.
372	851	− 28·4	− 31·6		
373	850	− 24·6	− 31·1		
374	849	− 17·7	− 32·0		
375	848	− 18·7	− 30·7		
376	847	− 51·9	− 30·0		
377	846	− 32·5	− 29·8		
378	845	− 26·9	− 30·6		
379	844	− 40·0	− 33·9	− 44·3	+ 10·4
380	843	− 29.5	− 35·5		
381	842	− 22·3	− 37·0		
382	841	− 34·9	− 35·0		
383	840	− 37·6	− 36·4		
384	839	− 61·2	− 37·8		
385	12	− 35·4	− 38·4		
386	838	− 34·6	− 40·2		
387	837	− 30·3	− 43·4		
388	836	− 47·4	− 45·5		
389	835	− 42·1	− 47·8		
390	834	− 47·3	− 48·0	− 42·8	− 5·2
391	833	− 49·2	− 51·0		
392	832	− 57·0	− 54·0		
393	831	− 58·6	− 57·3		
394	830	− 62·3	− 59·0		
395	829	− 63·8	− 63·6		
396	828	− 68·0	− 67·0		
397	2967	− 67·6	− 70·7		
398	2966	− 66·6	− 71·5		
399	2965	− 67·0	− 73·0		
400	2964	− 91·8	− 73·4		
401	2963	− 85·1	− 73·0	− 68·2	− 4·8
402	2962	− 89·5	− 72·3		
403	2961	− 66·2	− 72·2		
404	2960	− 74·7	− 72·7		
405	2959	− 67·4	− 72·7		

(*to be continued.*)

Table I. (*continued.*)

	B.M.	Δh	$\frac{1}{11}\Sigma\Delta h$	$\frac{1}{55}\Sigma\Delta h$	$\frac{1}{11}\Sigma\Delta h-\frac{1}{55}\Sigma\Delta h$
		mm.	mm.	mm.	mm.
406	2958	− 58·8	− 71·1		
407	2957	− 60·2	− 70·6		
408	2956	− 67·2	− 69·3		
409	2955	− 71·5	− 70·7		
410	2954	− 66·8	− 71·8		
411	2953	− 74·6	− 73·6		
412	2952	− 80·0	− 76.0	− 86·6	+ 10·6
413	2951	− 75.2	− 79·3		
414	2950	− 81·4	− 82·4		
415	2949	− 86·3	− 85·2		
416	2948	− 88·0	− 88·7		
417	2947	− 85.1	− 91·9		
418	2946	− 96·7	− 94·9		
419	2945	−101·0	− 99·7		
420	2944	−101·7	−102·7		
421	2943	−105·3	−105·7		
422	2942	−110·6	−107·4		
423	2941	−113·1	−110·3	− 98·0	− 12·3
424	2940	−127·0	−112·1		
425	2939	−114·8	−113·2		
426	2938	−119·1	−115·2		
427	2937	——	−116·3		
428	2936	−113·5	−119·9		
429	2935	−114·8	−120·9		
430	2934	−112·2	−120·5		
431	2933	−121·6	−121·6		
432	2932	——	−121·9		
433	2931	−142·7	−122·3		
434	2930	−122·1	−125·6	−104·3	− 21·3
435	2929	−123·8	−126·1		
436	2928	−124·8	−125·5		
437	3703	——	−124·3		
438	3704	−125·4	−123·5		
439	3705	−142·8	−120·1		

(*to be continued.*)

Table I. (*continued.*)

	B.M.	Δh	$\frac{1}{11}\Sigma\Delta h$	$\frac{1}{55}\Sigma\Delta h$	$\frac{1}{11}\Sigma\Delta h-\frac{1}{55}\Sigma\Delta h$
		mm.	mm.	mm.	mm.
440	3706	−119·1	−118·3		
441	3707	−107·0	−114·5		
442	3708	−111·3	−113·3		
443	3709	−116·3	−113·3		
444	3710	−107·9	−109·3		
445	3711	−104·6	−105·1	−101·1	− 4·0
446	3712	− 85·6	−103·1		
447	3713	(−298·2)	− 98·9		
448	3714	——	− 93·2		
449	3715	− 89·0	− 87·6		
450	3716	——	− 84·3		
451	3717	——	− 80·7		
452	3718	− 77·8	− 90·1		
453	3719	− 71·5	− 96·0		
454	3720	− 77·1	−101·0		
455	3721	——	−106·6		
456	3722	− 83·2	−104·7	− 90·6	− 14·1
457	3723	−147·8	−102·6		
458	3724	−125·5	−102·3		
459	3725	−136.3	−101·7		
460	3726	−133·6	−100·8		
461	3727	− 89·2	− 97·5		
462	3728	− 83·6	− 95·0		
463	3729	− 75·6	− 86·0		
464	3730	− 64·7	− 79·3		
465	3731	− 68·8	− 71·0		
466	3732	− 63·8	− 62·3		
467	3733	− 56·6	− 59·6	− 83·0	+ 23·4
468	3734	− 48·8	− 54·4		
469	3735	− 50·8	− 51·0		
470	3736	− 45·2	− 47·8		
471	3737	− 38·2	− 44·1		
472	3738	——	− 41·5		
473	3739	− 31·0	− 43·0		

(*to be continued.*)

Table I. (*continued.*)

	B.M.	Δh	$\frac{1}{11}\Sigma\Delta h$	$\frac{1}{55}\Sigma\Delta h$	$\frac{1}{11}\Sigma\Delta h-\frac{1}{55}\Sigma\Delta h$
		mm.	mm.	mm.	mm.
474	3740	− 41·7	− 46·3		
475	3741	− 32·7	− 49·1		
476	3742	− 32·2	− 52·6		
477	3743	− 37·5	− 56·8		
478	3744	− 71·8	− 58·2	− 81·7	+ 23·5
479	3745	− 82·1	− 62·1		
480	4463	− 78·4	− 64·7		
481	4462	− 80·3	− 68·3		
482	4461	− 79·9	− 72·0		
483	4460	− 73·1	− 75·3		
484	4459	− 73·1	− 75·7		
485	4458	− 70·8	− 75.3		
486	4457	− 71·7	− 75·2		
487	4456	− 72·8	− 75·5		
488	4455	− 74.3	− 82·8		
489	4454	——	− 87·6	− 89·3	+ 1·7
490	4453	− 78·5	− 90·6		
491	4452	− 77·9	− 92·3		
492	4451	− 82·8	− 95·5		
493	4450	−152·6	− 98·3		
494	4449	−121·1	−102·6		
495	4448	−103·0	−102·5		
496	4447	− 90·1	−103·8		
497	4446	−101·7	−105·1		
498	4445	−100·7	−105·8		
499	4444	−117·4	− 99·9		
500	4443	−101·4	− 98·5	−114·0	+ 15·5
501	4442	− 92·7	− 97·0		
502	4441	− 92·7	− 99·0		
503	4440	− 90·9	− 99·7		
504	4439	− 87·2	−100·0		
505	4438	− 95·6	− 99·9		
506	4437	——	−102·2		
507	4436	−109·4	−108·2		

(*to be continued.*)

Table I. (*continued.*)

	B.M.	Δh	$\frac{1}{11}\Sigma\Delta h$	$\frac{1}{55}\Sigma\Delta h$	$\frac{1}{11}\Sigma\Delta h-\frac{1}{55}\Sigma\Delta h$
		mm.	mm.		
508	4435	−108·8	−109·9		
509	4434	−104·1	−121·7		
510	4433	−116·3	−132·5		
511	4432	−124·3	−142·4		
512	4431	−152·4	−147·4		
513	4430	——	−157·3		
514	4429	−197·3	−167·4		
515	4428	−184·4	−179·4		
516	4427	−185·0	−188·6		
517	4426	−192.3	−192·9		
518	4425	−208·2	−194·3		
519	4424	−209.4	−191·9		
520	4423	−223·9	−187·0		
521	4422	−208·9	−188·0		
522	4421	−166·7	−183·3		
523	4420	−166·8	−177·0		
524	4419	−167.7	−168·0		
525	4418	−143·2	−159.8		
526	4417	−196·0	−147·4		
527	4416	−133·3	−138·0		
528	4415	−123·2	−132·1		
529	4414	−108·6			
530	4413	−115·7			
531	4412	− 90·9			
532	4411	−106·1			
533	4410	−101·2			

13. 本州日本海沿岸に於ける地殼の波狀的變動

坪　井　忠　二

濱田より新發田に到る水準線路改測の結果を整理し，地殼の變動が凡そ 80 粁の週期を有する波形を示す事を指摘した.