35. *Land Slip in the Imaichi District Revealed from the Breaks in the Well-Tubes.**

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Introduction.

After the earthquake of Dec. 26, 1949, a large number of wells became dry or muddy in the Imaichi district, and the inhabitants found breaks in the well-tubes at some depth beneath the ground. The writer examined the water-wells distributed in and around the town of Imaichi and found out the horizontal slip of the strata of soil concealed under the ground. Then, with the cooperation of his 20 pupils of the Imaichi Middle School, he carried out more detailed investigations into this phenomenon from the end of May to the beginning of July, 1950.

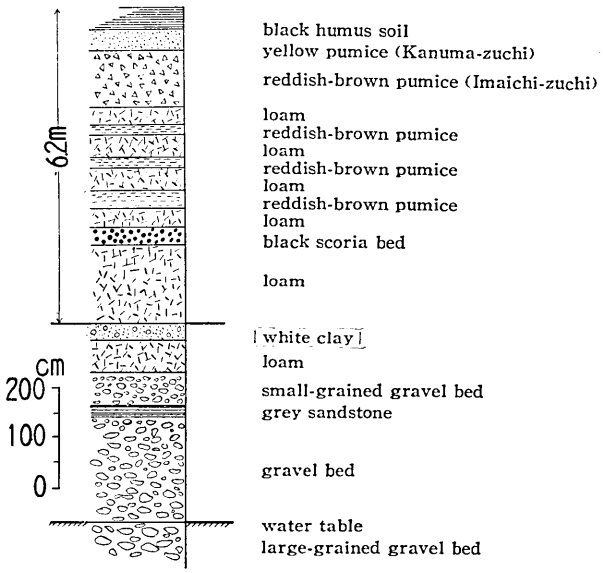

Fig 1. Columnar section of the strata observed in the well. (after J. Osaka)

* Communicated by T. HAGIWARA.

We carefully investigated whether the wall of the well was relatively displaced or not. The number of the wells investigated by us reached 168. When displacement was recognized, we measured the depth where the displacement occurred, and also the direction and amount of the displacement. As far as we know, the slip plane surely coincided with the white clayey bed

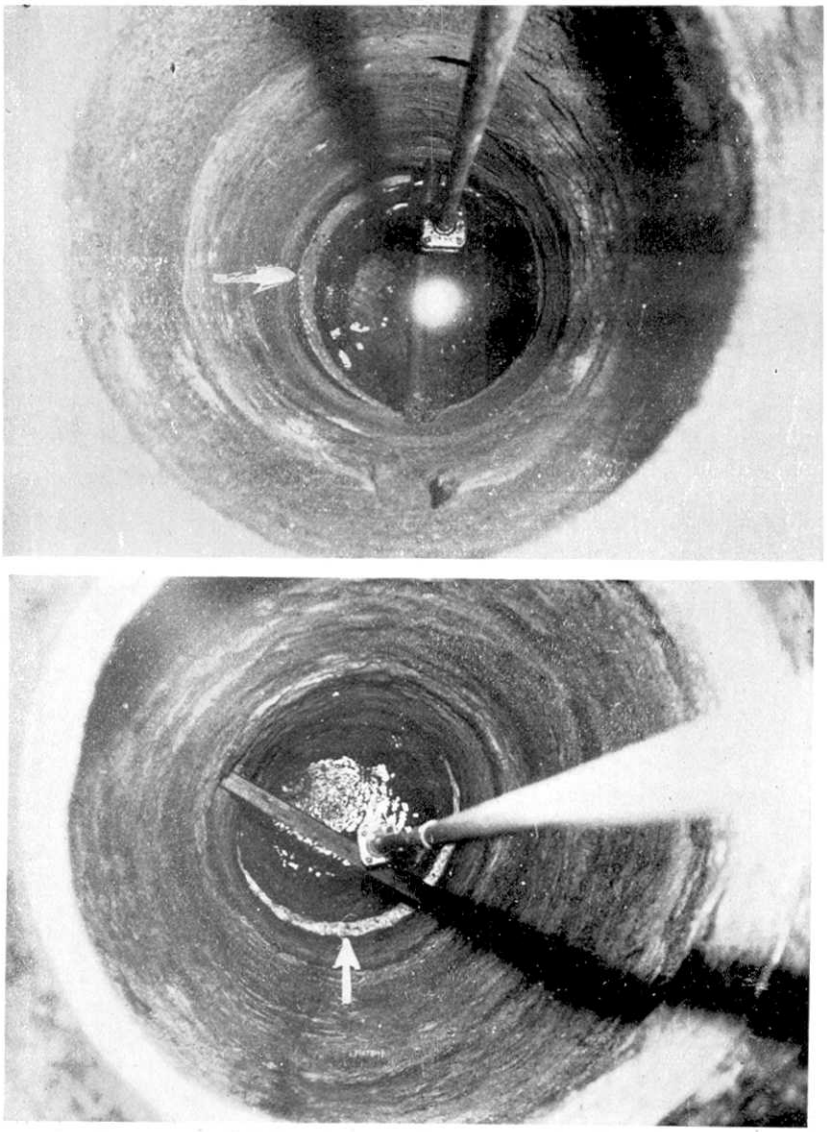

Fig. 2. White clayey bed is seen in a crescent-shape, showing the displacement of the side-wall of the well.

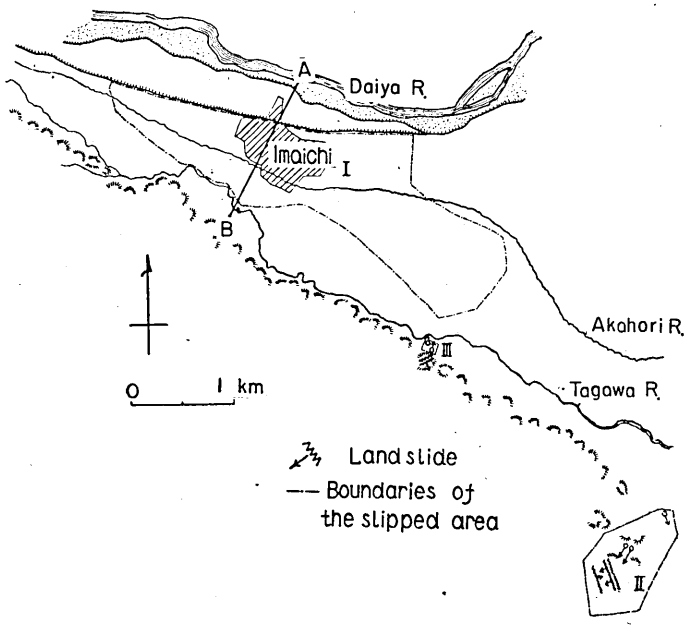

Fig. 3. Distribution of the slipped area.

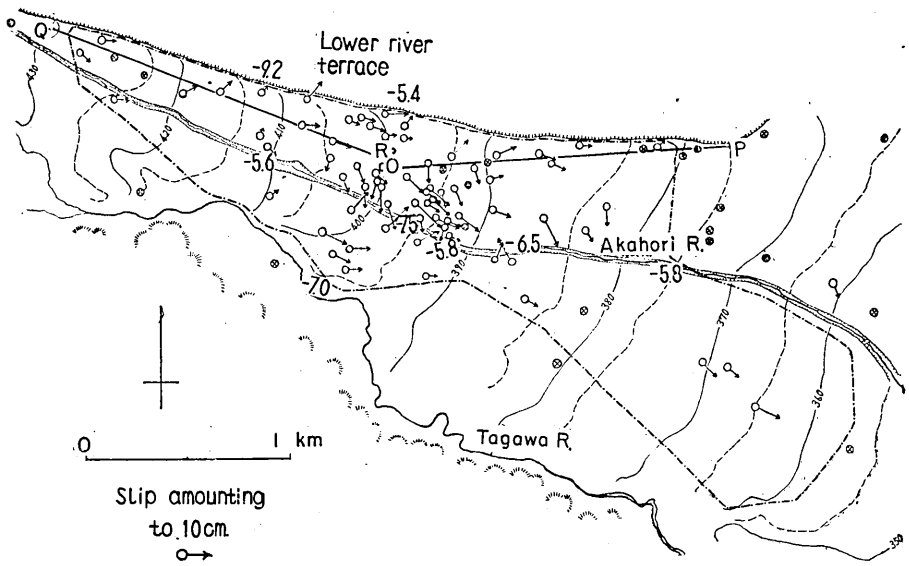

Fig. 4. ⇾ Direction and amount of the slip. ⊗ Wells whose break could not be observed. Numbers (f.e. −5.8) Relative height (m); the surface of the alluvial fan being assumed as 0.

in the loam deposite overlaid by the so-called Imaichi-zuchi or Kanuma-zuchi (Zuchi means soil in Japanese), thick aeolian pumice deposites (Fig. 1). We also measured the depth to this white clayey bed and the temperature of water in the wells. Examples of the slip plane that is seen in the well are shown in Fig. 2.

Sometimes our investigation was disturbed by the following causes. (1) The surface of the well-tube was already smoothed for the sake of well-cleaning. (2) The white calyey bed lies deep under the water level. (3) The drlling was stopped at this calyey bed since the water was supplied from this water bearing bed, as was seen in Moritomo and Mizunashi. (4) The well-tube was destroyed by the earthquake. (5) The cover of the well could not be removed, or the A. C. source for illuminating the well could not be available.

In spite of the difficulties just mentioned, we succeeded in obtaining the data of 168 wells. The accuracy of the measurement in the present case may be considered as 0.5 m for the depth of the slip plane, 1 cm for the amount of the displacement and 20°~30° for the direction of the slip.

Area where the slip in the well occurred.

To determine the area where the slip in the well appeared, investigations were carried out in the town of Imaichi and in the surrounding villages, within 6~8 km distant from the center of the town. In determining the boundary of the area the statements made by the inhabitants were also taken into consideration provided they could trusted. The area of the slip thus determined is shown in Fig. 3 and 4.

Topographically speaking, the area where the slip occurred is the western part of the alluviall fan, sloping gently along the river of Daiya. The thickness of fan deposite is largest in the neighbourhood of the town of Imaichi. This fact will be proved by the depth of the well, since the wells in this region are drilled to the bed rock (Fig. 5 and 6). The area is 3.6 km long along the slope of the fan and bounded on both sides by the terraces of Daiya River and Tagawa River, the dimensions amounting to 3.4 km^2. A remarkable fact is that the wells drilled in the lower river terrace do not show any slip.

We found these slips in wells in other area as indicated by the symbols II and III in Fig. 4, but these slips were so local that we could not obtain sufficient data to discuss their character in detail. They seem to have been induced by the landslide which occurred in the neighbourhood of them, because the wells which slipped could not be found in places rather distant from there.

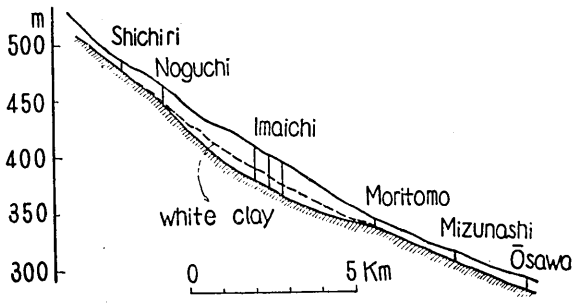

Fig. 5.

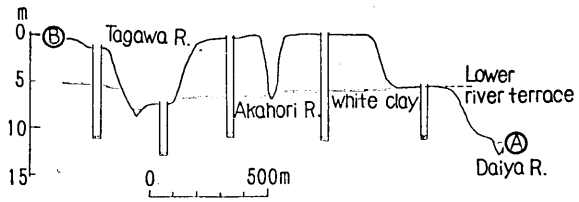

Fig. 6.

Direction and amount of the slip, and depth of the slip plane.

The slip plane found in the wells is at the depth of 6.3 m in average under the ground. The slip plane seems to spread continuously in the area where the slip of the wells exists. The direction of the slip is almost perpendicular to the contour line of the topographical map. It may be considered that the strong shock of the earthquake of Dec. 26, 1949 caused the sliding of the upper layer along the surface of the white clayey bed that had smaller friction and adhesion.

The length of the arrows drawn in Fig. 3 shows the horizontal displacement of the wells. The average value of the displacements of 65 wells is 7.4 cm in length.

The horizontal displacement of the wells lying within distance of 100 m from the line QR and OP was projected to a vertical plane parallel to the line (Fig. 7 and 8). As will be seen in the Figure, the displacements are largest in the middle portion of the area (O, R) and smallest at the margins both north and south (Q, P). The mean inclination of the ground between Q and P is about 1° in angle.

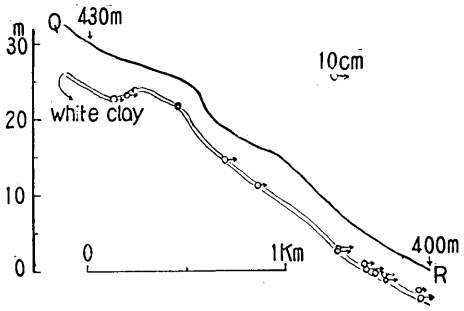

Fig. 7.

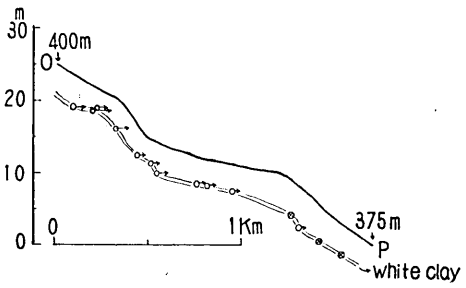

Fig. 8.

Muddiness of the well caused by the earthquake.

Following the Earthquake of Dec. 26, 1946, the writer collected the statements made by the inhabitants of that district. The results are classified as shown in Table I.

Table I

Well / Colour of muddiness	Slipped	Not slipped	Undetermined
white	34	9	15
Red or yellow	27	21	7
Mixture of white & red, or white & yellow	1	—	1
Dark or others	—	3	—
Not muddy	8	17	1
Indistinct	6	8	10
Total	76	58	34

As will been in the Table, a large number of the wells which slipped became muddy in white colour. This fact means that the white clayey bed played an important rôle in the slip of the land.

Résumé.

Investigating the slip caused in the wells, it was found that the land around the town of Imaichi, which sloped in angle of 1°, slided downwards. The land block which slided was estimated to be 3.4 km^2 in area and 6~7 m in thickness. The amount of the distance slided is largest in the central part of

the area, smallest at the north and south margins, and 7 cm in length averagely.

In conclusion, the writer wishes to express his hearty thanks to Professor T. Hagiwara and Assist. Professor R. Morimoto of the Earthquake Research Institute and Mr. Y. Mori, the master of the Imaichi Middle School for their kind advice and encouragement in the course of these studies. Thanks are also due to his pupils belonging to the group for meteorological study for the helps they offered in field works.

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35. 井戸調査から知られた今市地方の地層の横辷りについて

今市中學校　本田孝雄

今市地震後，同地方にある井戸の壁に，地層の横辷りを示す著しい食違いが認められたが，この現象に興味を抱いた筆者は，今市町を中心とする數 km の範圍に亘り井戸の調査を行つた．横辷りの有る場合は，井戸の壁上に附屬寫眞のような三日月型に白粘土層が認められるから，この型に着目して，横辷りの方向，距離を測定する事が出來た．調査に當つてはこの他，横辷りの起つている層迄の深さ，水位，水溫等も併せて測定し，同時に地震前後の井戸狀態の變化に關する質問を行つた．

調査の對象となつた井戸は總計 168 に上り，いろいろの理由で現象の確認できないものもあつたが，結果を綜合すると上記現象の認められる井戸は別圖の如く三地域内に分布している．この内 II, III の地域は現象がきわめて局部的なので，考察から除外するが，I の地域においては，殆んど例外なしに，井戸の上層部の地層が土地の傾斜方向に移動している模樣である．この地方の構造は，地理的及び地質的に二，三の研究者により調べられており，その結果を參照すると，上記現象は，今市町を含む面積 3.4 km^2, 厚さ 6～7 m の土塊（附圖參照）が地震動の爲に白粘土層を境として，土地の傾斜方向に 7 cm 程度移動した結果と推定されるに至つた．

更に，この地塊の中央部において移動量は最も大きく，南北の兩端部に於て小さい事は，興味深く思われる．尙，横辷りのあつた井戸の場合，地震後白濁したものが最も多い模樣であり，これからも，白粘土層が横辷りに密接な關係を有していた事が想像される．
