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# ECHELON ARRANGEMENT OF SATELLITES AND CRATERS OF THE KIRISHIMA VOLCANO, JAPAN

By

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## 1. Introduction

A severe earthquake occurred on 21st Feb., 1968 at the north foot of the Kirishima Volcano. Many earthquakes, felt or unfelt, occurred every day since then. On the way of surveying effects of them, the writer surveyed the geology. The earthquake was caused by the geological structure of the basement strata of the Kirishima Volcano. The structure elongates in the direction of chief axis of the Kirishima Volcano. The Kirishima Volcano is situated on the Kirishima Volcanic Zone. Many volcanoes are arranged in that direction. However, the arrangement of satellites and craters of a single volcano is controlled by the geological structure characteristic in the district. Volcanoes forming the volcanic zone are situated on a deep fissure, probably attaining to the mantle of the earth; however, satellites and craters of each volcano are arranged in the direction of shallow geological structures.

The earthquake on 21st Feb. was severe at Yoshimatsu Town, Kagoshima Prefecture, and Kyômachî, Ebino Town, Miyazaki Prefecture. Kyômachî is nearly situated on the sheared zone of the direction of N 40°W, which is also the chief direction of the Kirishima Volcano. The epicenter was perceived at the northern foot of Mt. Iimori, a satellite of the Kirishima Volcano. Yoshimatsu is situated on the faults cutting the formation occupying the Kakuto Basin. In the basin, the Quaternary strata of the Kakuto Formation are prevailing under the basal lava of the Kirishima Volcano.

Satellites and craters of the Kirishima Volcano are arranged on the echelon cracks traversing the chief axis of the Kirishima Volcano.

## 2. Brief Note on the Geology

The Kakuto Basin including Yoshimatsu and Ebino Towns are formed by the faults curving to E-W from N-S directions at the northwestern corner of the basin. Surrounding mountains are formed of propylite, probably of the Miocene, and of andesite and dacite, probably of the Pliocene.

The Kakuto Formation is divided into the following four facies in ascending order: shale, white sandstone, shale and pumice beds. These rocks are stratified and the pebbles in them are abraded. In general appearance, the white sandstone and pumice-beds

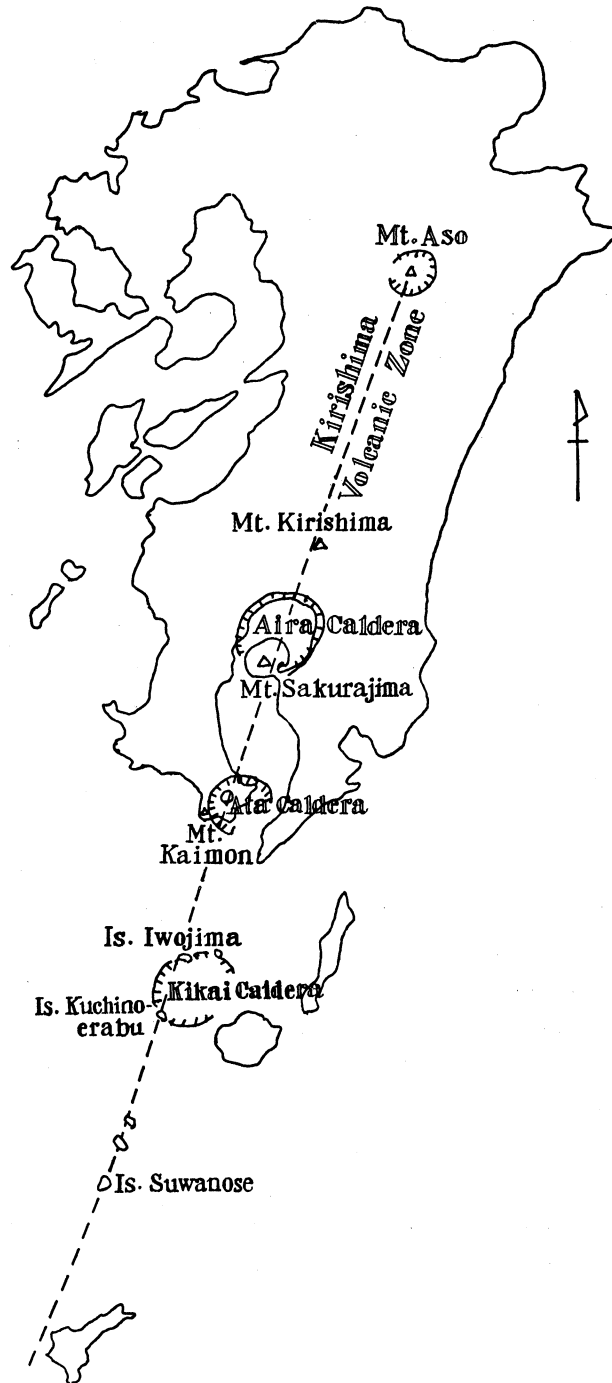


Fig. 1. Kirishima Volcanic Zone.

closely resemble the Shirasu beds of the Ito pyroclastic flow derived from the Aira Caldera. However, the pumice blocks are extremely abraded and quite different from those of the Ito pyroclastic flow. The pumice blocks are secondarily derived from the Ito Shirasu bed.

The Kakuto Formation is very calmly horizontal in the east. However, in the zone of N 40°W direction, one kilometer in width, passing Hiéda, it is strongly disturbed. The

zone elongates to the Masaki Station northward, and to Ikemure southward. In the zone, shales of the Kakuto Formation partially show an extraordinary strike and dip, such as N 40°W, 85°E, and an anticline and a syncline, and those are cut by a few faults. The direction of this zone coincides with the direction of the chief axis of the Kirishima Volcano. On the lava overlying the Kakuto Formation, the disturbance is scarcely perceived and the effects of the earthquake are slight regardless of the distance from the epicenter.

At a tomb-yard near Tsurumaru most tomb-stones fell down to the earth from their footstones. The predominant direction of their tumbling is N 50°E, and the subordinate one is N 40°W. The former coincides with the fault direction and the latter with that of the sheared zone. The rest except of the two main directions are variable and considered to be the composed ones of the two. From the fact, the earthquake is considered to have occurred along the two directions of the crustal movements.

### 3. Echelon Arrangement

On the Kirishima Volcano many satellites and craters are found. The chief axis of the volcano is N 40°W and many satellites and craters are arranged on the echelon cracks traversing the axis (as shown in Fig. 2). Mt. Karakuni is the principal of the Kirishima Volcano and situated on the axis.

Arrangements of the echelon cracks are inverse S-shaped without exception. This fact clearly indicates that the northeast side of the chief axis of the Kirishima Volcano moved northwestward and the southwest side moved southeastward. The movement occurred in the deeply-seated basement strata, probably in the sheared zone. On the contrary, echelon cracks were made in the superficial andesites and many satellites and craters were formed along the cracks. Consequently, satellites and craters are arranged in the direction controlled by the geological structure of the basement strata.

In the south of the region, the chief axis of the Kirishima Volcano is slightly curved to the west and the sheared zone stretches to Takarabe Town.

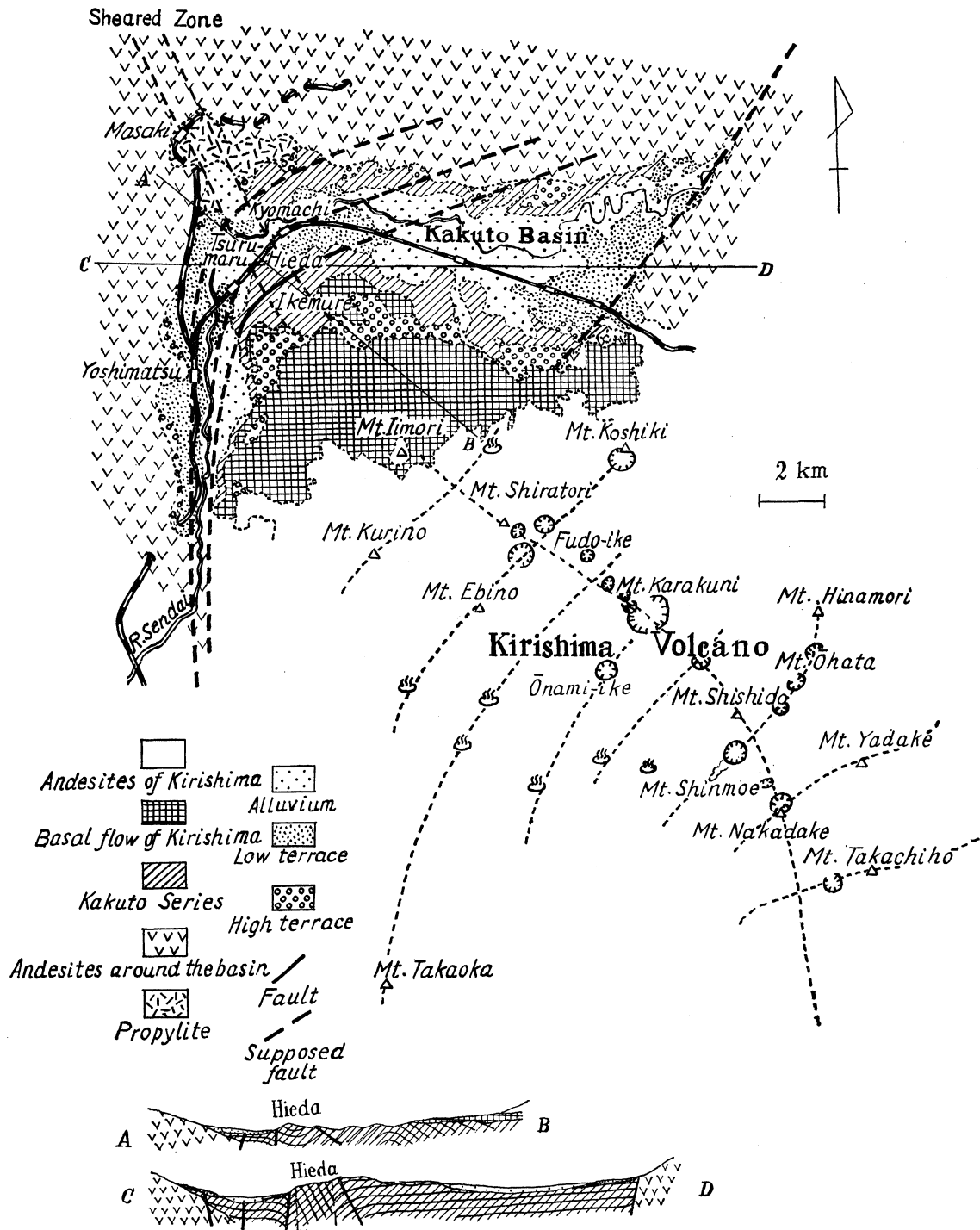


Fig. 2. The Kakuto Basin and the Kirishima Volcano.