ANALYSES OF SURFACE AND UNDERGROUND DATA OF TAKAMATSU CRATER IN JAPAN. Y. Miura, Inst. Earth Planet. Sci., Graduate School, Sci. & Eng., Yamaguchi University, Yoshida 1677-1, Yamaguchi, 753-8512, Japan. yasmiura@yamaguchi-u.ac.jp

Introduction: Almost all impact craters on planetary bodies of the Solar System (including the Moon and Asteroids) can be identified by surface data of topographic, rock composition, and gravity anomaly maps. This is mainly because such impact craters keep original topology and composition even after any erosion and weathering process. However, active planet of Earth shows complicated types of impact crater. Main purpose is to discuss surface and underground data which are required to analyze impact craters of active Earth (especially on volcanic islands of Japan) [1-11].

Types of Survived Impact Craters on Earth: The following types of impact craters can be classified on Earth:

1) *Type 1*: On non-volcanic regions, impact craters show distinct surface and underground data of topology, composition and gravity anomaly maps. The broken and weathered craters of type 1 can be easily estimated the original shape of crater based on rock composition and gravity maps and so on.

2) *Type 2*: On volcanic regions, impact craters should be analyzed by surface and underground data of gravitational map and rock composition. The buried and broken impact craters of type 2 are covered by followed sedimentation (mainly under water) which is easily broken by later tectonic events (such as volcanic intrusion and earthquake). On these two types, only shocked data of volcanic islands without geophysical data are not included as crater type 2 because the impact crater cannot keep original shape and composition after heavy tectonic movements (such as covering by new deposits in lowlands and increase of s*ea-sediments* to form mountains). In fact, if there is direct impact crater on mountains in active Japan, it is easily broken by shock wave not to be observed original shape anymore. Almost all small crater shapes of Japanese mountains are considered to be artificial traces of bomb shooting as military target trainings (especially tops of local mountains in Japan).

Example of Survived Impact Crater in Japan: Typical example of type 2 impact crater in volcanic islands of Japan is Takamatsu crater located in Busshozan-Cho, Takamatsu City, Kagawa Prefecture [7-11], which is now joined to locality name of new Takamatsu City. The center of the structure is Latitude 34.3° and Longitude 134.05°. Takamatsu crater is completely surrounded Cretaceous Ryoke granite, which has been intruded by andesites to produce small mountains after impact crater event.

Surface Data of Irregular Rim Shape: There is no clear crater shape of type 2 crater on topographic map. In fact, Takamatsu crater is covered by later Quarternary Mitoyo sediment which indicates that the crater was located under sea-water bottom for sedimentation after impact event [2-11]. There are two types of andesite intrusions on surface of crater structure as follows:

1) *rounded rim of uplifted granitic rock:* Only southern round rim of the crater shows broken and brecciated granitic rocks with 8km in size increased by andesitic intrusion along cracks (solid circles in Fig.1) and .

2) *small andesitic intrusions with breccias on different orientation*: Inside the crater, only southern part shows small andesitic breccias which are mixed with crater impact breccias with 4km in size [10-11] (plotted by white circles in Fig.1). Many small andesite intrusions are found on rims of gravity anomaly of 4km in size along final shapes of gravity anomaly map. A few small andesites are intruded inside the final crater shape of gravity map. However at the center of crater there are *no* andesite intrusions of crater of gravity anomaly map which indicates of large non-volcanic crater, but also followed small andesite intrusions along final shape of impact crater of gravity anomaly (Fig.1).

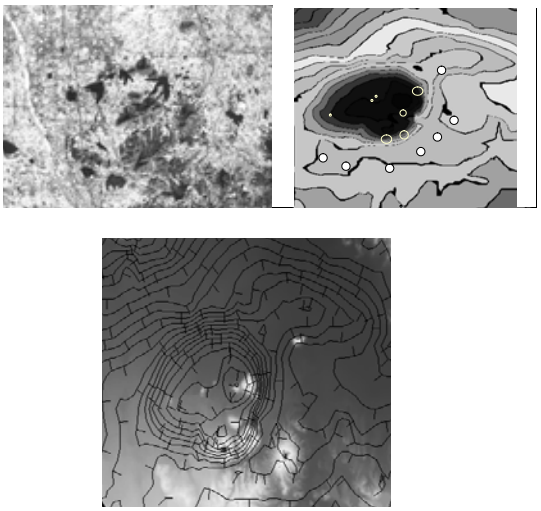

Fig.1. Surface map of Takamatsu crater by satellite topography (upper left), gravity anomaly map with solid and white circles of andesitic intrusion (upper right) and gravity anomaly map with topography as whitish parts of andesitic intrusion sites (lower) [7-11].

Three-Dimensional Analyses of Underground by Gravity Anomaly Data: Although gravity anomaly data have been reported to find Takamatsu buried crater at first [1], but formation age (15.3Ma ago) of the crater indicates that Takamatsu crater has been changed by the following events during Japanese island formations:

1) *Formation of Japan islands:* Large separation was started and moved from China continental side (northern part from present location) to present location to form the Japan Four-Main-Islands finally as in state of wide blocks of granites. In fact, crater ejecta along the crater with gravity anomaly is eliminated, and shape of gravity anomaly map has been elongated to EW direction during compression to NS direction (Fig. 2).

2) *Formation of Shikoku Island:* Small change by compression was started by separation from the Honshu main island of Japan (Figs. 2 and 3). Compression of crustal activity produces elongated gravity anomaly to EW direction, mainly in West direction (Fig.2).

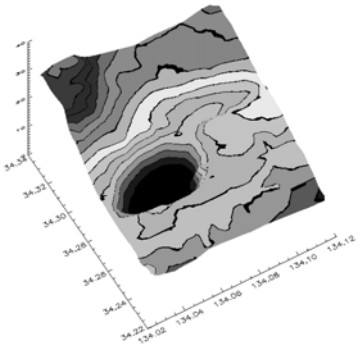

Fig. 2 Gravity anomaly map of Takamatsu crater with longitude and latitude scale [3, 9-11]. The crater is elongated mainly to West direction finally.

Depth profiles of gravity anomaly map are produced by our computer for several sections (Fig.3). Only southern part has uplifted of granitic basement which is formed with steep slope of crater rim produced by small andesitic intrusions after impact. There is no clear central uplift by andesitic intrusions formed by large volcanism, but irregular shape of crater bottom and wall is formed by effect later movement to form Japanese islands. Such irregular shapes of gravity anomaly are formed by tectonic compression and andesitic intrusions along cracks.

Rock and Mineral Compositions of the Crater: Surface of Takamatsu crater region is completely covered by later sediments except small andesictic mountains which have two types of andesites and breccias of andesite and impact rocks.

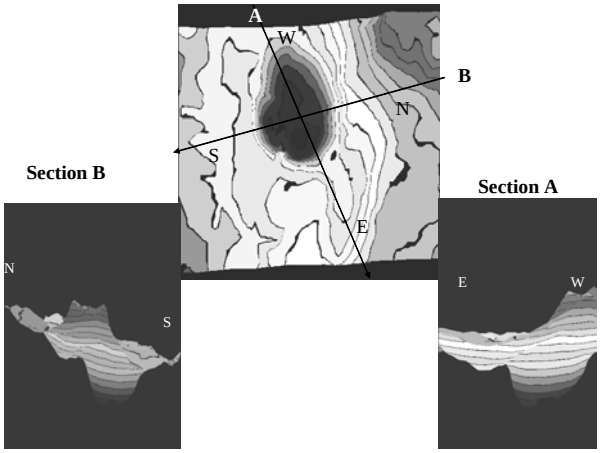

Fig.3. Surface map and depth profiles of gravity anomaly in Takamatsu crater for NS and EW directions [8-11]. Only southern part has uplifted granitic basement on underground maps which produces final steep slope of crater rim produced by small andesitic intrusions after impact. There is *no* central uplift by andesitic intrusions (as large volcano) in Figs. 1 and 3.

Shocked quartz with planar deformation features (PDFs) can be found in melt breccias of drilled samples (north site), and of surface around andesitic intrusions.

Bulk major and trace compositions of drilled samples of 930m and 960m melt breccias indicate that major elements are similar with granitic composition and trace elements are mixed with meteoritic elements as Fe_2O_3=2.1, 1.7 (wt.%), Co=21, 0 (ppm), Ni=1, 20 (ppm), and Ir=42, 0 (ppm), respectively.

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