

# GIS MAPPING OF LANDSCAPE AND DISASTERS OF SADO ISLAND, JAPAN

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## ABSTRACT:

Sado Island is floating offshore of Niigata on Sea of Japan. This island is 855km<sup>2</sup> and composed of Ko-sado (Small Sado) and O-Sado (Large Sado), and both them are arranged in a direction of NNE-SSW. This arrangement are parallel to Kakuda-Yahiko Range, south of Niigata City in the main land. O-Sado has the highest peak of more than 1100 m (Kinpokusan: 1172m), and Ko-Sado of 600 m high peak (Daichiyama: 645m). The total areas of the Sado Islands are 855km<sup>2</sup>, and East-west length is 32.7km, North-South length 59.5km. Total shore lines are up to 280.4km. The population is more than 67,000, the population density is 80.7/km<sup>2</sup>. The average temperature is 13.7oC, and annual precipitation is 1550 mm. Geologically, the Sado Island is composed of Neogene terrestrial and marine volcanic rocks of andesite, dacite and rhyolite. The Sado is a beautiful island, but is prone to landsliding and tectonic movements evidenced by upheaved benches and active faults. This island is also known as extinct birds "Crested Ibis, *Nipponia nippon*". This paper deals with GIS using mapping of landslide disasters, landscape and cultural heritages of Sado Island, referring to geology and geomorphology.



Figure 1. ALOS Image of Sado Island

1. GEOLOGY AND TOPOGRAPHY OF SADO ISLAND

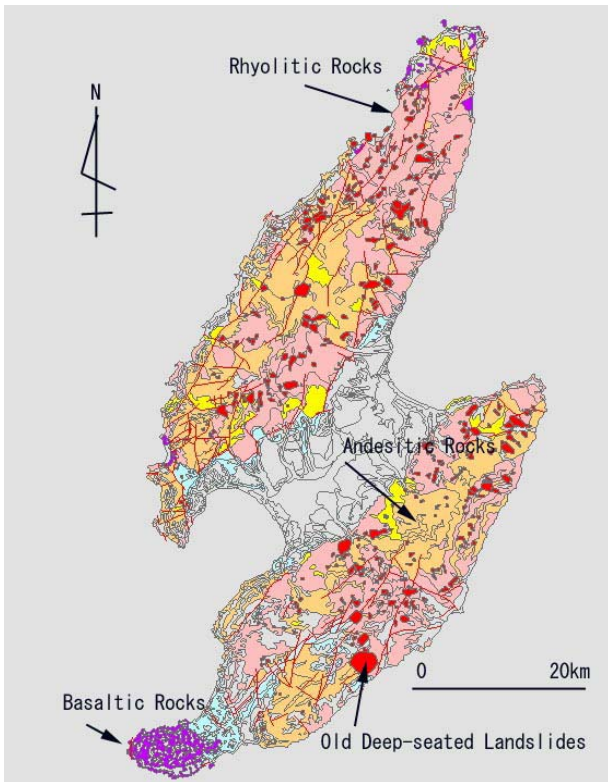


Figure 2 Geologic Map of Sado Island derived from Geological Survey of Japan (2007). Notice the red color area indicates deep-seated landslides. taken in 1947.

Sado island (Fig. 1) which is composed of O-Sado and Ko-Sado, is a part of the submarine ridges called Sado Ridge which are arranged in Sea of Japan.

The Sado Island is characteristic of tectonic movements by large earthquakes in ancient times. They are evidenced by upheaved marine terraces (Futami Peninsula), active faults and warping deformation (Kuninaka-Minami Fault), upheaved sea-shore bench (Shukunegi Beach). Geology of Sado Island is diagnostic of marine to terrestrial volcanic rocks of Middle Miocene (Figure 2). Almost of the volcanics are andesitic and rhyolitic lavas and fragmental rocks, and the basalts are very few (Figure 3). The ages of these volcanics are about 20Ma.

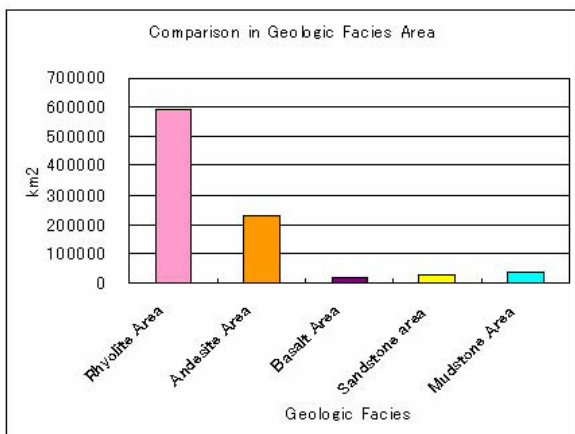


Figure 3. Geologic ratio from Figure 2.

Map of Landslide and Debris-flow areas

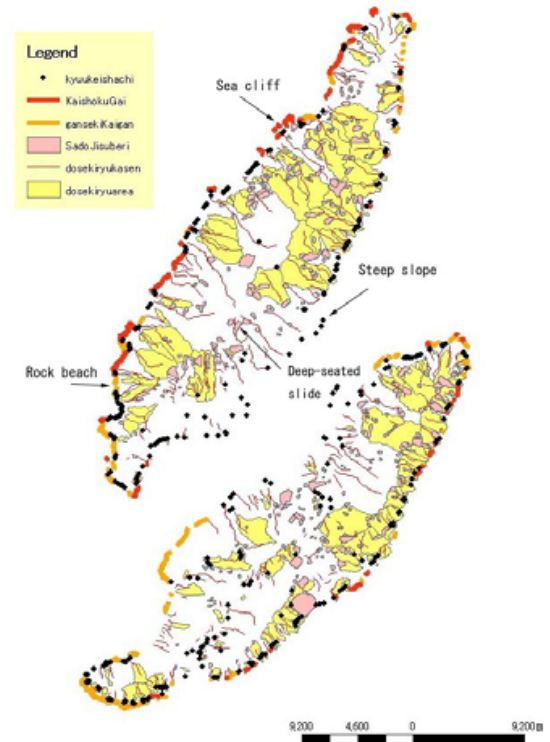


Figure 4. Map of the landslides and debris flows in Sado Island

2. HAZARD MAPS OF SADO

Sado Island is mostly composed of mountains and hills; therefore, it is prone landslides and debris disasters. Niigata Prefecture has been making such disaster areas (Figure. 4). Recently, the prefecture government has opened to the public the website of debris hazard warning system (<http://doboku-bousai.pref.niigata.jp/sabou/index.html>).

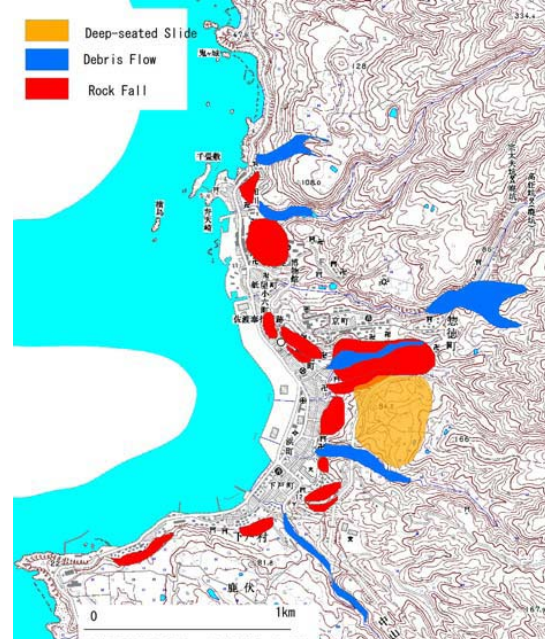


Figure 5. Landslide and debris-flow warning zones designated by Niigata Prefecture Government

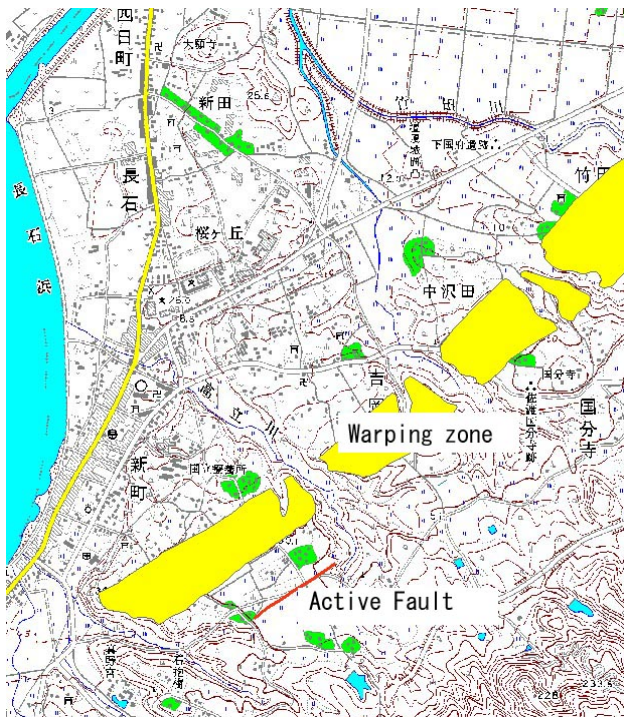


Figure 6. Map showing warping zone (yellow zone) and active fault (red line).

The home page shows debris disaster warning areas due to new law concerning (Figure. 5). On the other hand, Ko-Sado is known as upheaved beach by 1812 earthquake, and as active faults and warping zones (Figure. 6).

### 3. ENVIRONMENTAL MAPS OF SADO

In Sado island, environmental maps of forest division map (distribution of shore-line division) were opened to the public. In addition, recently extinct birds (Japanese Crested Ibis, *Nipponia nippon*, Toki in Japanese) are fed in the cages, imported from Chinese Crested Ibis, for future wild return, because in 1970's Japanese Crested Ibis extincted from the Sado Island. Therefore, I checked the sequence of distribution of the paddy fields which were feeding the birds in winter season (Figure 7). Namely, the age of diminishing of the paddy fields coincides with the extinction of the birds.

### 4. CULTURAL HERITAGES OF THE SADO ISLAND

Sado is also known as many cultural heritages and old gold and silver mines (Figure 8). Because, in ancient times the Sado Island was for used as jail island for criminal important people. However, Sado island has produced gold and silver from Sado Mines (Figure 8) which is now used for exhibition to the public and now is expected to be a World Heritage.

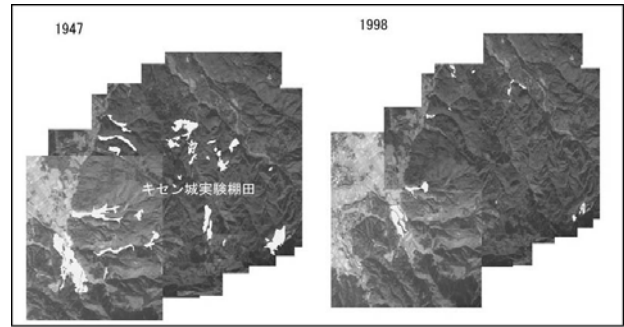


図 9 1947 年と 1998 年の空中写真による棚田分布の比較.

Figure 7. Comparison in distribution of paddy fields between 1947 and 1998.

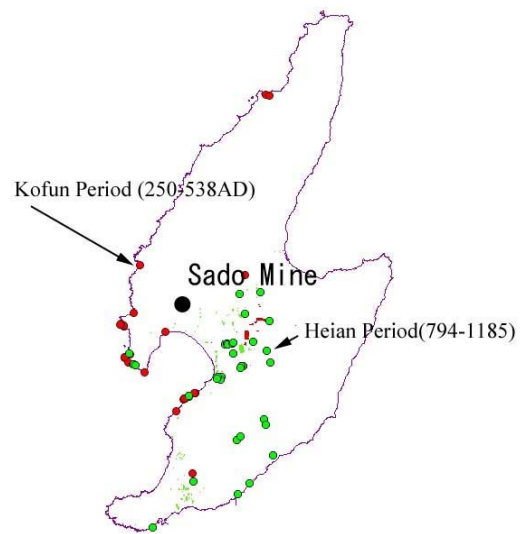


Figure 8. Map showing Sado Mine and distribution of cultural heritage of Kofun and Heian Peirod

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