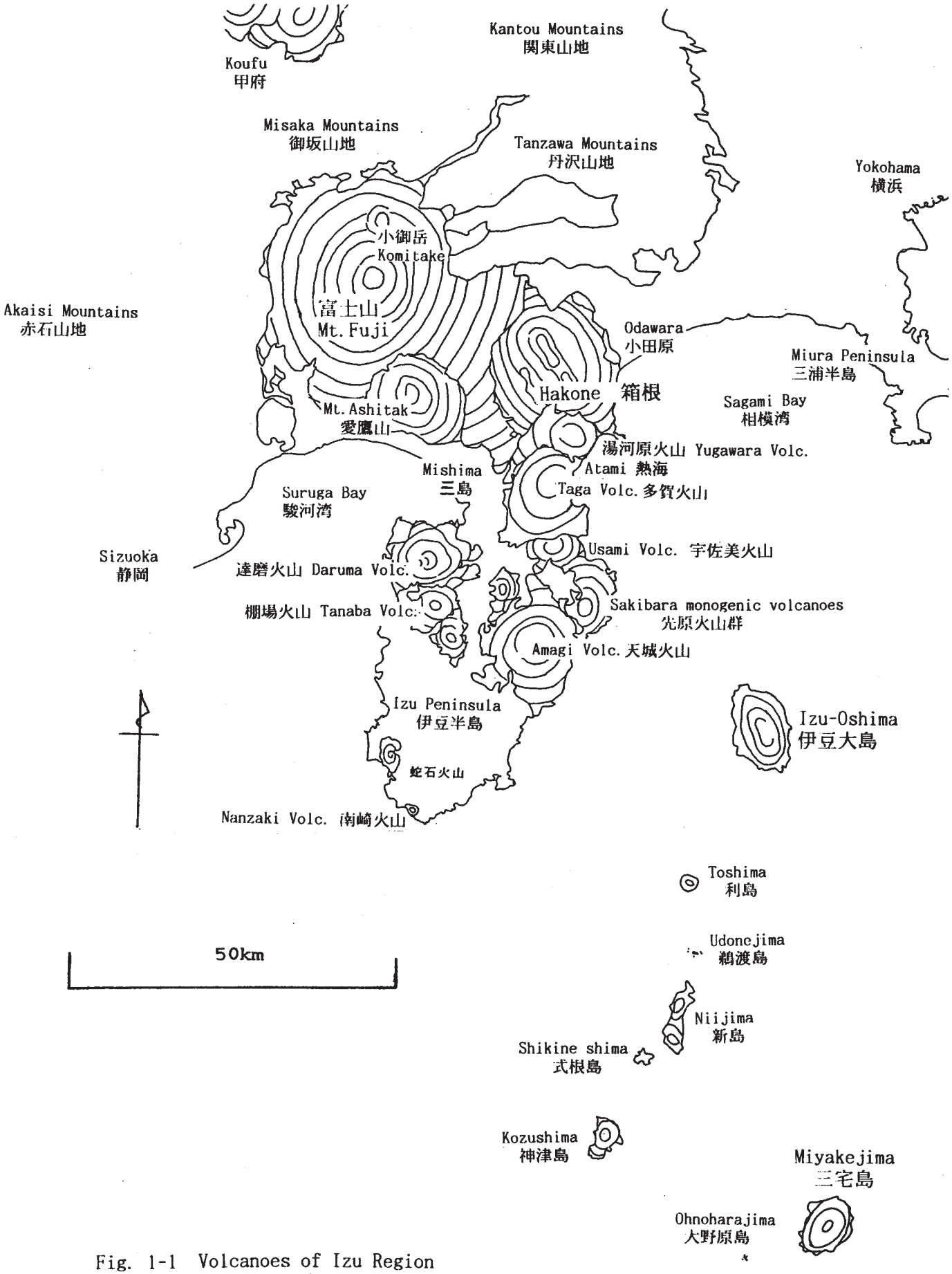


Fig. 1-1 Volcanoes of Izu Region
図 1-1 伊豆地域の火山の分布

5th International Symposium on Vulcanospeleology, Izunagaoka, Japan

Outdoor Guidebook

1. General aspects of the area

There is a volcanic zone trending NNW-SSE at about 100km west of Tokyo, in central Japan, including Mt. Fuji, Hakone, Volcanoes of Izu Peninsula, Oshima Island and Miyake Island (Figure 1-1).

Hakone is a complex volcano with a caldera and several central cones. Odawara City at the eastern foot of Hakone is easily accessible by the New Tokaido line which takes about half an hour and by the combined train-cablecar-ropeway or bus services which lead to the mountain top. Tomei expressway from the Eastern suburbs of Tokyou passes through the saddle between Mt. Fuji and Hakone, where Gotenba Interchange provides a ready access to Hakone from the north. This is a one and a half hour drive to the mountain top from Tokyo to Hakone. State highway No 1, Tokaido, passes over the Hakone mountain between Odawara and Mishima City at the south-western foot.

There are no written records of eruptions at Hakone but it is believed that the last eruption took place about 3000 years ago at the northern flank of Kamiyama, at Owakidani. Hakone has three active solfataras, Owakidani, Sounzan and Yunohanazawa, and the central cone Kamiyama causes occasional swarm earthquakes. There are many hot springs in Hakone and most of them are distributed in the Hayakawa valley.

Mt. Fuji is also accessible from Gotenba at its eastern foot, or from Fuji City on the south, where there is a Shinkansen Station. It is also accessible from the n orth by the Central expressway from the western suburbs of Tokyo in just over an hour's drive. Mt. Fuji is the highest peak in Japan with its peak 3776m above sea level, which is almost 500m higher than of the second highest non-volcanic Shirane-Kitadake in the Southern Alps of Japan measuring 3192m. Not only is Mt. Fuji greater in altitude than the other 200 volcanoes of Japan, she is also much larger in volume, with some 20 written historical records of eruption since 780 AD.

Oshima is an active volcano which has a large number of recorded eruptions and it erupted in 1912, 1950-51 and in 1986 with tens of millions of tons of basaltic lava effusion. This island is accessible by airliner from Haneda Tokyo Domestic Airport in about 40 minutes or from Atami City, located on the New Tokaido line, by boat in an hour or so.

Miyake Island is south of Oshima and the two are similar in that they have both been active through history. Miyake Island has had recent eruptions in 1940, 1962 and 1983 with a few tens of millions of tons fo lava expelled from fracture vents open on her flank. The last eruption in 1983 demolished 400 houses in less than fifteen hours. Rift caves of the flank openings may be visited on the excursion.

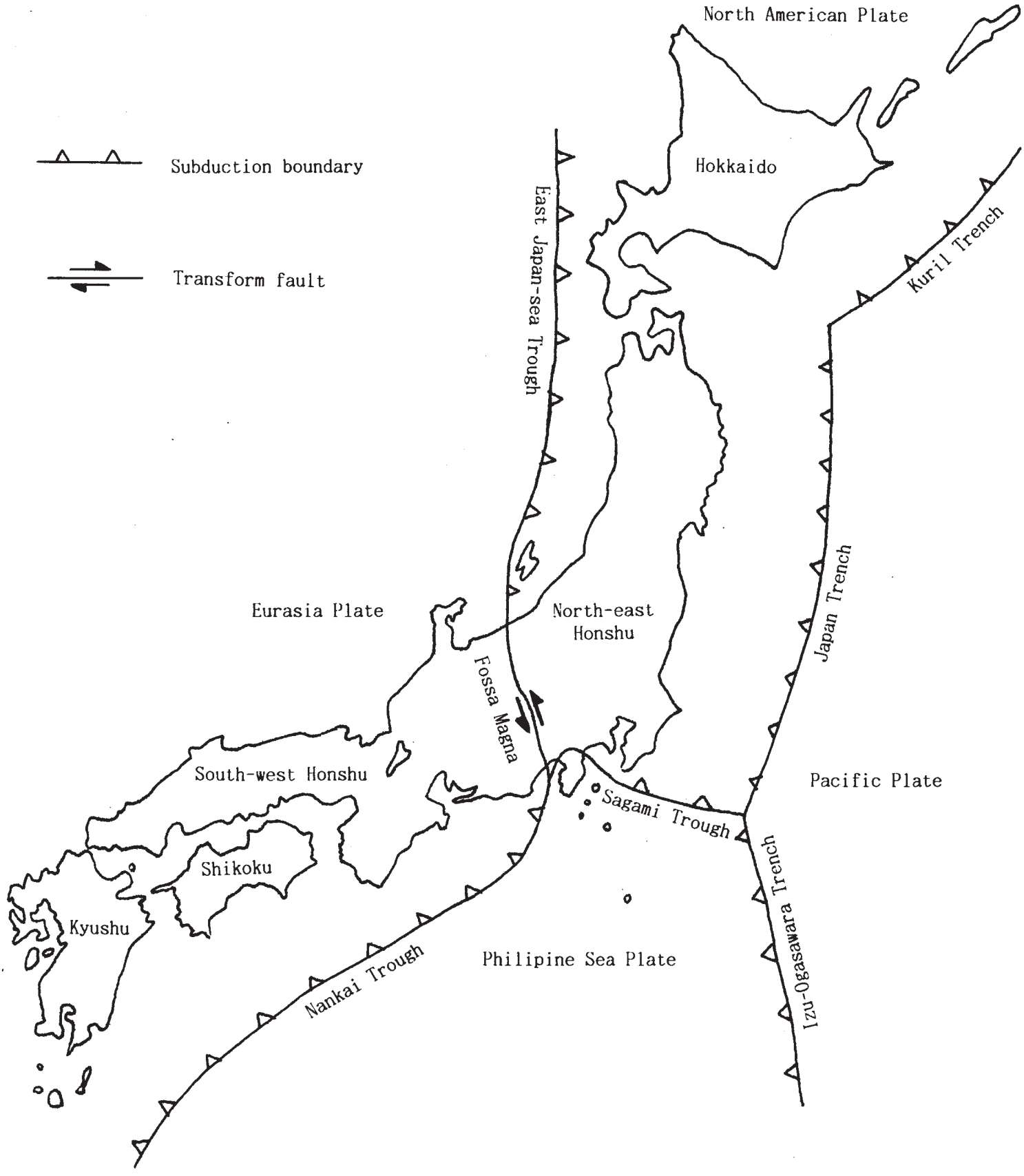
There are about 20 volcanoes between Mt. Fuji and Miyake Island (Figure 1-1), and active volcanoes among them are Mt. Fuji, Hakone, Ohima, Niishima, Kozushima and Miyake Island. Besides these there are many monogenic volcanoes under the sea between Oshima and Izu Peninsula. Monogenic volcanoes are also distributed on the Izu Peninsula to the south of Ito City. There are some 70 small volcanoes in a 15×20km area, and of these 4 rhyolite-dactite and 4 basaltic volcanoes have been dated at around 3000 years BP. This seismic-volcanic active region is situated on the complex active plate boundaries, including subduction, collision and translational relations.

According to the Plate Tectonics theory developed in the 1960's, the globe is covered by several rigid plates of several tens of kilometres in thickness. These plates are bounded to each other by active boundaries, spreading, subducting, translational and collision. Spreading boundaries are also called diverting boundaries, where basaltic magma squeezed up from the mantle fills the gap opened by tensional stress to form dikeswarms. The Mid-Atlantic Ridge has turned out to be a volcanic chain under the ocean where the oceanic crust is made. Spreading ridges were then found in the southern Pacific Ocean, and in the middle of the Indian Ocean. The spreading speed of the oceanic crust (2-10cm/yr) is probably controlled by the strength of the tension and amount of supply of the basaltic magma material from the mantle.

Oceanic trenches deeper than 6000m are all representing the subduction boundaries of

図　1-2　日本列島周辺のプレートの境界

Fig. 1-2　Plate Boundaries around Japan



the plates. The trench can be paired with either an island arc or a mountain range on the edge of the continent. The subduction margin is active in seismicity and large scale earthquakes occur at the land side of the trench at shallow depths. Subduction zones are traceable by the three dimensional plot of seismic hypocentres, which are called Wadachi-Benioff zones after the authors first recognised this.

The continental crust consists of lighter materials than the oceanic crust, and spreads along with an oceanic crust. It may not subduct of its bouyancy, and may collide with other Continental crusts. India Peninsula is a typical example, which is colliding in to the Eurasian Plate where the Himalayas have risen. Translational boundary is the boundary of the transform fault, which is an active fault with horizontal displacement with both sides ending with a trench or spreading centre. A typical example of it is the Alpine Fault of the South Island of New Zealand, where the west side Indian Plate is passing the east side Pacific Plate.

Recent interpretation shows that there are four plates around Honshu Island of Japan, bounded by subduction, translational and collision relations(Figure 1-2).

Pacific Plate subducts at Kuril Trench, Japan Trench and Izu-Ogasawara Trench, underneath the Kuril Island's Arc, Honshu Arc and Izu-Ogasawara Arc, respectively. To the west of the Izu-Ogasawara Island Arc there is a Phillipines Sea Plate which is moving NNW, subducting under central Honshu, Shikoku, Kyusyu and Ryukyu Islands Arcs. Near the western margin of the Phillipines Sea Plate there are the Izu Peninsula and the Seven Izu Islands, which has been revealed to have a 30-40km thick continental crust, and thus not being able to subduct has collided in to the Honshu Arc continental crust. Izu Peninsula probably collided with Honshu about a million years ago, pushing up the Misaka and Tanzawa mountains to a height of almost 2000m in a short time.

There is evidence indicating that the Izu Peninsula used to be in the far south. The fossil evidence of warm water low lattitude dwellers in Miocene sediments and palaeo-magnetic evidence of much more gentle original inclinations found in the Miocene rocks of the peninsula. The Miocene sediments must be deposited at 10-15 ° lattitude south and moved up north to collide with Honshu Arc some time ago.

The Honshu Arc is subdivided by the Itoigawa-Fujikawa transform fault in the western

margin of the Fossa Magna graben. The fault bounded Eurasia Plate on its west and North American Plate on the east. The fault transforms to the Nankai Trough at the south and to the Japan Sea Trough at the north, and these troughs are thought to be depths caused by the subdection of the Phillipines Sea Plate and Eurasian Plate but the subductions have initiated recently and trench formation is still in an immature stage.

There are a couple of triple junctions on the four plates boundaries. One exists at about 200km south-east of Tokyo at the junction of the Japan Trench and the Izu-Ogasawara trenches. The other exists in Suruga Bay just 30km south-east of Mt Fuji. The former triple junction is at where the Pacific, Phillipines Sea and and North American Plates join and the latter triple junction is where the phillipines Sea, North American and Eurasian Plates join.

This region has been very active in seismicity and volcanism during historical time, which is from the seventh century onwords, and in the twentieth century the following events have been recorded(Table 1-1).

Table 1-1 20th Century Seismic and Volcanic Activities in the Mt. Fuji-Izu-Miyake Island Region

1900	Miyake Island Earthquake M6.8
1905	Oshima Earthquake M7.0
1912-14	Oshima Eruption 1×10^7 m^3ejecta
1923	Kwanto (Tokyo) Earthquake M7.9 (Epicentre in Sagami Bay) 142807 Dead
1924	Tanzawa M7.2, 19 Dead
1930	Ito Swarm Earthquakes (Felt 4880, Maximum M5.5)
1930	Kita-Izu M7.3, 272 Dead
1936	Niishima M6.3, 3 Dead
1940	Miyake Island Eruption 1.9×10^7 m^3 ejecta
1950-51	Oshima Eruption 3×10^7 m^3 ejecta
1962	Miyake Island Eruption 1×10^7 m^3 ejecta
1974	Izu Peninsula M6.9, 29 Dead
1976	Kawazu Earthquake M5.8
1978	Oshima Earthquake M7.0, 25 Dead
1980	Izu Peninsula Earthquake M6.7
1983	Miyake Island Eruption 2×10^7 m^3 ejecta
1986	Oshima Eruption 5×10^7 m^3 ejecta
1987	Fuji Earthquake swarm (Felt 4)
1988	Izu Peninsula Earthquake swarm (Felt several thousands)