MOVEMENT OF SIMOSATO REVEALS PLATE BOUNDARY DEFORMATION

Hydrographic Department of Japan has been conducting Satellite Laser Ranging (SLR) observation at the Simosato Hydrographic Observatory (SHO) located southwest Japan since 1982. SLR is a technique which measures the round trip time of an optical laser pulse between a ground-based station to an artificial satellite. SLR observation reveals precise position and its variation of the station in a worldwide geodetic system. Our major purpose is to determine position of islands in the Japanese territory for safe navigation.

Site velocity of Simosato has been detected from our analysis of SLR data obtained at Simosato and other global laser tracking network. Our analysis suggests that Simosato moves 3.2 cm/year to the west-northwest (291 degree in azimuth) with respect to the Eurasian plate (see Figure 1).

Figure 1. Movement of Simosato relative to the Eurosian plate. The motion of the Philippine sea plate is also shown.

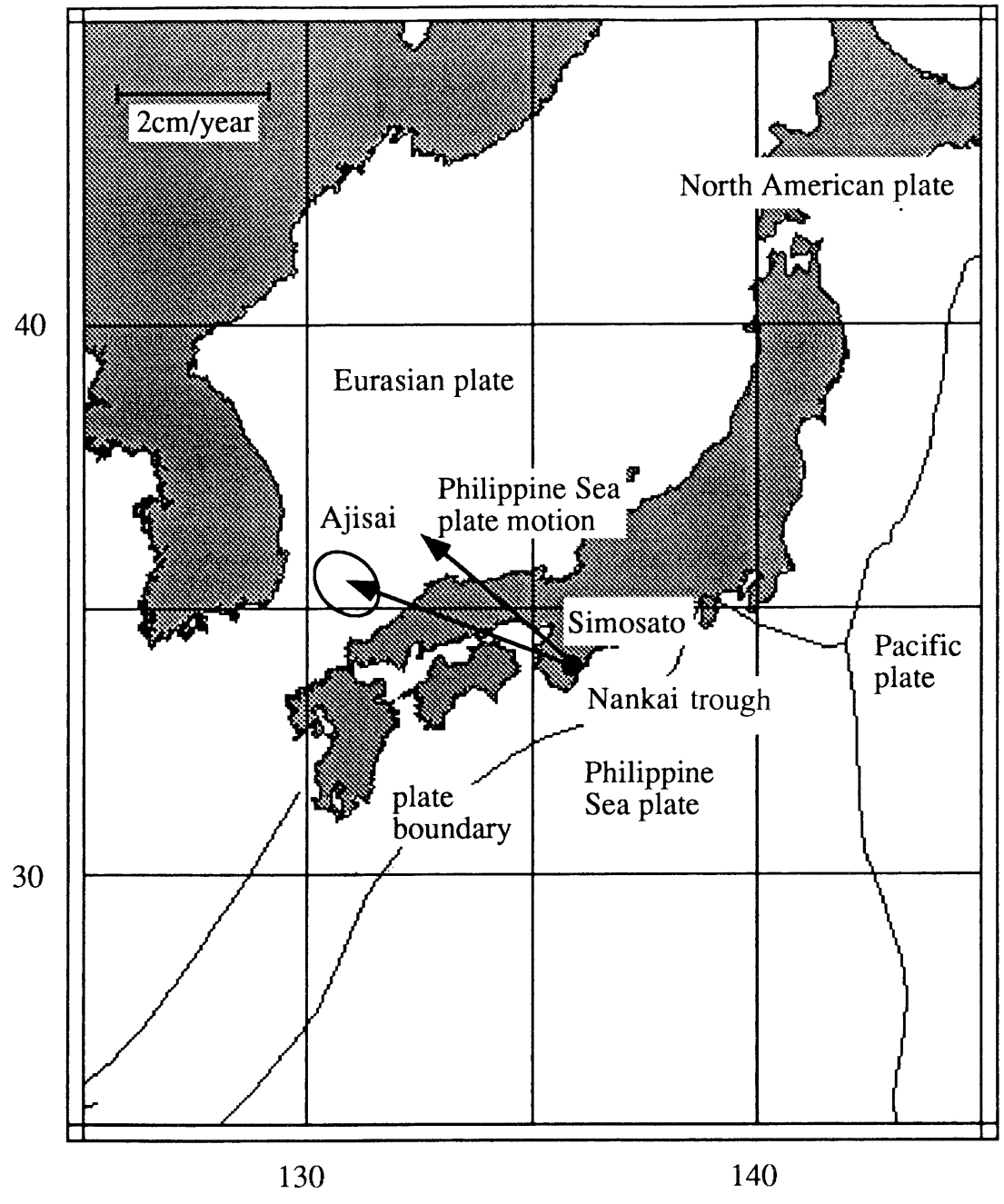

Figure 2.

A mechanism of large earthquakes at the plate boundary region.

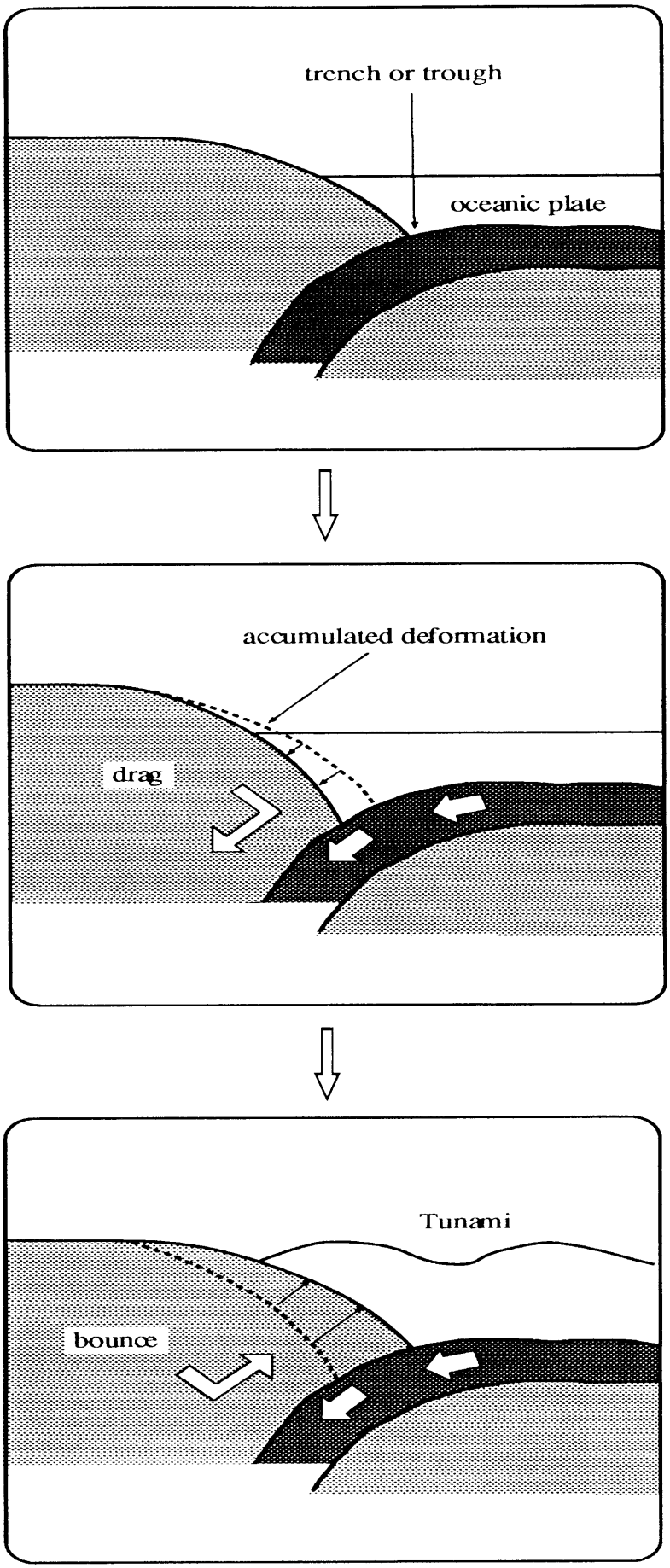

Plate tectonic theory assumes that the surface of the Earth is covered with several rigid plates that move linearly and constantly on the Earth's surface. Simosato is located on the edge of the Eurasian plate, which stretches from Europe to east Asia. According to the plate tectonic theory, the Philippine Sea plate collides with and subducts under the Eurasian plate at the Nankai trough in south Japan.

Japan is located at the plate boundary among the Eurasian, Philippine Sea, North American, and Pacific plates. We have so many earthquakes and volcanoes which are believed to be driven by the plate collision.

If the Eurasian plate is completely rigid, Simosato does not move with respect to the Eurasian plate. Our result clearly suggests significant deformation of the Eurasian plate at the plate boundary region. Simosato is about 100 km apart from the plate boundary, the Nankai trough, and moves in a velocity close to that of the Philippine sea plate modeled by Seno (1987) as if Simosato were located on the Philippine sea plate, which infers that the plate boundary between the two plates is locked and the plates move together.

It is commonly believed that plate boundary deformation brings about large earthquakes. Our result shows the magnitude and direction of the deformation in this area. Consequently, SLR observation reveals the plate boundary deformation and contributes to earthquake prediction as well as to safe navigation at sea.