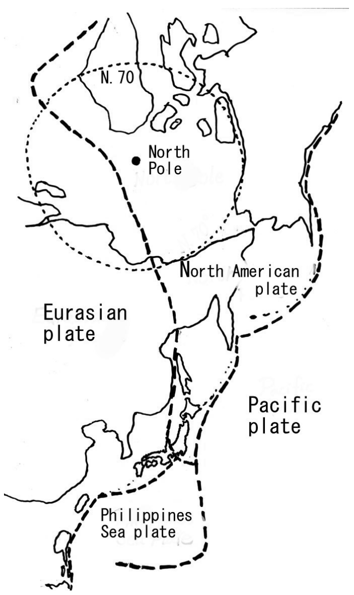

Fig. 1. The North American and the neighboring plates. The dotted circle is the north latitude of 70 degree.

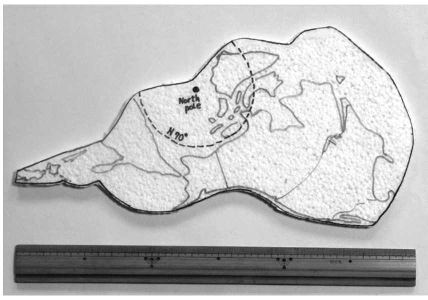

Fig. 2. Simple model of the North American plate. The spot near the upper edge is the North Pole, and the dashed circle is the north latitude of 70 degree.

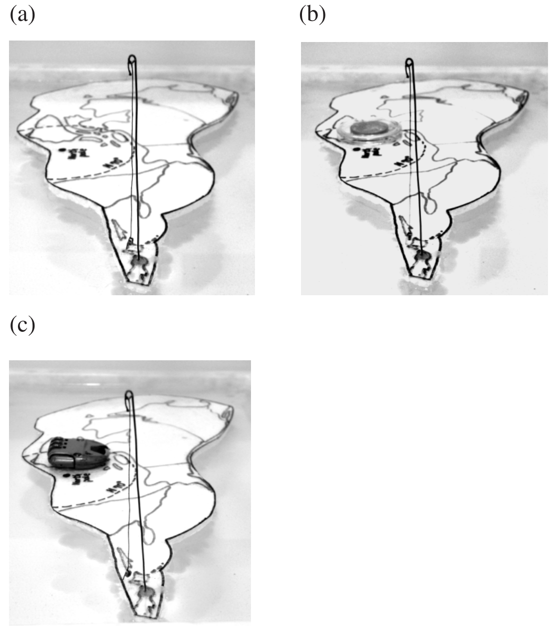

Fig. 3. The model of plate floating on the water with a pole for measuring the angle of tilting, (a) without weight, (b) with a light weight (13 gram) near the North Pole, (c) with a heavy weight (40 gram).

and (c) were about 1, 3, 5 degrees, respectively. We can see from this result that the melting of ice near the North Pole (corresponding to Fig. 3(a)) tends to tilt the North American plate near Japan so that its eastern edge sinks and presses down the Pacific plate. This effect should have suppressed the slip at the contact surface and allowed integration of stress in the North American plate.

Of course, what is happening in the plates is much more complicated than that shown in this experiment. For example, the North American plate touches also to the Eurasian plate and the Philippines plate, the North American plate has flexibility and will deform while tilting, and the plate is not flat but is a part of sphere, and so on. However, the result presented here will work as a trigger of more precise researches, such as a computer simulation of behavior of the North American plate with melting ice.

4. Comparison of the Earthquake Frequency and the Average Temperature

The average atmospheric temperature has been measured precisely only since about 100 years. On the other hand, in order to consider of the effect of the global warming we need information of the average temperature for a period including the age of global cooling, i.e. at least since 17th century. For that purpose the numbers of sunspots are reliable, because they are considered to have a positive correlation with the average temperature.

Figure 4 shows a comparison of the sunspot numbers since the year of 1600 (Hoyt and Schatten, 1997) and the years of recorded earthquakes with magnitude more than 7 (Homepage of GRW). Magnitudes (M) of earthquakes are indicated by the fonts of numbers; normal fonts for M 7.0–7.9, bold-type fonts for M 8.0–8.9 and large bold-type fonts for M 9.0–9.9. If the magnitude is expressed with interval in the reference, like 7.9–8.2 for example, the value of the lower limit (7.9) is used.

The data of GRW includes earthquakes in the whole world, but here those in the following three regions are picked up; (A) the northern part of Japan (Tohoku, Hokkaido) and the Okhotsk Sea and the Bering Sea areas (the area near to Alaska is not included) corresponding to the boundary of the North American and the Pacific plates, (B) the central part of Japan (Kanto, Chubu) corresponding to the boundary of the North American and the Philippines plates and (C) the southern part of Japan, Taiwan, the south coast of China and Philippines corresponding to boundary of the Eurasian and the Philippines plates (the area near Indonesia is not included). A few inner plate earthquakes are included in these regions.

The data of sunspot numbers show that we had the global warming since about 1720 with a short cool period of 1800–1830 (called Dalton minimum). Before that we had a long cool period of 1620–1720 (called Mounder minimum). On the other hand, there is a delay in the melting of ice after the warm period has begun. According to the data of change of glacier thickness since 1960 (Durgerov and Meier, 2005), the thickness decreased in the global warming with a rate