Tectonic development of the Japanese islands caused by migrating Japan Trench controlled by Philippine Sea Plate motion

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The *Euler Pole* position of the Philippine Sea Plate relative to stable Eurasian Plate between 15 and 3 Ma can be estimated at around 150E, 36N, on the basis of the geological constraints that the intersection of the Izu-Ogasawara Arc with Southwest Japan has never moved from South Fossa Magna since 15 Ma. The timing of relocation of the *Euler Pole* to its present location (154E, 47N) should have occurred at 3 Ma because fore-arc basin in Southwest Japan was once interrupted by the *Kurotaki Unconformity* at 3 Ma.

The Philippine Sea Plate now moves northwestward and subducts beneath Southwest Japan at a convergent rate of 4cm/yr. The Izu-Ogasawara Trench also moves at the same rate as its westward component (ca. 3 cm/yr.) of the Philippine Sea Plate motion. Both the trench-trench-trench (TTT) triple junction and Japan Trench should migrate westward, because thick, cold, and sturdy Pacific Plate has never been cut by the transform fault at the TTT triple junction. Northeast Japan would also move westward because tectonic erosion along the Japan Trench would not be sufficient for westward migration of the Japan Trench. Thus, the present Philippine Sea Plate motion causes the westward migration of Izu-Ogasawara Trench, TTT triple junction, Japan Trench and then Northeast Japan. This westward motion of Northeast Japan against the sturdy oceanic lithosphere of the Japan Sea has caused an E-W contraction of Northeast Japan since northward motion of the Philippine Sea Plate changed to northwestward at 3 Ma.

The Japan Trench should have been moved eastward and then westward during 15 and 3 Ma, because rotating Izu-Ogasawara Arc is almost linear. The east- and westward migration during this interval was very small, probably only a few kilometers, so that Northeast Japan might have been subsided gently under weak-tension stress field in the former stage (15-9 Ma), and then uplifted under weak-compression stress field in the latter stage (9-3 Ma). This tectonic response is quite concordant with a geologic history of Northeast Japan, i.e., middle Miocene transgression and late Miocene to Pliocene regression.

It can be easily predicted that rifting of thin, heated arc-lithosphere of the Izu-Ogasawara Arc would reach break-up before the thick, cold lithosphere of the Pacific Plate would be torn by right-lateral transform fault at the TTT triple junction. Once rifting reaches break-up, the northwestward movement of the Philippine Sea Plate would be compensated by back-arc spreading, and this motion would not be propagated to the Izu-Ogasawara Trench, Japan Trench nor Northeast Japan. Therefore, the present E-W contraction in Japan would cease in the geologically near future when back-arc rifting along the Izu-Ogasawara Arc reaches break-up. This also suggests that the Japanese islands, uplifting now under E-W contraction, would be subsided when rifting reaches break up.

Thus the tectonic framework, such as contraction or extension of Northeast Japan is caused by migration of the Japan Trench, which is originally controlled by the Philippine Sea Plate motion. The rifting and break-up behind the Izu-Ogasawara volcanic arc, and following subsidence of Japan, are also in the control of this tectonic framework.