

The Examples of the "puzzle-solving" in the Plate Tectonics Theory

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It is generally considered that the plate tectonics theory has become a paradigm in the field of solid earth science (for instance, Miyashiro, 1998). Indeed, when I was engaged in descriptive research on the structural geology of Boso peninsula when I was studying for the doctoral degree, I would use technical terms of the accretionary prism theory, a sub-theory of the plate tectonics theory, to interpret observed facts. Also, looking at an outcrop in front of me, I was often asking myself, "Which part of an accretionary does this piece correspond to?" in the middle of a field survey. By doing so, I was trying to integrate new observed facts into the framework of the accretionary prism theory, which can be considered in a sense as "puzzle-solving" in normal science as referred to by Thomas Kuhn.

Tomari (2008) describes how the Japanese earth science society accepted the plate tectonics theory, apart from the memoirs of people directly involved in this process. Tomari argued that while geophysicists and seismologist accepted the plate tectonics theory in a relatively smooth manner, it took ten more years for geologists to accept it, which he described as "a lost decade". He ascribes it to the following causes: the geologists were interested less in application of physics and chemistry (principle of the present) than description of the respective geographical features of each region in accordance with the orogenesis theory; also, the geologists who were the leading figures in the Association for the Geological Collaboration in Japan, which accounted for the majority of the geological society in Japan at that time, harshly criticized the plate tectonics theory. Shibasaki(2011) argued against the claim of Tomari, by noting that the Japanese geological society by no means accepted the plate tectonics theory late for the following reasons: geologists who were conducting research on biostratigraphy with the use of Radiolaria fossils from the late 1970s to the early 1980s led the geological society to accept the plate tectonics theory by, for example, successfully explaining some of the problems of areal geology with the accretionary prism theory ? in particular, the problem associated with age determination of block-in-matrices (Radiolaria revolution); as such, they were able make a contribution to a theory on global movements precisely because they were engaged in research on areal geology. She also maintained that since most of the young researchers who contributed to the Radiolaria revolution belonged to the Association for the Geological Collaboration in Japan, while it is certainly true that the researchers who were the leading figures of the association were against the plate tectonics theory, their influence was limited. She then argued that it is necessary to conduct more integrated research on science history.

With regard to the question described above, I argue that it is meaningful to review when the kind of research that corresponds to the "puzzle solving" of the plate tectonics theory began in each of the sub-fields of geology (structural geology, stratigraphy, volcanic petrology, metamorphic petrology and mineralogy, in addition to areal geology). It is because it is possible to determine whether the result of any given research corresponds to the "puzzle-solving" of the plate tectonics theory from its theoretical structure; and by doing so, it is possible to show that the plate tectonics theory functions as a paradigm. In this presentation, I introduce some examples of the geological studies which are regarded as the "puzzle-solving" in the plate tectonics theory.

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