Japan Academy Prize to:

Asahiko Taira

Executive Director, Japan Agency for Marine-Earth Science and Technology

for "Accretion Tectonics and Evolution of the Japan Islands"

Outline of the work:

Dr. Asahiko Taira proved, based on a unique approach that later revolutionized the study of orogenic belts, that the basement geology of the islands of Japan is composed of rocks accreted by plate subduction processes at deep-sea trenches. He showed that the Japan islands were formed by accretion of oceanic materials, such as basaltic lava, pelagic sediments and trench-fill sediments, to an overriding continental plate associated with a thrust-fold structure and seismic belt. Through this study, the geosyncline hypothesis that emphasized local and vertical crust motion was rejected in favor of accretion tectonics related to global-scale plate movements.

From the 1970's to 80's, plate tectonics had spread as a new paradigm for understanding geological and geophysical phenomena. Because the idea of plate tectonics initiated from the intense study of mid-oceanic ridges, the understanding of plate subduction zones was insufficient, leaving many important subjects unresolved during that time. In particular, the origin of highly complicated geological provinces along plate subduction zones, such as is typical of the islands of Japan, remained poorly understood.

From 1977, Dr. Taira began his study of the Shimanto Belt, the largest geological province of Japan, which is composed of a large volume of sandstone, mudstone and minor amounts of basaltic lava and chert. By 1985, He presented the following evidence:
(1) A unique combination of detailed radiolarian biostratigraphy, petrology, and structural geology revealed that the pillowed basaltic lava and radiolarian chert are of oceanic plate origin, mixed with turbidite deposited in the deep-sea trench. The accretion of those rocks started from the early Cretaceous (140 million years ago) to the Tertiary (30 million years ago).
(2) Paleomagnetic analysis showed that the pillow basalt and associated pelagic limestone were formed at equatorial latitudes about 130 million years ago and moved to their present position about 70 million years ago, traveling a minimum distance of 3000 km.

He further applied these methods and his ideas to the other geological provinces of Japan and showed that a similar process formed those rocks, which were, however, older than the Shimanto Belt. This work proved, for the first time, the accretion of oceanic materials at subduction zones and how the structure of geological provinces in Japan evolved through a subduction process that lasted over 100 million years. This innovative study opened a new field (accretion tectonics) in the geology of orogenic belts.

From 1985, Dr. Taira took the leadership of the study of the Nankai Trough and Izu-Ogasawara Island Arc system and became actively involved with the Ocean Drilling Program. It was shown through the study of the Nankai Trough, active formation of the Nankai accretionary prism occurred due to the supply of a large volume of trench turbidite from the Izu-collision zone. Through this study, he suggested

that a series of events at convergent plate boundaries, such as arc collision, mountain uplift, massive erosion and sedimentation and rapid growth of accretionary prism are the key processes of the formation of an orogenic belt.

Dr. Taira's work showed how the Japan Islands have grown much like tree rings through the processes related to the accretion of oceanic materials along the margin of the Asian continent from Paleozoic to Cenozoic times. This study rewrote the entire story of the evolution of the Japan Islands.

His study further extended toward the evolution of continental crust. Through the study of island arcs and oceanic plateaus of the Western Pacific region, he indicated that the accretion of oceanic island arcs played an important role in the growth and evolution of continental crust.

His work has been highly praised internationally as a benchmark study of orogenic belts and crustal evolution.

From the 1990's he has been actively engaged with the development of Integrated Ocean Drilling Program (IODP) and the D/V Chikyu and is currently leading this new frontier of ocean-floor investigation.

Selected original papers

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