

A Stratigraphic and Sedimentary Analysis of the Miocene in Northern Taiwan

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ABSTRACT

The Miocene sequence in northern Taiwan, includes, in ascending order, the Wuchihshar Formation, the Mushan Formation, the Kungkuan Tuff, the Taliao Formation, the Shihti Formation, the Tsouho Formation, the Nankang Sandstone, the Nanchuang Formation, and the Kueichulin Formation. This sequence, being nearly 3000 m in thickness on the Kuanyin Shelf, thickens gradually toward the south and southeast to a maximum thickness of more than 5000 m. The sandstone percentage decreases slowly from the northwestern coast (the Chinshan-Peitou-Kuanyin-Tiehchenshan belt) toward the southeastern margin of the foothills region. The southeastward thickening of the Miocene formations in northern Taiwan is accompanied by an increasing percentage of argillaceous sediments. The grain size of the Miocene sandstones is found to be somewhat greater along the northwestern coast, in the Chinshan-Peitou-Kuanyin-Chiting-Tiehchenshan belt, and gradually smaller toward the southeast. The effective porosity of the Miocene sandstones decreases slowly from the northwestern part of present Taiwan toward the southeast.

The Miocene sandstones in northern Taiwan comprise two groups: protoquartzite and/or orthoquartzite forming the dominant group, and subgraywacke and/or lithic graywacke the minor group. The protoquartzite is fine- to coarse-grained, moderately sorted, well matured, alternated with siltstone and gray shale, and intercalated with coal and coaly shale with underclay. They were deposited in the fluvial, deltaic, lagoonal, littoral, and inner neritic environments. The subgraywacke and lithic graywacke are mainly fine-grained, poorly to moderately sorted, relatively not well matured, and alternating with siltstone and gray shale, which sometimes contain marine fossils. They were deposited mainly in a neritic environment, and partly in an inner bathyal environment.

Based on light and heavy mineral studies, the writer assumes that the Miocene sandstones in northern Taiwan may be derived mostly from acid igneous rocks and granite-pegmatites, and partly from reworked sediments, metamorphic rocks, and basic igneous rocks.

The writer considers that, in the source area, the uplift was weaker, the relief was lower, the rate of erosion was lower, and the climate was steady during the deposition of the Wuchihshar Formation, the Mushan Formation, the Shihti Formation, the Talu sandstones, the Nanchuang Formation, and a part of the Taliao Formation and the Kueichulin Formation. This implies that, during the Wuchihshar, Mushan, Shihti, and Nanchuang times, and a part of the Taliao, Talu, and Kueichulin times, both the rate of subsidence of the depositional basin and the rate of the deposition in northern Taiwan were lower, indicating that these formations are relatively of stable shelf sediments, in molasse association.

The writer also assumes that, in the source area, the uplift was rather strong, the rate of erosion was fairly rapid, and the climate was only somewhat steady during most of the deposition of the Taliao Formation, the Tsouho Formation, the Nankang Sandstone, and the Kueichulin Formation. This implies that, during most of the Taliao, Tsouho, Nankang, and Kueichulin times, the rate of subsidence of the sea bottom slightly exceeded the rate of deposition, indicating that these four formations are partly of geosynclinal sediments and partly of relatively unstable shelf sediments, in combined molasse and flysch associations.

Before the deposition of the Talu Shale, the middle member of the Nankang Sandstone, the depositional basin in northern Taiwan was comparatively stable and its subsidence was relatively