

Tephrostratigraphy and diatom biostratigraphy of the middle to upper Miocene sequence in the Tsugawa area, Niigata Prefecture

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Tephrostratigraphy and diatom biostratigraphy are studied for the middle to upper Miocene Nomura Formation exposed along the Shinazawagawa section in the Tsugawa area, Niigata Prefecture, central Japan. The Nomura Formation is composed of massive diatomaceous mudstone intercalating numerous ash beds, four of which are widely distributed and useful for long-distance correlation. Diatom zones from the upper zone NPD 5B through the lower zone NPD 7A, along with twelve useful diatom biohorizons, are identified in the Nomura Formation and a workable high-resolution diatom biostratigraphic and tephrostratigraphic framework is established. A sedimentation rate curve is constructed for the Shinazawagawa section, using the ages of the diatom biohorizons, and the duration of the Nomura Formation is determined from 12.0 Ma to 7.5 Ma. The ages of the four widespread ash beds, Sng, Stm, Tmhq and Sng Ash Beds, are estimated at 10.2, 9.4, 8.7 and 8.0 Ma, respectively.