

## Discovery and the Causes of re-weaked Middle Pleistocene deposits

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The northern coast of Ariake Sea forms part of the Tsukushi Plain in Kyushu, West Japan. The area is underlain by thick Quaternary deposits in which the surface layers consist of weak strata. Bearing piers for structures such as bridges need to be founded on strata that are sufficiently strong to support the anticipated loads. This is commonly determined in Japan by means of the Standard Penetration Test (SPT) in which a 63.5 kg hammer falls through a fixed distance of 76 cm to drive a diameter sample tube into the sediment. The number of blows (the N-value) taken to drive the drive the sample tube 30 cm into the sediment provides an indication of density and hardness of the sediment that can be used to indicate its load bearing capability. SPT N-values greater than 30 are usually necessary for load-bearing layers in the Tsukushi Plain. In general, the density and hardness of sediments increases with depth after deposition due to compaction and, in some cases, cementation (diagenesis). For this reason, older formations are commonly more dense and stronger than younger formations. It has generally been thought that in the Tsukushi Plain area the Aso-4 pyroclastic flow deposits (80-90 ka) were strong enough to support heavy buildings. However, weak Middle Pleistocene Formations (N-value < 10), referred to as the Shagarami Formation in this account, have been found in recent years beneath the Aso-4 deposits. The low bearing capacity of the Shagarami Formation causes engineering problems.

The two main reasons for the low N-values are considered here. First the possibility is that the stratum is too young to have been sufficiently altered by diagenesis. Second, that it is a calcareous marine deposit in which the carbonate grains have been dissolved by groundwater cultivation for agricultural purposes and that this produced loose silt. Few borehole cores have been taken from below Aso-4 in this region, but the availability of cores in the Shagarami Formation from a site near the mouth of Rokkaku River made it possible to examine sediments that were known to have unusually low N-values. The aim of the present study was determine the age and depositional environments of the formation and their relationship to the low N-values.

The boreholes proved the presence of a previously unknown tephra in the Shagarami Formation (the Shagarami tephra) which gave a zircon FT age of 0.33 Ma. The refractive index of volcanic glass from the tephra together with its age and the petrological feature such as mineral combination suggests correlation with the Kakutou tephra (Kkt, 0.33-0.34 Ma). The Shagarami Formation contains diatoms, shell fossils and sedimentary structures indicative of deposition in marine environments. No carbonate shells apart from oyster shells were preserved in the cores. The formation can be divided into two sequence units that were probably deposited at periods of high stand in Marine Isotope Stage 9 and 11.

In conclusion, the cause of the low N-values in the Shagarami Formation is that the formation is too young to have become sufficiently compacted or lithified. Underground weathering or leaching might also be a contributing factor.

Keywords: Tsukushi Plain, lowland, Fission Track age, Middle Pleistocene, underground weathering, leaching