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Sedimentary process of Miocene, upper bathyal, tsunami-induced conglomerates including gigantic boulders

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The Miocene, upper bathyal conglomerate bodies crop out in Tsubutegaura Coast, Chita Peninsula, Central Japan. The size of the constituent gravels included in the conglomerates are various and range 2 mm to 3 m in diameter. Among them, the gigantic boulders are the most remarkable constituent in the conglomerate bodies.

The occurrence of the gigantic boulders included in the conglomerates are paradoxical, because it is believed that any agents including tsunami cannot transport gigantic boulders in upper bathyal seafloors, where very fine clasts (mainly clay and silt) are usually deposited. Actually, except the conglomerates, clay and silt are the normal background sediment components distributed around the conglomerates.

Two possible processes of transportation and deposition of the conglomerates are assumed. The first one is assumed that the gigantic boulders were transported from coastal region to upper bathyal region by back flow of a tsunami. The second is that gigantic boulders were supplied from the cliff or steep slope which existed near the site of deposition of the conglomerates. It is apparent that the estimated threshold velocity of gigantic boulders are lager than estimated back flow velocity of the biggest tsunami which can be assumed. This result shows that gigantic boulders cannot be transported from coastal region. Another process, which was previously implied [1], is hydrodynamically possible.

On the other hand, observation results of gravels in the conglomerates are classified 6 sets (Set A to Set F) based on gravel characteristics (e.g. size or shape) and occurrence conditions. Set A consists of the largest boulder (about 3 meters in diameter). The only one example is cropped out in Tsubutegaura Coast. The gravel is sub-rounded and isolated in fine sediments . Set B consists of large (about several tens centimeters to 2 meters), angular boulders. These gravels are main elements of the conglomerates. Set C consists of isolated, angular large gravels. Set D consists of angular to s ub-angular gravels of brick-like shape and size (a few tens centimeters). Set E consists of angular to sub-rounded gravels of fist-like shape and size (several to 10 centimeters). The gravels of Set D and E often show imbrication structures. Set F consists of gravels smaller than Set E.

Very singular lithology of the constituent gravels and the angularity of the gravels' shape show that the gravels are yielded by the collapse of a cliff. Considering tectonic settings, it is assumed that the cliff was a fault scarp. Namely, the fault scarp close to the depositional site of the conglomerates were collapsed by fault activities. And then, clasts yielded by the collapse formed some mass flow or rock fall, and were deposited as the conglomerates.

Some very characteristic sedimentary structures such as gravel cluster of Set B gravels and the imbrication of Set D to E imply strong effects of tsunami currents. another agent or process in addition to the simple transportation. Tsunami currents are the possible factor, considered the setting of the conglomerates

REFERENCES

[1] Shiki, T. and Yamazaki, (1996) Tsunami-induced conglomerates in Miocene upper bathyal deposits, Chita Peninsula, central Japan, Sesimentary Geology, vol.104,175-188