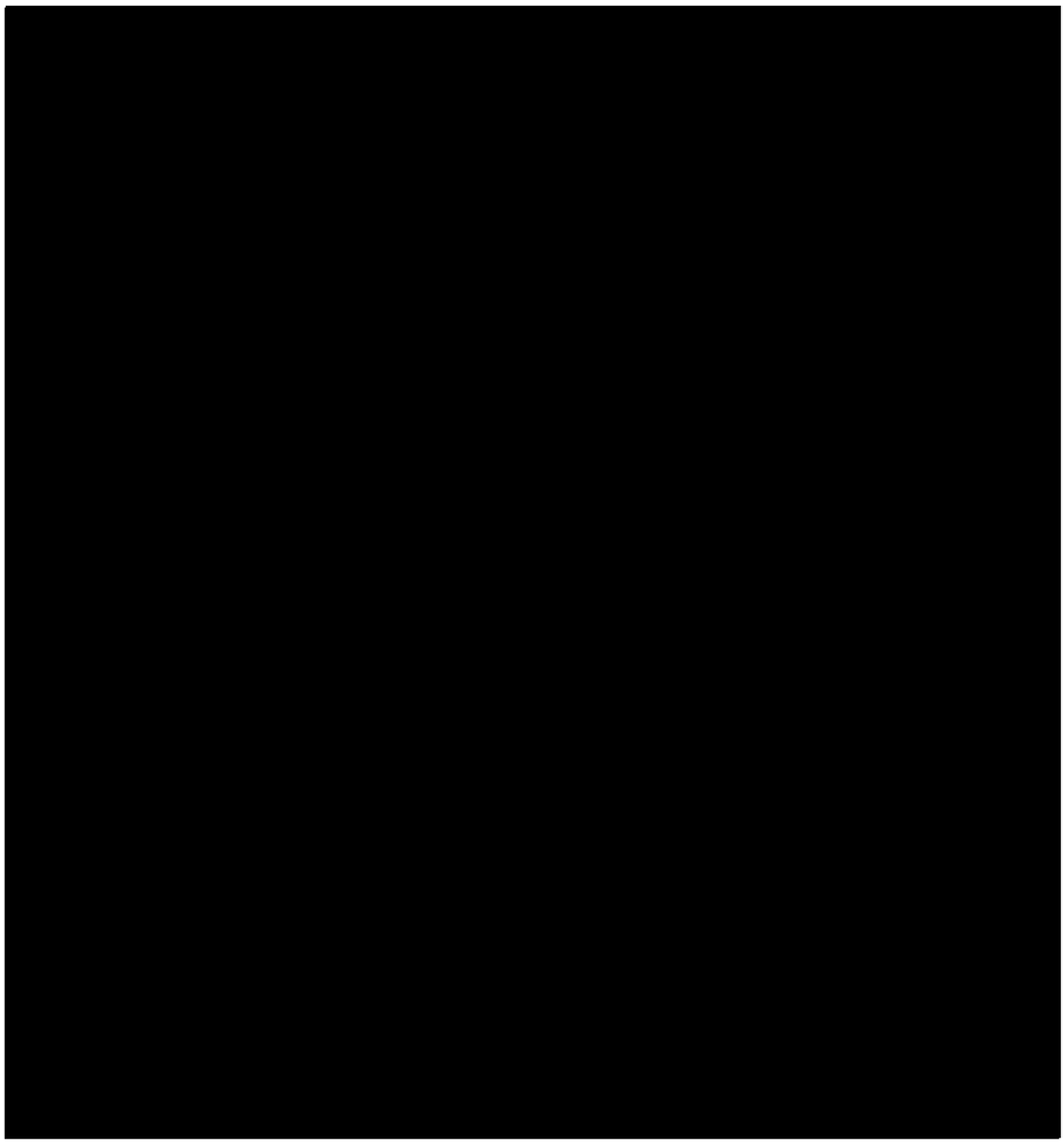

SEISMIC TURBIDITES IN LAKE BIWA, JAPAN

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Lake Biwa, 672.3 km^2, is the largest lake in Japan, and is about 100 m deep in maximum. We found some acoustic reflectors which fade away offshore-ward in the bottom sediments of Lake Biwa. Such reflectors were surveyed by all-core drillings along one acoustic survey line (Fig. 2, X-64600), and were confirmed to be sand and silt layers with graded texture. The age of the uppermost graded sand layer well corresponds with that of the historical earthquake which gave severe damages

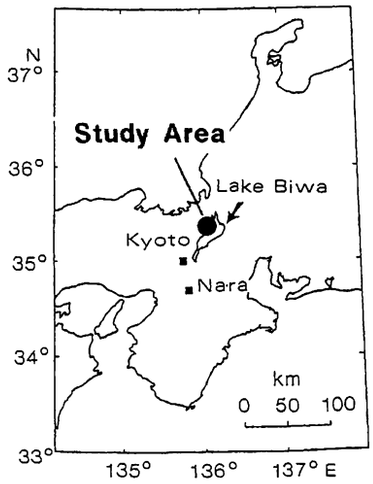

Figure 1. *Index map of study area.*

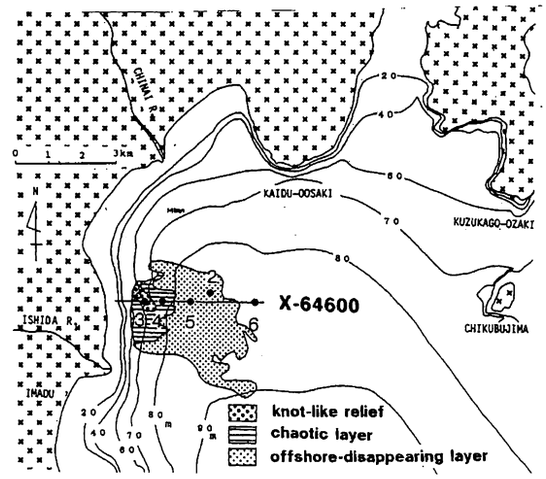

Figure 2. *Distribution of acoustic character and drilling sites off Imadu Town, Lake Biwa, Japan.*

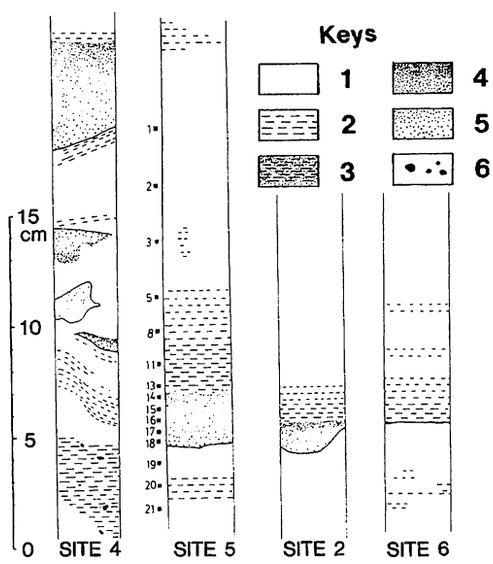

Figure 3. *Lithological change of Layer C at four sites. The layer at each site were correlated by acoustic reflector. 1. blue-gray clay, 2. brownish dark grey silt, 3. silt-fine-grained sand, 4. fine-g. sand, 5. medium-grained sand, 6. gravel*

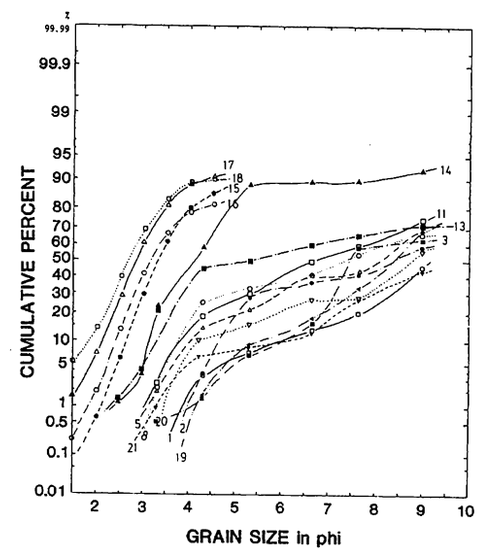

Figure 4. *Grain-size distribution of Layer C at Site 5 Non-turbidite sediments (Sp. 1, 2, 3, 19 & 21) were also analyzed for comparison. Analyzed positions are shown in the column of Fig. 3.*

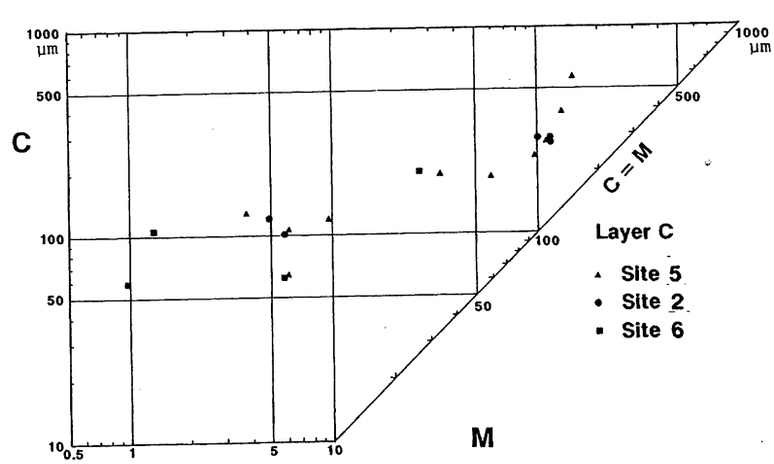

Figure 5. *Grain-size characters of Layer C plotted on C-M diagram.*

to the northern part of Lake Biwa in 1185 AD (M.7.4). Then, the graded layers seem to have been deposited from a turbidity current caused by the intense shock of earthquake. Other twenty turbidites were also recognized as peaks of apparent density, silt layers, dark layers of soft X-ray photographs and/or acoustic reflectors in the uppermost parts of the subsurface sediments. Most of the turbidites can be correlated with the historical earthquakes which had quake intensities stronger than Grade IV_L on Japanese Meteorological Agency earthquake scale, that is 44 gal acceleration at Lake Biwa (Inouchi et al., 1996).

On the other hand, we tried to describe the turbidite layers in detail. Turbidite layers are intercalated in blue-grey clay. Three distinct sand layers at the upper horizon of the drilled sediments are targets of this study.

Turbidite layers have sharp lower boundary and gradual upper boundary. There recognized sometimes burrow features at the basal boundary. All three layers become thinner and finer eastward. Layer C of the three layers shows especially distinct downward lithologic change as shown in Fig. 3. Sediments at Site 4 show overturned sand layer and some sand lenses, indicating slump origin. Turbidite layers can be traced as the same acoustic reflector, and correlated as shown in Fig. 3. A systematic downward degrease of sand layer thickness is obvious.

Silt part overlying sand part was recognized as dark grey part by naked eyes and as darker part (weak transparency part) on soft X-ray photograph, and seems to be a part of turbidite (that is, turbidite mud).

The grain-size distribution of tubidite sediments were analyzed by sieving and ultrasonic sieving methods. The former was used for sandy sediments and later for muddy ones. Ultrasonic sieving enable to analyze as fine as 2 μm, although it need a lot of laborious and time-wasting works. There recognized a systematic decreasing of grain-size distribution from sand to clay. Rapid change of grain-size between sand and silt is worthy to note. These facts imply that the sand and silt layer was formed from a single turbidity current, and there exist some changes of depositional mechanism between sand and silt parts. Silt part also have graded bedding, and its grain-size is clearly coarser than blue-grey clay which overlies turbidite mud. Grain-size characters of turbidite layer and their systematic change were checked on C-M diagram (Fig. 5). Sediments of sandy part are plotted on the graded suspension area which is subparallel with C-M line. Sediments of silty part are plotted on the uniform suspension area. They form one trend as a whole, and the trend of vertical change at one site is almost same as the lateral change from site to site. This may reflect the flow mechanism of turbidite current.

Reference

Inouchi, Y.; Kinugasa, Y.; Kumon, F.; Nakano, S.; Yasumatsu, S. & Shiki, T. (1996): Turbidites as records of intense paleoearthquakes in Lake Biwa, Japan. *Sed. Geology*, 104, 117-125.