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Pleistocene-Holocene sedimentary evolution of the Japan Basin (Japan Sea) from seismic stratigraphy

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The Japan Sea is one of the back-arc basins located in the transition zone between the Asian continent and the Pacific Ocean. Three deep-water basins are recognized in the sea: the Japan (Central), Yamato (Honshu), and Tsushima. The basins are separated by rises, the largest of which are the Yamato and East Korean rises in the central and western parts of the sea, respectively. The study area occupied a western part of the Japan Basin. A single-channel seismic reflection survey with airgun was carried out by Pacific Oceanological Institute (POI) in 1990-2001. The investigated part of basin is characterized by a smooth and flat sea floor.

The floor depth is increase in the SE direction from 3400 up to 3570 m. Within the uppermost part of the sedimentary cover were recognized two key horizons. The key horizons are defined by seismic onlap near the basin margins but form conformable surfaces throughout much of the deep basin. The key horizons and the seismic units bounded by these horizons are referred to as B1 and B2, from youngest to oldest. Geologic ages of the key horizons were estimated from correlation with DSDP Site 301. As a result, the upper horizon can be compared to boundary between Upper and Lower Pleistocene which was recognize in hole DSDP Site 301 on depths 126.5-136 m. The lower horizon is compared to boundary between Pliocene and Pleistocene sediments on depths 221.5-240.5 m. Age upper seismic unit Â1 is Upper Pleistocene-Holocene. Age of lower seismic unit Â2 is Lower Pleistocene. Three seismic facies are recognized in this study. Seismic facies 1 is characterized by low-to-high amplitude, moderate-to-good continuity reflections. Seismic facies 1 is interpreted as distal turbidites and hemipalagic sediments because of the continuous reflections and uniform seismic character. Seismic facieses 2 is characterized by high variable amplitude and poor-to-low continuity reflections. Within the facies top occur erosion channels.

Seismic facies 2 is interpreted as turbidites and hemipalagic sediments which was deposits over the range zones of channels activity. Seismic facieses 3 is characterized by different scale, regular bedforms. They are interpreted as a series of sediment waves migrating along a horizontal surface, and are connected to activity of contour currents, surrounding a continental slope and submarine rises. The Â1 thickness on a largest part of the study area is 0.10-0.12 s (the two-way travel time). The depth of a base Â1 is increase in eastern direction from 4.6 to 4.9 seconds. The marginal of the study area is occupied by sediments of a facies S1. The central part is occupied by sediments of a facies S2. The facies S3 is occur on a small segment of continental foot on the north of the study area. The Â2 thickness are varies from 0.10-0.15 s. The depth of a base B2 is increase in eastern direction from 4.5 to 5.0 s. The facies S2 is dominates. Facies S1 occur locally. On the area between abyssal basin and Yamato Rise foot within the B1 and B2 was recognized a zone of active resent faulting. As a result, we can recognize the dramatic change during B1 and B2 sedimentation. In Upper Pleistocene-Holocene the distal turbidites and hemipalagic sedimentation was dominated. In the Lower Pleistocene time the turbidites and hemipalagic sedimentation was complicated by erosional channels activity. This phenomenon can be explain by of lower sea level in the Lower Pleistocene and increase erosional activity surrounding land areas. The Japan Sea level stand was occur 0.8 m.y. As the results, the decrease erosional processes and distal turbidites and hemipalagic sedimentation was dominated. The occurrence of sedimentary waves within the Upper Pleistocene-Holocene sediments is explained by opening the striates between Japan Sea and Pacific Ocean and adjacent marginal seas and water current activizations. The active resent faulting in the area between abyssal basin and Yamato Rise foot is explain by thrust activity of Yamato Rise begun approximately 5 million years ago as the results of closing of Japan Sea.