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Volume of turbidite body evaluated from 1-D geological information

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To estimate the volume of a sedimentary body composed of turbidite distributing three-dimensionally, using one-dimensional information such as the sedimentary log of outcrops or a borehole, several hypotheses and the experience and knowledge of specialists are required. For determining the sedimentary environments or depositional elements in turbidite successions, we will consider the thickness of individual turbidite beds, the ratio of hemipelagic mudstone to turbidite bed, variability of the turbidite thickness, lateral variation in bed thickness or sedimentary facies, and stratigraphic changes in these characteristics. Because these characteristics are statistical in nature, the consideration of these data of turbidites suggests that one-dimensional information makes it possible to estimate the volume of sedimentary body and lateral variability on the basis of sedimentary environments and depositional elements, even if it is hard to achieve. In this study, we present an evaluating method to estimate the volume of sedimentary body on the basis of bed geometries, bed thickness trends of depositional elements, and statistical data of turbidite successions in several examples.

In turbidite successions, examples of depositional elements that have a good continuity in the lateral direction include deep-sea channel fills, sheet-sand, and lobe deposits. Lobe deposits have a good continuity in the lateral direction and are one of the most important elements of sedimentary body in turbidite successions. Although these data are not independent variables, the following data are necessary for estimating the volume of sedimentary body from a one-dimensional columnar section: (1) lateral continuity and extent of the body, (2) thickness of the body, and (3) observation location of the body. In this study, we focused on lobe deposits, which have a large extent and can satisfy these conditions as compared to other depositional elements. First, we investigated the statistical characters and the method for determining the observation location from the lobe deposits from several turbidite successions, then applied the method, and as a case study, analyzed the turbidite succession of the Awa Group that have detailed three-dimensional information.

Keywords: turbidite, depositional body, volume, bed-thickness distribution, bed-by-bed correlation, depositional element