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Sediment Wave in the Conrad Rise (Preliminary result of KH10-7 cruise)

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Sediment waves are often formed in association with bottom currents and turbidity currents. Reconstructing the development of these sediments can provide clues to understand paleo-currents and related oceanic environments. The Conrad Rise, located in the Southwestern Indian Ocean, is expected to have sediments that are affected by the environmental change such as glacial-interglacial cycle, because it is located between the subtropical front and the northern limit of the drift ice. A series of sediment waves are discovered at the Conrad Rise in the KH07-4 cruise, but the quantity of data is not enough to reconstruct paleo-currents. Accordingly, additional multi-beam bathymetry and seismic reflection surveys were conducted in the KH10-7 cruise in order to reconstruct the sedimentary environments.

The sediment waves are located at all depth range of the survey area between 2400 and 3400 m. Wave length are 1-2 km, lateral height is 5-40 km, and maximum height of crest is ca.150 m. Their strikes are variable but roughly arranged in parallel or slightly oblique to the contour lines. Morphology of sediment waves is variale in the northern, middle, and the southern part of the survey area. In the northern area, they have WNW-trending linear sediment waves. Heights of waves are higher compared with the other areas. In the middle area, NW- to nearly NS-trending sediment waves are observed. Some arcuate and crosscutting sediment waves are observed. In the southern area, highly continuous, arcuate sediment waves are observed.

The sedimentary strata in the survey area are divided into three units, A, B, and C in descending order based on seismic facies and their external forms.

The Unit A has 0.1-0.5 sec thick in the two-way travel time (TWT), with thickening southward external form. This unit is transparent with continuous reflectors inside. Reflectors are parallel to its upper surface. The migration of sediment waves is observed but less than a wave length. A strong reflector (A-1 reflector) is observed at the middle of the unit. The amplitude of the reflector is weak in the southern area whereas strong in the northern area. The depth of the reflector varies in each waves, especially in the northern area.

The Unit B has 0.1-0.2 sec thick in TWT, with lens-shaped external form. A strong reflector is observed at its upper surface. Though the upper surface shows undulation parallel to the sediment wave, internal reflectors are not parallel to the upper surface. Local erosional truncation is observed. Reflectors in the lower part are low-amplitude and poorly continuous ones.

The Unit C is 0.7 sec thick at maximum in TWT, with similar seismic facies to that of the Unit B. Its upper part has strong reflectors whereas transparent in the lower part. Reflectors are onlapping to the basement with basin-fill external form.

Based on these observations, we interpreted sedimentary environments of the Conrad Rise. In the seismic profiles, migration of sediment waves is little and the unit A shows continuous and transparent facies, thus significant change of the bottom current is not expected during sedimentation of the unit. Unit B is interpreted as a kind of local landslide deposit. Component of the unit is not uniform because it has some strong reflectors inside. Erosional truncation at its upper surface indicate that the unit is eroded during the sedimentation of the unit A. The component of the Unit C can be similar to that of the unit B.

The significant change of sedimentary environment is observed only twice at the boundaries of sedimentary units. Thus, these changes are not corresponding to cyclic change such as glacial-interglacial cycles. In order to reconstruct the bottom currents, we need to observe the relationship between the bottom current and sediment waves.

Keywords: Southern Ocean, Sediment Wave, Conrad Rise, Bottom Current