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The distribution and timing of recent activity in the Kego Fault Zone in Hakata Bay, West Japan

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The Kego Fault Zone is divided into two segments, northwest and southeast. The sources of the Fukuoka Prefecture Western Offshore Earthquakes of 20th March, 2005 were in north-western segment. The southeastern part (the Kego Fault in the narrow sense) is an extension of the north-western segment but was not active at that time. It is important to understand the outcrop position and activity history of the Kego Fault in detail because it passes beneath densely-populated areas in the Fukuoka Plain. For this reason, trenching surveys were carried out at Osano, Dazaifu City (Fukuoka Prefecture Office, 1996), at Yakuin, Fukuoka City (Fukuoka City Office, 2001), at Kamioori, Onojo City (Miyashita et al., 2007), at the Hamanomachi Park, Chuo-Ku, Fukuoka City (Fukuoka City Office, 2009), and a piston-coring survey was made in Hakata Bay (Okamura et al., 2009). The results indicate that the recent activity and the intervals between the activities on the Kego Fault were different at the sites surveyed. In particular, the most recent activity at the piston-coring site in Hakata Bay was c. 4,000 yBP whilst that at the trenching site in Hamanomachi Park was c. 8,000 yBP, even though the two sites are only 5.5 kilometers apart.

The purpose of this study was to determine the ages and locations of recent seismic events along the Kego Fault Zone in Hakata Bay. The survey was commissioned by the Ministry of Education, Culture, Sports, Science and Technology in Japan.

A submarine acoustic survey was carried out to determine the locations of the most recently activity parts of the active fault zone, and Geoslicer cores were obtained to determine the ages of the most recently seismic events of the faults. This sedimentology of the cores was described, and radiocarbon dating and volcanic-glass analyses were carried out. The acoustic survey provided numerous sections that enabled four principal acoustic- reflection layers to be identified in the near-surface sediments. These were labeled, in ascending order, A, B, C, and D in accordance with Okamura et al., 2009. Two patterns of fault-induced deformation were recognized in the acoustic profiles. In the first, in the northern part of the Hakata Bay, the B layer and the underlying beds were deformed. In the second, in the southern part of the bay, the C layer and the underlying beds were deformed. These patterns indicate a geographically unevenly distributed activity along the fault zone. A graben structure that consists of several faults is present in the central part of Hakata Bay.

Three or four 30 cm-wide sediment cores 8 to 10 m long were obtained using the Geoslicer along three transects of the faults. The cores and the acoustic sections were correlated, and the depositional ages of the sediments determined on the basis of their depth below sea bed correlated with the radiocarbon dates (revised for calendar years).

Two phases of fault activity were recognized during the Holocene at site HKA1 (at 2.2 to 2.7m below sea bed and 5.9 to 6.4m below sea bed), and only one at site HKA2 (at 5.9 into 6.8 m below sea bed). These events have been dated to c. 4,200 to 4,800 yBP and c. 8,000 to 8,300 yBP.

It is concluded from this study that the northwestern and southeastern faults within the Kego Fault Zone form a graben in the central part of Hakata Bay, and that the two parts have different recent activity histories. They were simultaneously active once in every two activity events.

Keywords: Kego Fault Zone, Hakata Bay, acoustic sections, Geo-Slicer core, latest activity event, segment boundary