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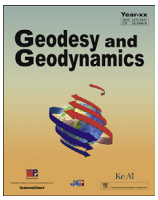

Interpretation of the west segment of the coastal fault zone in the coastal region of South China based on the gravity data

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ABSTRACT

By systemic processing, comprehensive analysis, and interpretation of gravity data, we confirmed the existence of the west segment of the coastal fault zone (west of Yangjiang to Beibu Bay) in the coastal region of South China. This showed an apparent high gravity gradient in the NEE direction, and worse linearity and less compactness than that in the Pearl River month. This also revealed a relatively large curvature and a complicated gravity structure. In the finding images processed by the gravity data system, each fault was well reflected and primarily characterized by isolines or thick black stripes with a cutting depth greater than 30 km. Though mutually cut by NW-trending and NE-trending faults, the apparent NEE stripe-shaped structure of the west segment of the coastal fault zone remained unchanged, with good continuity and an activity strength higher than that of NW and NE-trending faults. Moreover, we determined that the west segment of the coastal fault zone is the major seismogenic structure responsible for strong earthquakes in the coastal region in the border area of Guangdong, Guangxi, and Hainan.

1. Introduction

The coastal fault zone was recognized in a petroleum geological survey conducted in the South China Sea in the 1980s. It is a giant fault zone in the northern continental margin of the South China Sea and also the most representative fault zone among the NEE ones in the South China Sea faults system. It originates from the Beibu Bay and extends eastward to the Taiwan Strait, where several earthquakes stronger than magnitude 6 ($Ms = 6$) have occurred. Furthermore, almost all earthquakes with $Ms \geq 7$ in the coastal region of South China occurred in this fault zone. Therefore, it is a very important active fault zone with relatively strong seismic activity. However, descriptions regarding its spatial distribution, and the specific locations of each section, tend to be quite different, and actual data is rare to find [1–3]. Ren et al. comprehensively interpreted the Pearl River mouth section of the coastal fault zone based on gravimetry and magnetometry data, and achieved good results [4]. On the basis of the processing and interpretation of the Bouguer gravity data in the coastal region of South China, we investigated and study the west segment of the coastal fault zone (west of Yangjiang to Beibu Bay).

2. Bouguer gravity data and the processing

The Bouguer gravity data was from the Bouguer gravity map (1:1, 000, 000) and corresponding data published by the National Administration of Surveying, Mapping and Geoinformation, with reference to the Bouguer gravity map (1: 2, 000, 000) provided by the Guangzhou Marine Geological Survey. In this paper, the original paper map was digitally processed, and hundreds of thousands of

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multi-gravity anomaly value points were extracted, where the distance between two points and the one between two lines were all 2 km. This led to the Bouguer gravity anomaly map of the coastal region in South China (Fig. 1).

The gravity data processing software used in this paper was from the subject named "the gravimetry and magnetometry comprehensive inversion method technique and software system" which was included by the project "Crust detection technique in the deep ocean" (national 863 high-tech program of China). In total, more than 80 finding images in different categories were obtained after processing, and a series of representative images were selected for publication in this paper.

3. Basic characteristics of the gravity field in the coastal fault zone

The gravity data reflected the coastal fault zone relatively well. From the original Bouguer anomaly map (Fig. 1), it was apparent that a huge NEE-trending high gravity gradient belt exists in the coastal region of South China. Its northern margin was very clear (as indicated by the red dashed line in Fig. 1), but the southern margin was not studied due to incomplete gravity data regarding the pelagic region. And the western margin extended from Vietnam (west of Fangchenggang, Guangxi; not shown in Fig. 1). It further extended eastward to the Taiwan Strait via Zhelang. East of Zhelang was also not processed due to the lack of complete gravity data in the pelagic region. Moreover, this high gravity gradient belt was exactly the coastal fault zone.

The gravity value of the coastal fault zone gradually decreased from northeast to southwest with a maximum value around 25×10^{-5} m/s^2 found near the Danganlie Island. Conversely, the value reduces to a negative value in the Beibu Bay, with a minimum of -20×10^{-5} m/s^2. According to the distribution feature of the Bouguer gravity anomaly isolines, the coastal fault zone was divided into two segments (east and west segments) using Yangjiang as the boundary. The linearity in the eastern segment of the gravity anomaly isoline was good, and the gradient belt was slightly wavy and overall neat and compact in the NEE direction. These results matched the interpretation by Ren et al. when describing the Pearl River mouth segment [4]. The west one showed significantly poorer compactness of gravity anomaly isolines and NEE-trending linearity than the Pearl River mouth segment, as well as a relatively larger curvature and relatively complicated gravity structure. In addition, the NW-trending and NE-trending isolines inside the west segment protruded more significantly than those in the Pearl River mouth, which interspersed in the NEE-trending isolines to form multiple blocks, indicating relatively stronger activity in the NW-trending and NE-trending fault inside the west segment compared to that in the Pearl River mouth (described in detail later).

4. Interpretation of the west segment of the coastal fault zone based on the gravity data

Various finding images processed and obtained by the above software were comprehensively interpreted and studied to compile a distribution map of the west segment of the coastal fault zone (Fig. 2). The west segment of the coastal fault zone includes six faults, in which F1.1 and F1.3 are connected to the north boundary fault and south boundary fault in the Pearl River mouth, respectively [4], and because the southern pelagic region lacked complete data, F1.4, F1.5, and F1.6 to the east of the current region could not be investigated. In the following, we describe each fault in detail.

4.1. F1.1 Lianjiang-Yangxi Fault

This fault is located in the northern boundary in the west segment of the coastal fault zone in the coastal region of South China, starting from west of Fangchenggang and possibly extending westward into Vietnam [4]. It is connected to the northern boundary fault in the Pearl River mouth after passing Qinzhou Bay, Beihai, Lianjiang, Huazhou, Maoming, Yangxi, South Yangjiang. It mainly extends along the off-shore region along the Beibu Bay in Guangxi, and also extends eastward after crossing the Leizhou Peninsula. Geologically, it is the boundary between the land and the sea (Fig. 2).

This fault was well reflected in different kinds of maps, and was particularly clear in the 0° first-order directional derivative isoline graph (the 0° direction mainly reflected the nearly EW-trending fault). In that map, the Lianjiang-Yangxi Fault was a stable isoline belt extending along the nearly EW direction and was still very clear upward continuation to 30 km. It was cut off in the deeper

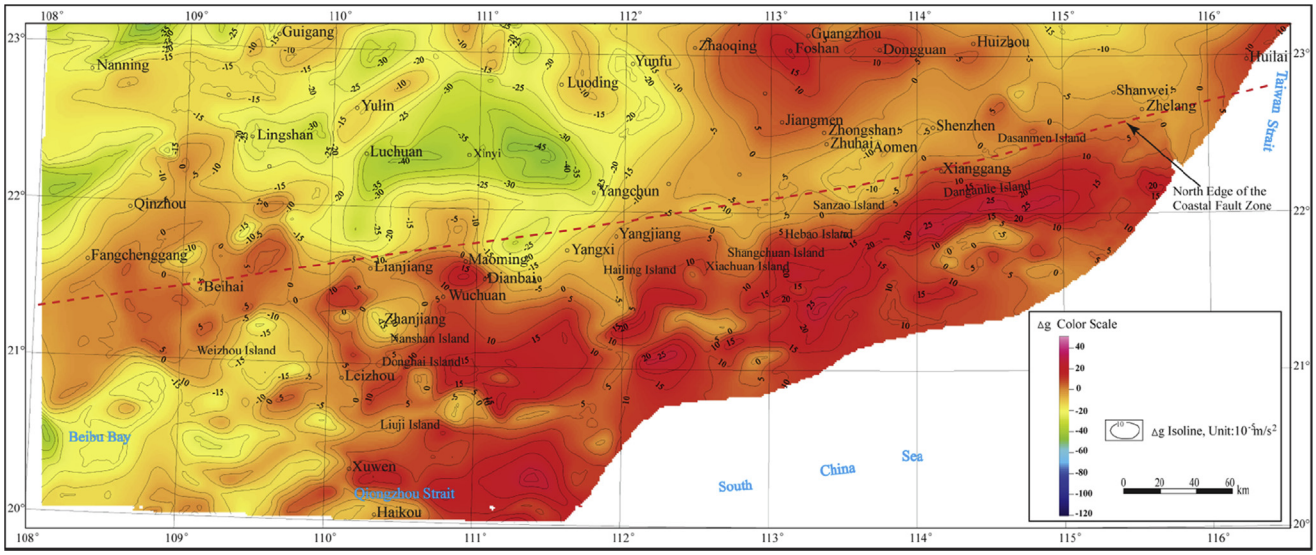

Fig. 1. Bouguer gravity anomaly map of the coastal region in South China.

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