

Gravity-derived dense clustering of latest Cenozoic caldera-like basins in Central Hokkaido, Japan

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We examine gravity structures of the central Hokkaido using new gravity data, and attempt to present preliminary interpretations of their characteristic features, particularly with special attention to the numerous sedimentary basins of latest Cenozoic age (late Miocene to Quaternary). We compile more than 7,000 gravity data of the study area and produce a new gravity anomaly map. The new map in the central Hokkaido delineates two characteristic features that are divided by a boundary which falls approximately along the Tokoro Tectonic Line (TTL) of the map area. To the east of TTL, the Bouguer anomaly field is characterized by the high-amplitude gravity ridge attributable to Mesozoic sequences associated with several ellipsoidal gravity depressions having an almost NE-SW major axis of 15-20 km, whereas to the west of TTL, anomaly relief is much lower with several closed gravity depressions relative to the region to the east of TTL. It is quite intriguing that these remarkable lows, dominant over the mountainous area to the west of TTL, clearly form a dense cluster of closed depression with a diameter of about 10-15 km, which well correlates with distributions of the known Cenozoic basins. These features are much strengthened by a relief-shaded Bouguer image.

Gravity analysis by horizontal derivatives and high-pass filtering of the gravity field shows that the major high Bouguer gradient zones, found to be nearly closed in a ring-shaped or oval-shaped form, are remarkable in the central part of the map area. Several of them indicate a better coincidence between the basin rims and the location of a steep gravity change. This implies that they have caldera-like collapse structure, and that the subsurface part of these basins accords with a steep-sided depression, with a flat bottom, probably filled with low-density volcanic materials. The Bouguer anomaly contours around these caldera-like basins are likely those of the thickness contours of the basin fill, which yields significant constraints on the subsurface structure beneath the basin. Assuming the average density of the basin fill to be 2.2 g/cm^3 (a density contrast of 0.47 g/cm^3) in one of the typical Cenozoic basins in the central Hokkaido, we obtain the result that an apparent maximum thickness of the basin fill amounts to be 750-1,000 m, which corresponds to a relative amplitude of 15 and 20 mgal, respectively.