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Geophysical constraints for terrane boundaries in southern Mongolia

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The Central Asian Orogenic Belt (CAOB) is a typical accretionary orogen divided into numerous lithostratigraphic terranes corresponding to magmatic arcs, back arcs, continental basement blocks, accretionary wedges and metamorphic blocks. These terranes should be in theory characterized by contrasting magnetic and gravity signatures thanks to their different petrophysical properties. To test this hypothesis, the stratigraphically defined terranes in southern Mongolia were compared with potential field data to constrain their boundaries and extent. The existence of terranes in southern Mongolia cannot be attested by the uniform geophysical fabrics due to the lack of systematic correspondence between the high/low amplitude and high/low frequency geophysical domains and major terranes. Processed magnetic and gravity grids show that both gravity and magnetic lineaments are E-W trending in the west and correlate with direction of some geological units. In the east, both magnetic and gravity lineaments are disrupted by NE-SW trending heterogeneities resulting in complete blurring of the geophysical pattern. Correlation of magnetic signal with geological map shows that the magnetic highs coincide with late Carboniferous-early Permian volcanic and plutonic belts. The matched-filtering shows good continuity of signal to the depth located along the boundaries of these high magnetic anomalies which may imply presence of deeply rooted tectono-magmatic zones. The axes of high density bodies in the western and central part of the studied CAOB are characterized by periodic alternations of NW–SE trending high frequency and high amplitude gravity anomalies corresponding to late Permian to Triassic cleavage fronts up to 20 km wide. The matched-filtering analysis shows that the largest deformation zones are deeply rooted down to 20 km depth. Such a gravity signal is explained by the verticalization of high density mantle and lower crustal rocks due to localized vertical shearing associated to upright folding. The magnetic signal is interpreted to result from a giant Permo-Triassic magmatic event associated lithosphere scale deformation whereas the gravity pattern is related to post-accretionary shortening of the CAOB in between North China and Siberia cratons. The blurring of the gravity signals to the west is attributed to activity of Triassic dextral shear zones parallel to the eastern Siberian boundary later on affected by Cretaceous extension and magmatism affecting the whole of eastern Asia.