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Using Edge Detection Techniques on Aeromagnetic Data to Delineate Structures that Control Orogenic Gold Deposits in the Sefwi Granite-Greenstone Belt, Ghana

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The orogenic gold deposits in the Sefwi granite-greenstone belt are associated with quartz veins and occur along shear zones. Edge detection techniques (i.e., analytic signal, vertical and tilt derivatives) were employed to delineate structural lineaments related with shear zones using aeromagnetic data. The enhancing techniques aided the delineation of NE-striking D_2 and D_3 deformation lineaments associated with the Kenyase-Yamfo, Hwidiem, Ketesso, Bibiani, and Afema shear zones in the study area. These shear zones are within the Sefwi belt and at the contact zones between the belt and the adjacent metamorphosed volcano-sedimentary rocks of the Sunyani-Comoé and Kumasi-Afema basins. Low-displacement N- to NNE-striking D_4 faults, which are oblique to the D_2 and D_3 shear zones, were also delineated. The local bend and offset along the D_2 and D_3 shear zones created by the cross-cutting N-to NNE-striking D_4 faults serve as favourable trap zones to focus mineralised fluids migrating along these shear zones. Fry analysis of known orogenic gold occurrences in the study areas shows that the NE-trending structures, with azimuths of 40° - 50° , are predominant in controlling most mineralisation and distribution of deposits; for example, regions of the Kenyase-Yamfo, Hwidiem, and Ketesso shear zones in the N-S to NNE-SSW direction with azimuths 0° - 10° and 10° - 20° . Integrating results from each edge detection filter effectively help to diffuse and separate different anomalies from shallow and closely spaced sources. The filters (first vertical derivative, tilt angle derivative, TAHG derivative, and STDR derivative) were used to separate and delineate closely spaced structural lineaments associated with the Kenyase-Yamfo, Hwidiem, Ketesso, Bibiani, and Afema shear zones. According to the Fry analysis, most orogenic gold occurrences are associated with NE-trending D_2 and D_3 structures and confirmed by ground checks (Newmont Ghana Gold Limited). The secondary structural trend in the N to NNE direction (D_4 deformation) influences orogenic gold mineralisation.