

Aeromagnetic Signature of Porphyry Copper Systems in Northern Chile and Its Geologic Implications

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Abstract

The compilation of a large aeromagnetic high-resolution dataset acquired for base metals exploration in northern Chile between lat 19° 45' S and 27° 15' S revealed a pattern of transorogenic regional magnetic anomalies. These anomalies occur as generally east-west stripes of negative residual magnetic intensity of more than -100 nanotesla (nT). They have an east-west extension of some tens of kilometers and a north-south width of some 5 to 10 km. Some of them can be observed continuously from the coast to the volcanic belt. Their residual intensity is typically more than -100 nT. They also show a loose north-south spacing. It is observed that all known porphyry copper deposits of the investigated segment are spatially related to these transverse magnetic anomalies. We propose that the transverse magnetic anomalies are the magnetic response to the loci of emplacement of intrusive bodies of batholithic size along paths of the advancing magmatic front of the active continental margin. The occurrence of several important porphyry copper deposits grouped in clusters within a district is explained as being related to a common parental intrusive complex, which is geophysically signaled by a corresponding transverse magnetic anomaly. A possible implication of the observed relationship between porphyry copper deposits and transverse magnetic anomalies is the quasideterministic restriction of porphyry copper deposits to certain orogen transverse loci (necessary condition) and the corresponding consequences for future exploration strategies.