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Magnetic response to geological mapping and exploration challenges in the Canadian Cordillera

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Difficulties for geological mapping and exploration posed by thin glacial and younger volcanic cover in parts of the Canadian Cordillera are mitigated by high resolution magnetic surveys. The current crisis for the lumber industry in British Columbia caused by the Mountain Pine beetle has witnessed increased mineral exploration activity, including airborne geophysical surveys sponsored by government agencies and the resource industry. Some of these augment several older combined aeromagnetic-radiometric surveys completed in the prospective Quesnel terrane, containing Triassic-Jurassic volcanic rocks and related sub-volcanic plutonic rocks associated with a variety of copper and copper-gold skarn, porphyry-type and polymetallic and gold-quartz vein mineralization. Alteration zones associated with porphyry copper deposits invariably are accompanied by high magnetite contents (commonly 5 - 10 % volume), and high concentrations of potassium. The exploration value of this association has been enhanced in recent years by the recognition that areas of low thorium/potassium ratio associated with an adjacent magnetic high frequently coincide with mineralization. Unlike potassium, relatively immobile thorium is not augmented by hydrothermal alteration, hence the low ratios. High resolution magnetic surveys also contribute to exploration by playing a key role in predicting bedrock geology beneath thin ($\sim$200 m maximum) Tertiary volcanic cover, outlining possible prospective Triassic-Jurassic volcanic rocks. Investigations of thickness variations in these rocks are proceeding using recently acquired magnetic rock property data. Magnetic signatures have been critical in revising positions of geological boundaries, thereby offering a fresh perspective for some mineral exploration strategies. Comparison of magnetic fabrics within a major “granitic” batholith has potential to discriminate between portions characterized

by relatively mafic-poor, un-mineralized and unaltered rocks, and more mafic heterogeneous portions containing pervasive propyllitic alteration and copper mineralization related to quartz veins and fractures. The impact of such magnetic investigations in this geological environment is illustrated with several examples.