A proton microprobe investigation of tungsten-rich quartz veins from the Macraes mine in Otago, New Zealand

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Quartz veins in shists from the Macraes mine in Otago, New Zealand were investigated with proton microscopy to detect high amounts of tungsten assumed to be associated with gold particulates in these samples. In many hydrothermally altered rocks, tungsten is commonly associated with gold. The samples were investigated with the external proton probe at GNS using 2.5 MeV protons passing through a 10 μ m Al window. The X-rays were collected with a Si(Li) detector positioned at 135 degree. Charge measurements were performed with a Nal detector measuring the Ar X-rays from air perpendicular to the ion beam. On that basis, regions of interest were selected for proton microprobe investigations using 2.5 MeV protons. In our search for gold, we have found high amounts of tungsten as expected but also regions containing tin, arsenic, iron, calcium and strontium, the latter two clearly associated with calcitic veins penetrating the rocks. We also considered areas that contain carbon for the microprobe studies that appear as dark regions in the veins. Specific results are discussed highlighting the usefulness of proton microprobe studies for quartz veins.

The proton microprobe studies are also discussed in the light of measurements we have made with a 50 mm diameter LOAX HPGe detector in conjunction with simultaneous measurements using a standard 2 mm diameter Si(Li) detector. K X-rays of energy greater than 20 keV were measured with higher sensitivity with the HPGe detector due its larger surface area. This was a particular advantage for detecting Sn with ca 200 ppm LOD. NIST standard SRM610 was used for the data evaluation with GUPIX and GEOPIXE.