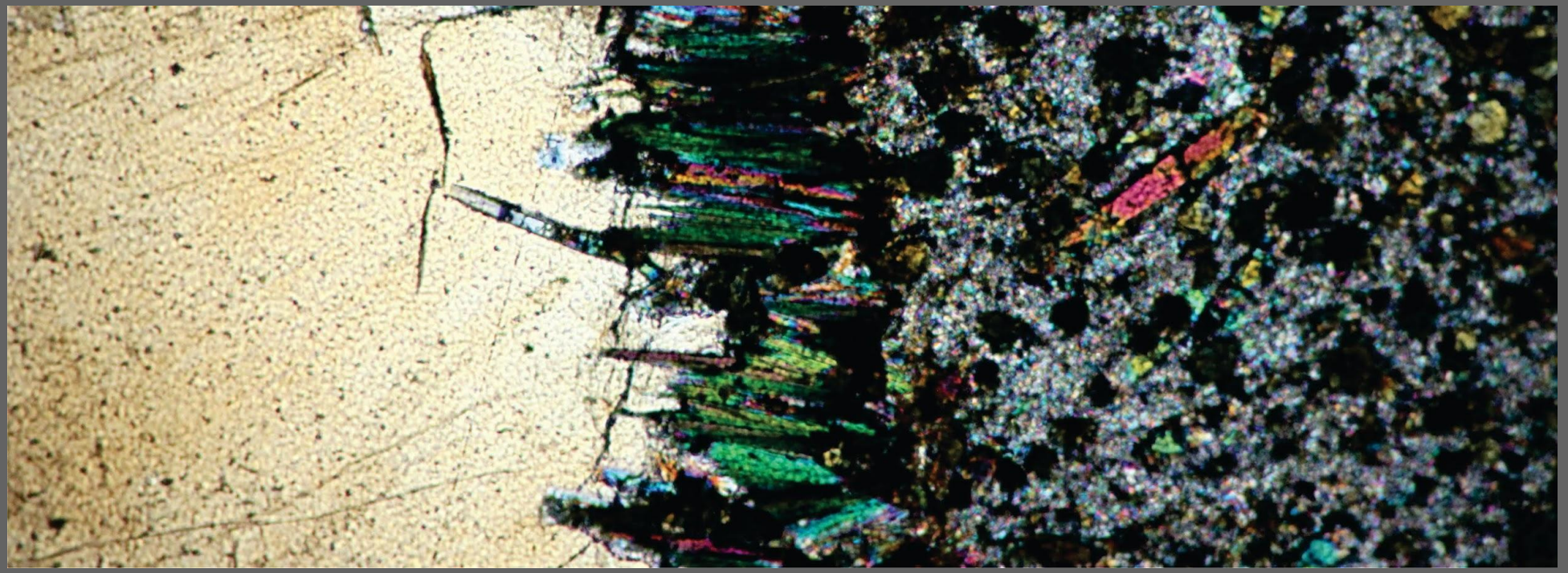
Granite-related scheelite and gold mineralisation at Kirwans Hill, Reefton



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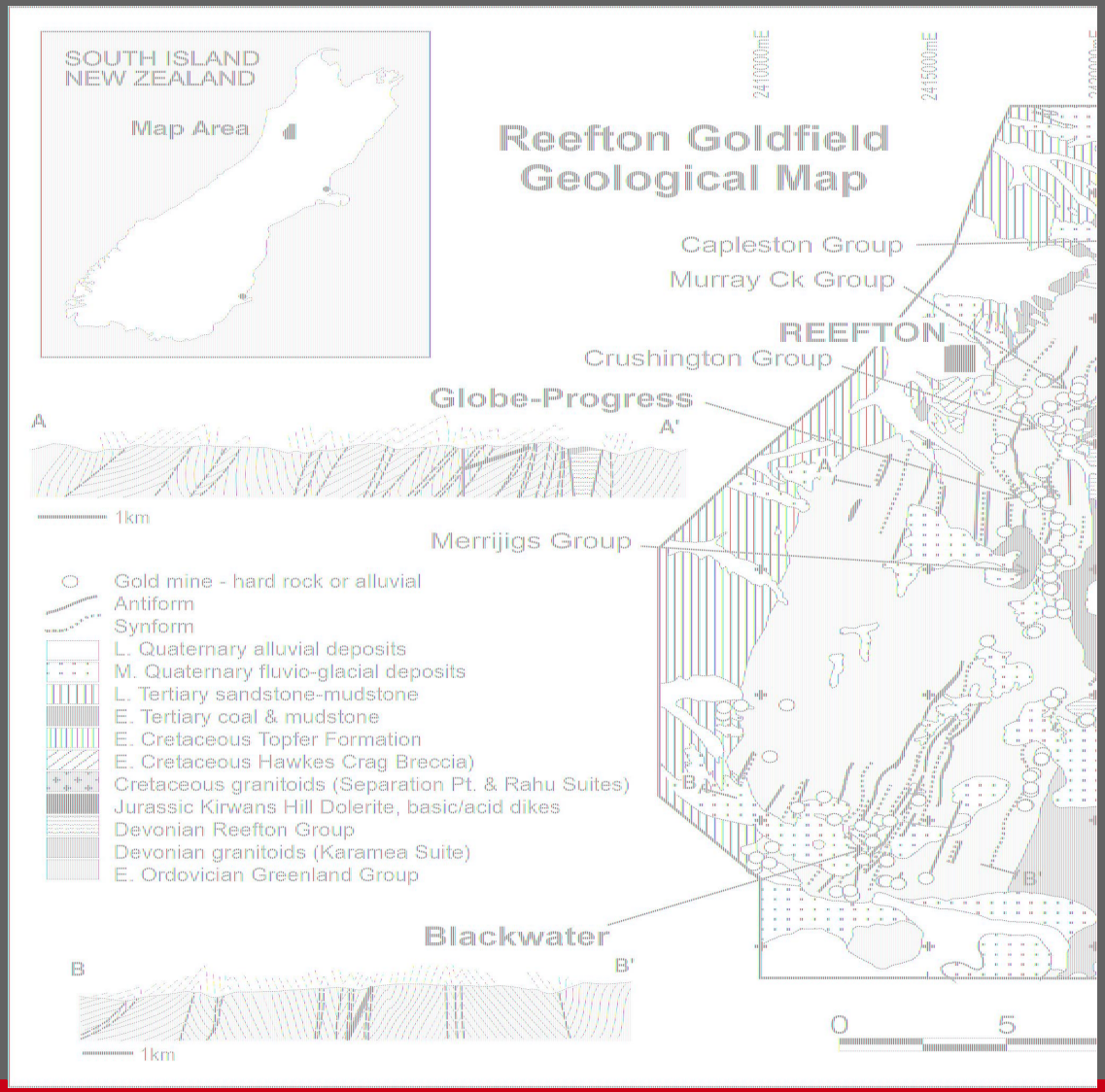
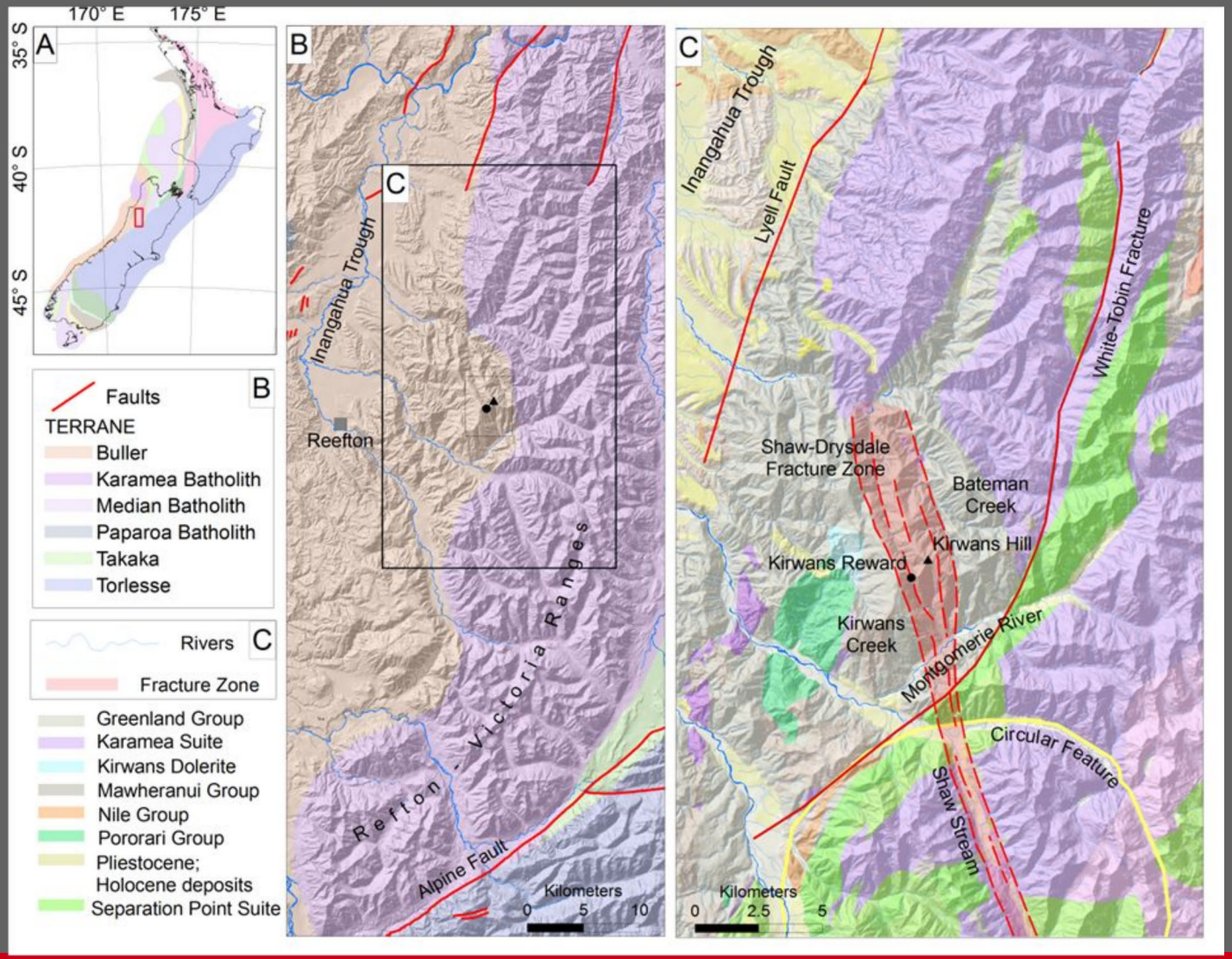


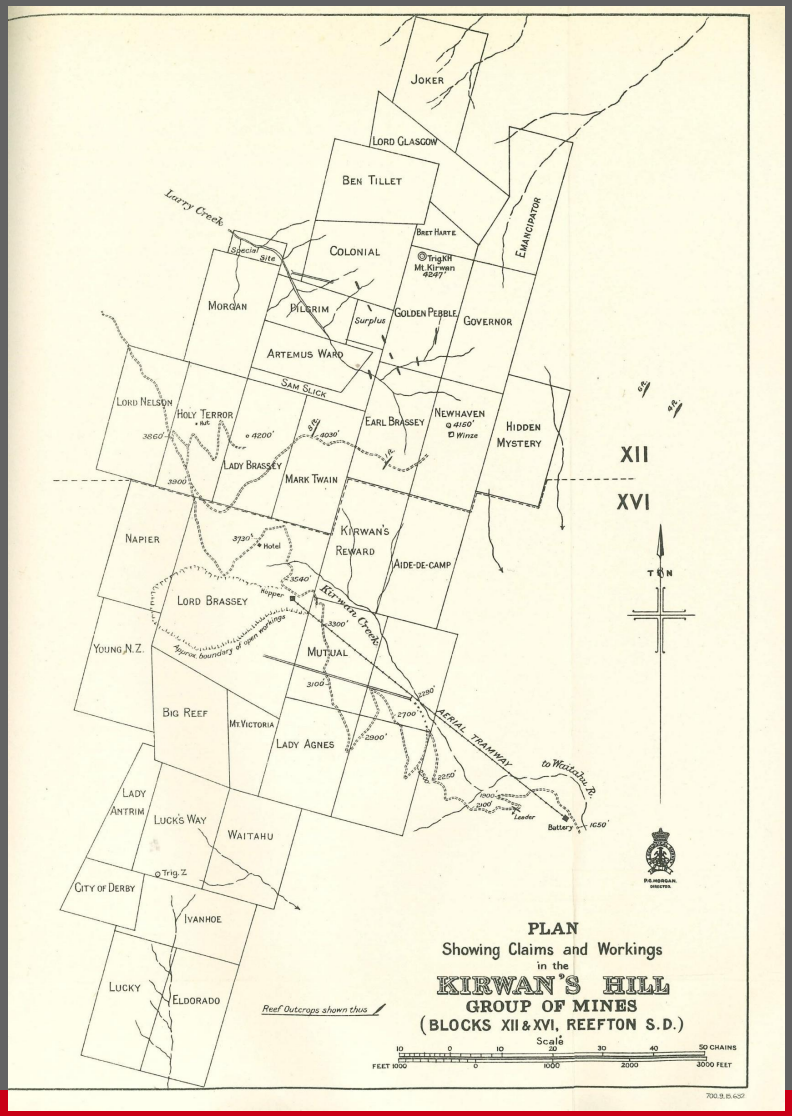
- Kirwans lies about 6 km east of the 10 km-wide corridor of the gold-quartz lodes of the Reefton Goldfield
- Gold-quartz lodes are localised in shear zones on the steeply dipping limbs of folds in Ordovician greywacke of the Greenland Group
- Gold is associated with sulfide minerals: pyrite, arsenopyrite and stibnite
- These gold-quartz-sulphide lodes are classified as orogenic type gold deposits of likely hydrothermal-metamorphic genesis
- Similar to the gold-quartz lodes of Ballarat-Bendigo in Victoria



Kirwans: Geological Setting

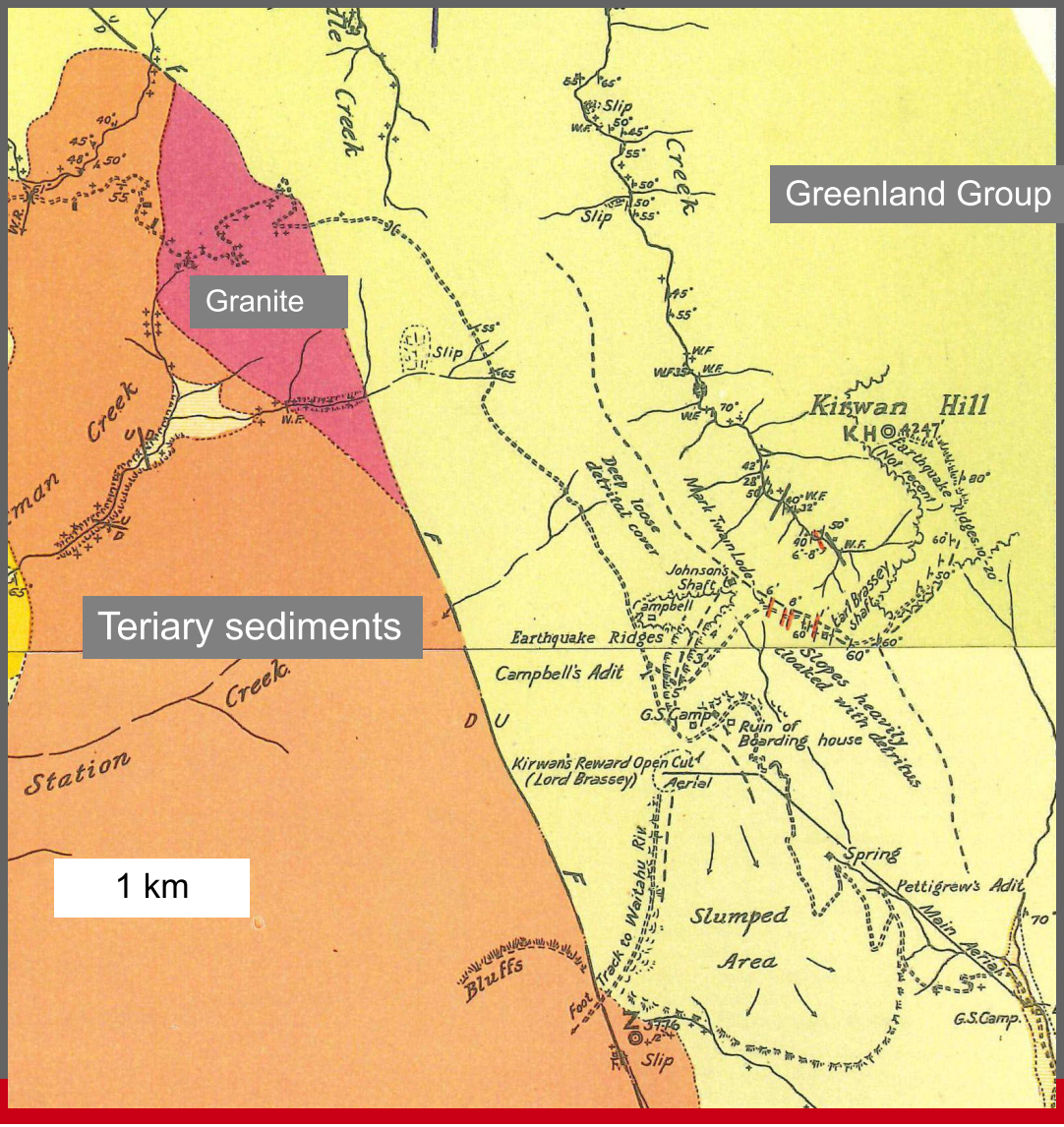
- Lies within an extensive fracture zone
- Hosted in Greenland Group Ordovician greywacke
- Karamea Suite Devonian granite nearby

(From Nathan et al. 2002, Durance & Polette 2016)



Kirwans Hill: Mine Claims (Henderson 1917)

- Loose boulders of gold-bearing vein quartz discovered by William Kirwan in 1896
- McKay (1898): the quartz occurs in blocks up to 3 tons, some with greywacke wall rock, thickly covering the surface over an area of 200 to 240 m by 80 to 100 m. Quartz reefs striking SSW were found to the NE of the loose quartz, but were poor in gold (Mckay 1898, Henderson 1917).
- Kirwans Reward Gold Mining Company formed in 1898 to mine the loose boulders on the Lord Brassey claim
- A 10-stamp battery, later enlarged to 15 stamps, was erected in Kirwans Creek, 600 m lower in elevation, connected to the battery by an aerial tramway
- Mining continued each summer until 1907, with a total production of 29,780 tons, yielding 12,698 oz of gold
- Mined by open cut over an area of 300 by 150 m, to a depth of up to 40 m, at which point the loose quartz cut out

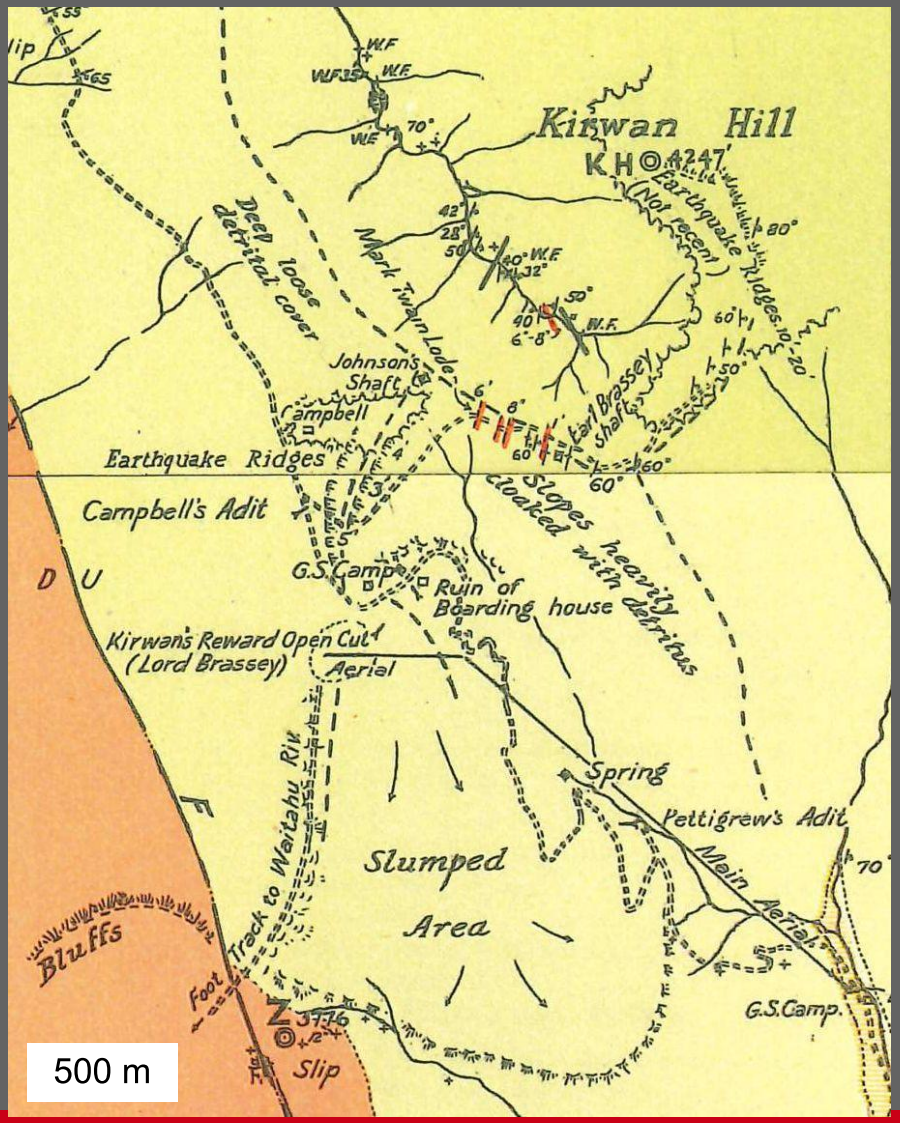


Kirwans Hill Map (Gage 1948)

Granite at Bateman Creek

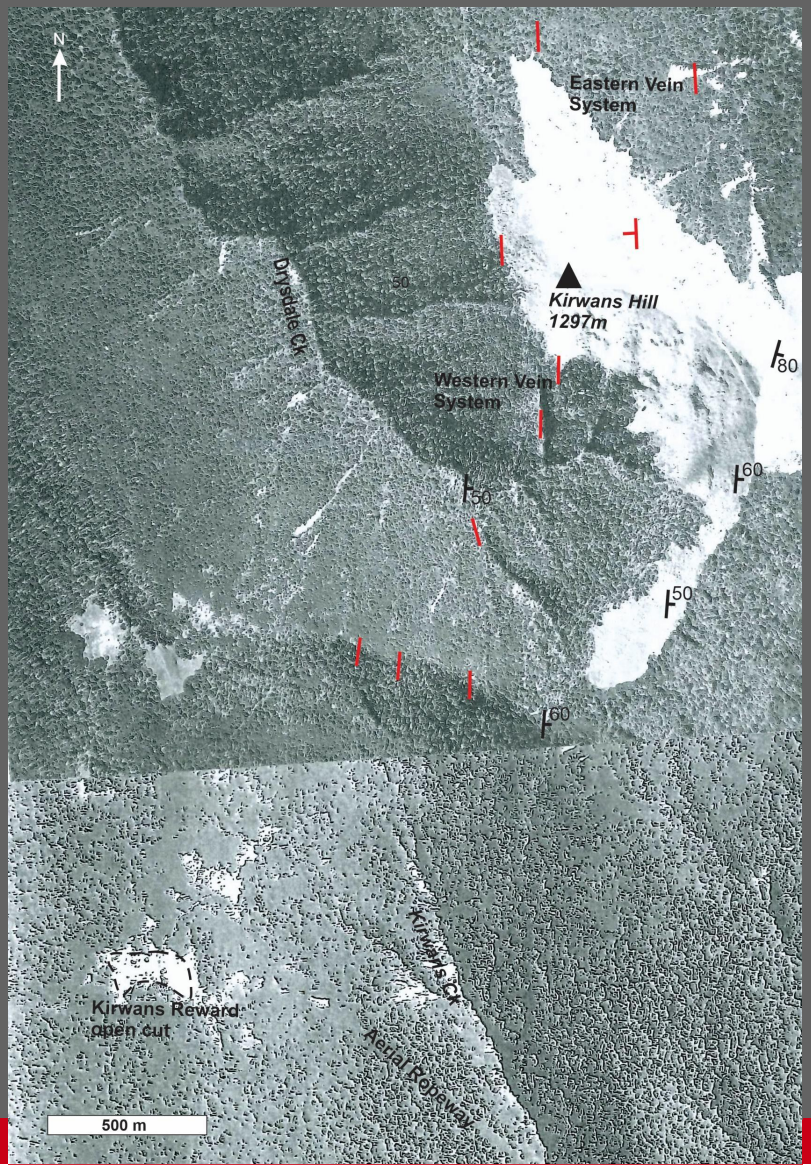
Mapped an extensive fault zone in Drysdale Creek extending southwest through Kirwans Reward

Quartz veins NNE of Kirwans Reward



Gage (1948)

- Numerous solid quartz veins about 1 km northeast of the open cut, but only low-grade
- Best results on the Newhaven claim, gold-bearing vein followed down to a depth of 10 m
- Henderson (1917) suggested these veins represented “poorer ore on the same lode-channel as the rich broken quartz”
- Several long adits (Pettigrews) didn’t reach targets
- Gage recorded numerous earthquake fissures and scarps up to 6 m in height along with large landslips, as part of an extensive fault zone (Shaw-Drysdale fracture zone)
- He suggested the loose gold-bearing quartz on the Lord Brassey claim was part of a large slip that took some 30 m off the top of the outcropping quartz veins



Kirwans Hill: Air Photo Map

(Base from photo 860/24 flown in1944 and 528/C15 flown in1948)

Location of quartz lodes from Hobach (1987) and Gage (1948). Lodes shown in red. Strike and dip of Greenland Group metagreywacke in black

Location of Kirwans Reward open cut

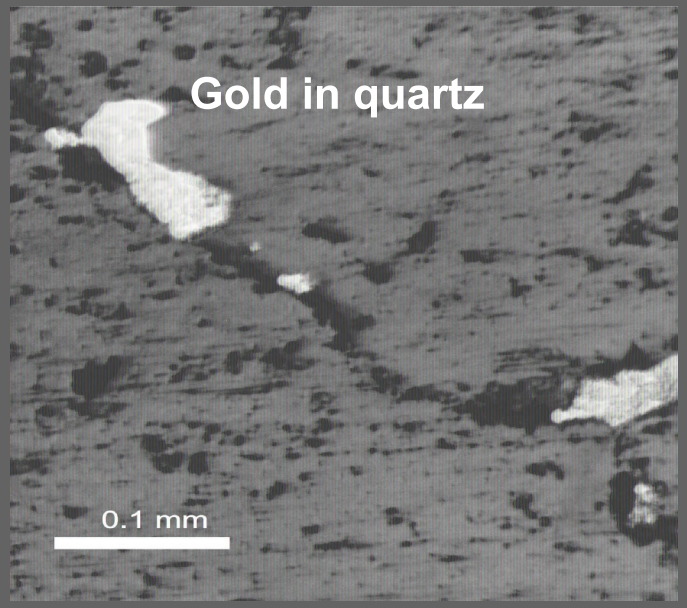
Location of Western and Eastern quartz-scheelite vein systems from Hobach (1987)

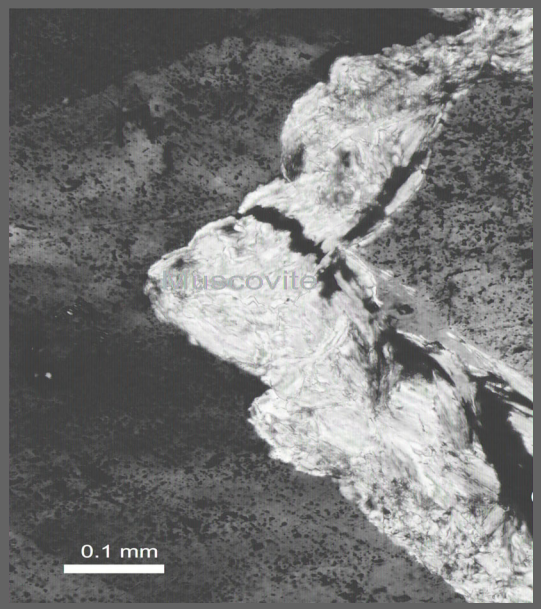
Modern Exploration (1970s to 2014)


Outcrop of sheeted quartz-scheelite veins of western vein system

Geochemical surveys in the 1980's led to the discovery of western and eastern sheeted quartz-scheelite-tourmaline-muscovite-pyrite-sphalerite, greisen-related vein systems at Kirwans Hill

The western vein system coincides with the low-grade gold-bearing veins mapped by Henderson and Gage



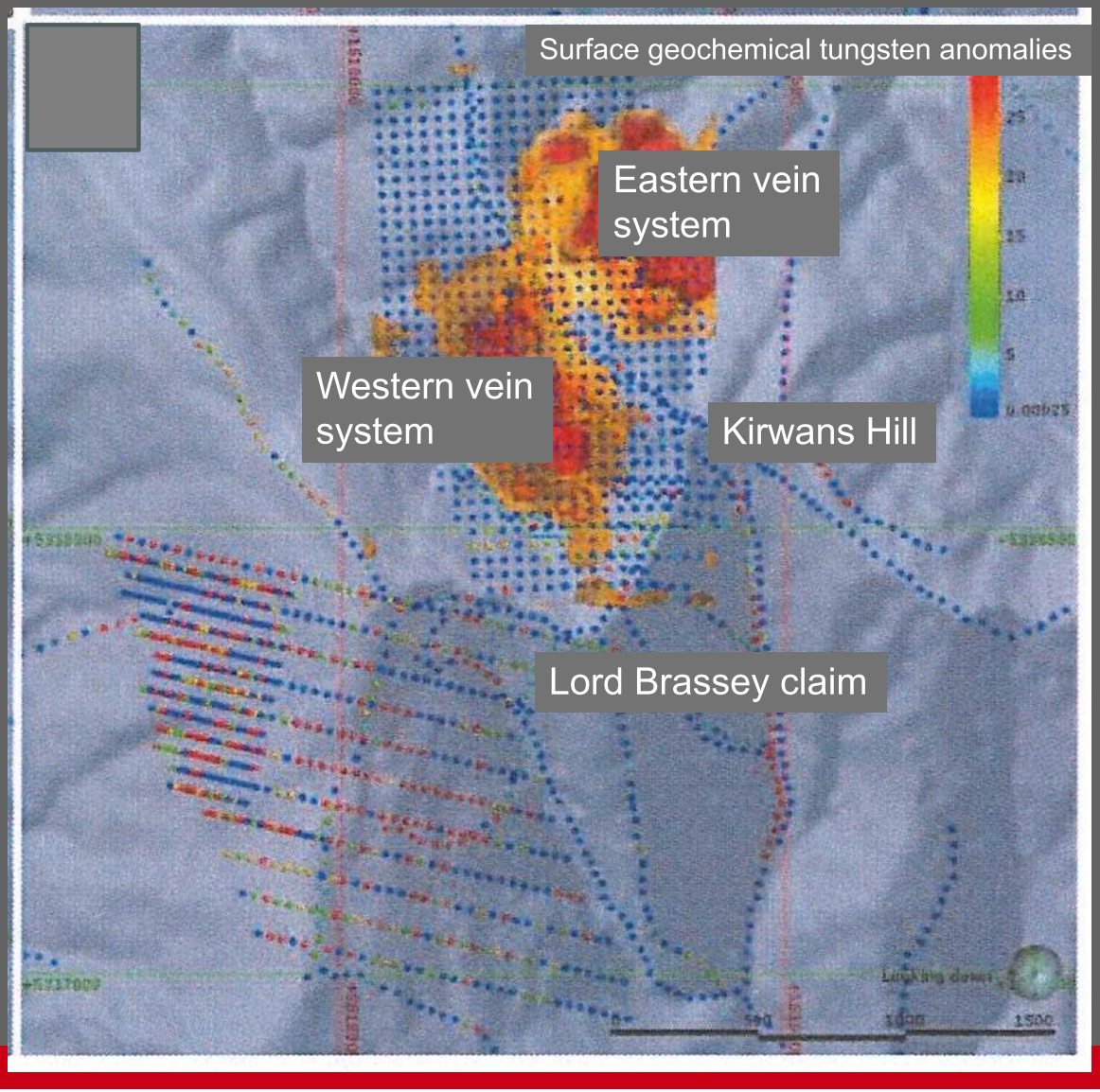


Mineralogy of Kirwans Reward quartz veins compared with Kirwans Greisen Veins

Several samples collected from the mine waste dump contain gold associated with muscovite-quartz-goethite (ex sulfide) veinlets within recrystallised vein quartz. Rare tourmaline

Tourmaline and muscovite are abundant in the quartz-scheelite-tourmaline-muscovite-pyrite-sphalerite, greisen-related vein systems at nearby Kirwans Hill

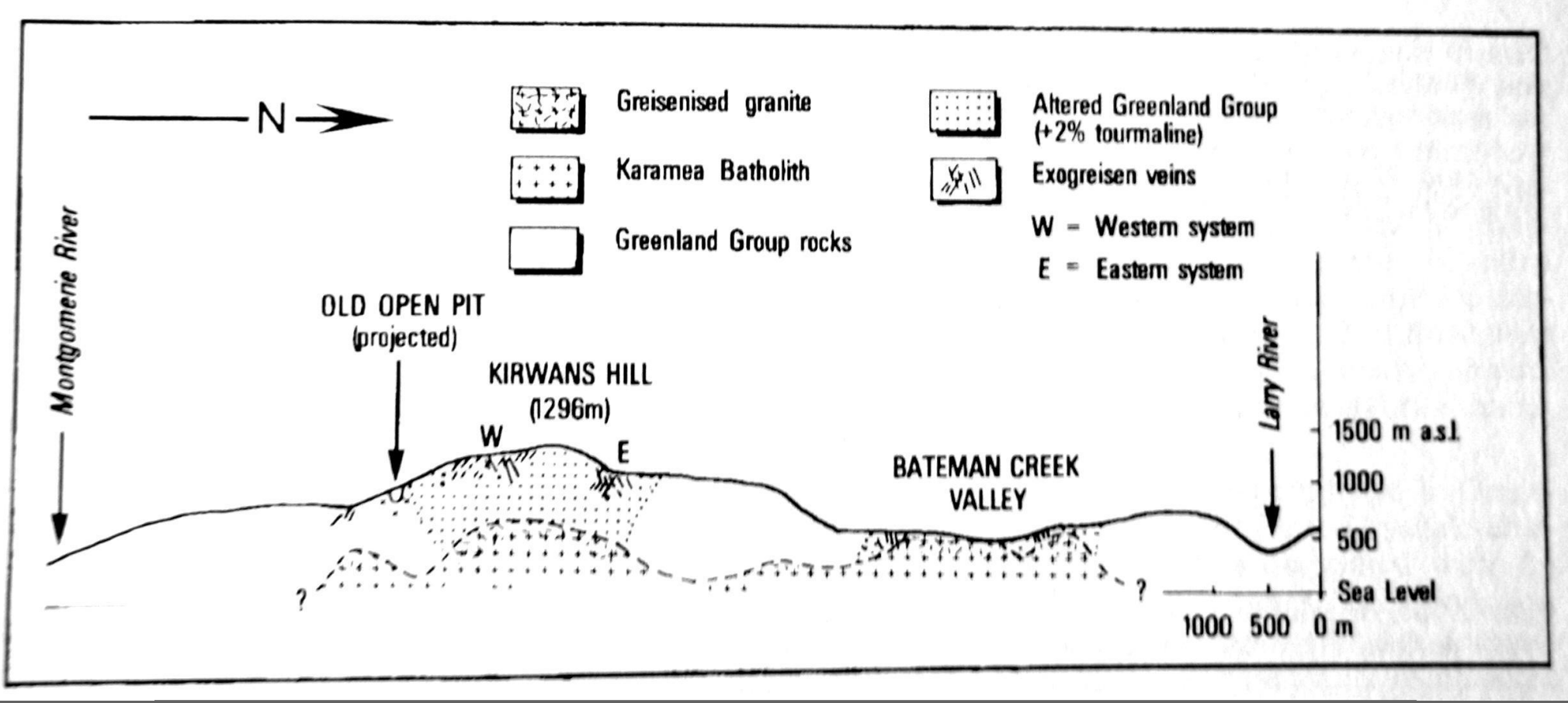
This indicates that the Kirwans Reward gold-bearing veins are genetically related to the Kirwans Hill scheelite-bearing veins



Western and Eastern Vein Systems Defined by Tungsten Anomalies

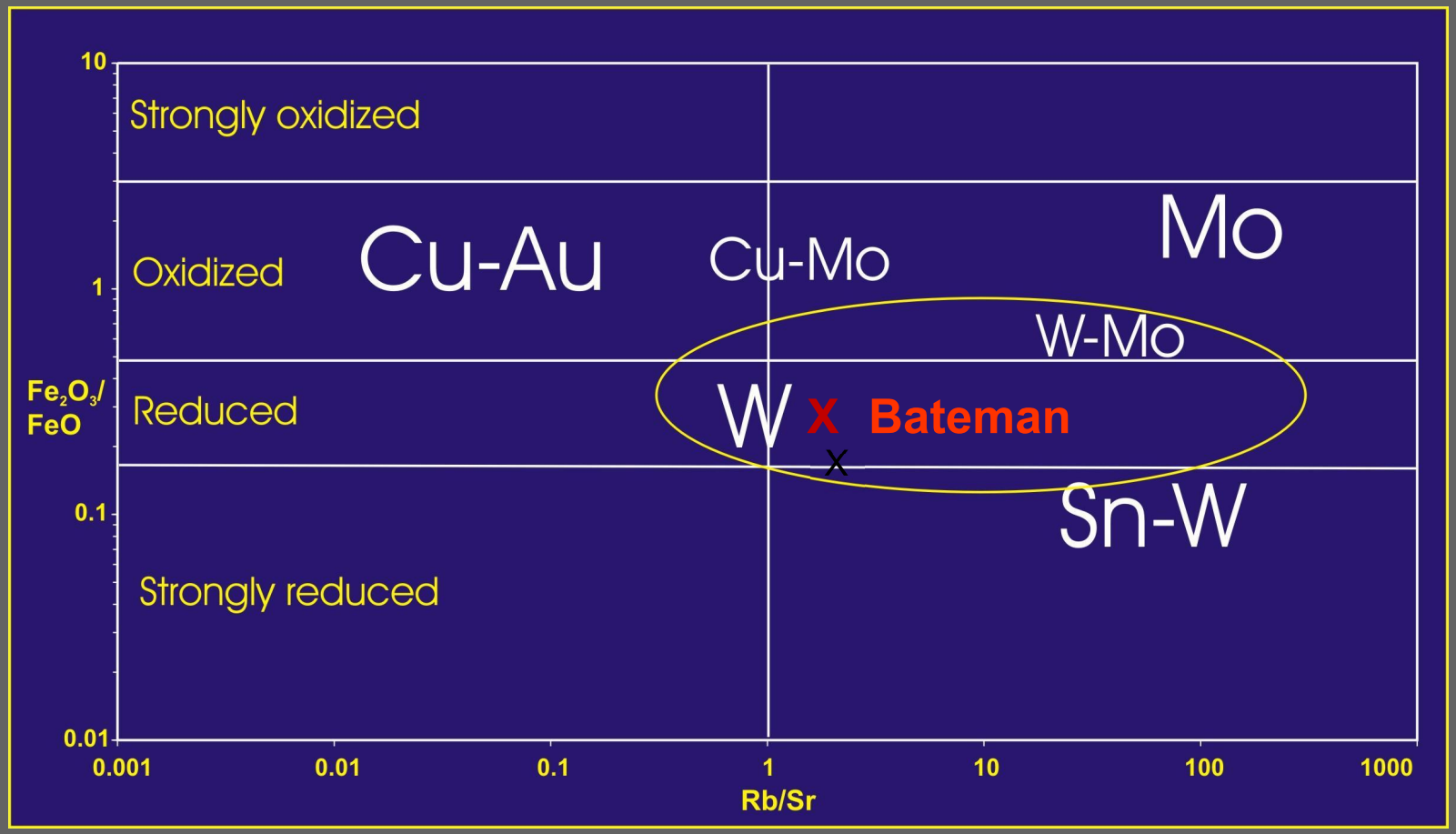
- The western vein system defined by surface tungsten values coincides with the low-grade gold-bearing veins mapped by Henderson and Gage
- Subsequent diamond drilling has shown a few intercepts of low-grade gold (best of 1 m @ 0.41 g/t), with numerous intercepts of scheelite (500-5,800 ppm W) mineralisation (Durance & Polette 2016)

Kirwans Hill gold-bearing and greisen-related vein systems may be sourced from the nearby Late Devonian Bateman Creek Granite



Schematic Cross Section Kirwans Hill – Bateman Creek (Piranjo & Bentley 1985)

Reduced Granite Related Gold Geochemistry (Baker et al.)



Summary and Conclusions I

- Loose boulders (up to 3 tons) of gold-bearing vein quartz discovered by William Kirwan in 1896 on southern flank of Kirwans Hill
- Kirwans Reward Gold Mining Company mined the boulders in a shallow open pit, producing 12,698 oz of gold from 29,780 tons, from 1898 to 1907
- Low-grade solid quartz veins found about 1 km northeast of the open cut
- Gage (1948) suggested gold-bearing quartz in the open cut was part of a slip that took the top of the outcropping quartz veins

Summary and Conclusions II

- Regional geochemical surveys in the 1980's discovered western and eastern sheeted quartz-scheelite greisen-related vein systems at Kirwans Hill
- Western vein system coincides with the low-grade gold-bearing veins
- Kirwans Hill gold-quartz veins differ from the typical gold-quartz-pyrite-arsenopyrite lodes of the Reefton Goldfield. Contain muscovite and tourmaline
- Kirwans Hill gold-bearing and greisen-scheelite veins sourced from Bateman Creek Granite of Late Devonian age (3723 Ma). Intrusion related gold deposit