

Exploration and Mining in the Kootenay-Boundary Region, 2015

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1.0. INTRODUCTION

The Kootenay-Boundary Region offers a variety of mining and exploration opportunities, and is accessible by well-developed infrastructure. Five operating metallurgical coal mines in the Elk Valley account for the majority of Canada's coal production, and exports. Several mines in the region also produce industrial minerals including silica, magnesite, gypsum, and graphite. The region also hosts the historic lead-zinc-silver Sullivan Mine, and the Trail smelter is still in operation. Exploration for both base and precious metals also continues to be an exploration focus for the region.

In 2015, total exploration spending was similar to 2014, with about \$50.8 million spent on exploration in the region (Fig. 1). With softer commodity prices, drill programs for both metals and coal were cut (approximately 92,000m in 2015; Fig. 2), and spending was increasingly focused on mine development and mine evaluation projects (Fig. 3), mainly on Environmental Assessment requirements.

2.0. GEOLOGICAL OVERVIEW

The Kootenay-Boundary region contains autochthonous and parautochthonous elements of ancestral North America (Laurentia) including: Archean to Mesoproterozoic basement rocks; Proterozoic rift and intracratonic basin successions; Paleozoic to Jurassic passive-margin, shelf, and slope successions that were deposited on the western flank of the ancient continent (Kootenay terrane, and North American platform); and Jurassic to Cretaceous foreland basin deposits. It also contains parts of the Slide Mountain terrane, which records mid- to late- Paleozoic back-arc extension that split the western flank of ancestral North America to form the Slide Mountain ocean; and Quesnellia and its basement (Okanagan subterrane), which accreted to the continental margin in the middle Jurassic (Nelson et al., 2013; Fig. 4).

The region can be sub-divided into a variety of tectono-stratigraphic elements that contain similar geological characteristics and deposit-types (Figs. 4, 5a, 5b). The Purcell Anticlinorium is a broad, north-plunging structure underlain by Proterozoic rift successions of Ancestral North America. Mineralization types include: sedimentary exhalative (SEDEX) deposits (bedded sulphide, feeder pipe, and vein); massive sulphide replacement deposits (Irish-type, Mississippi Valley type, and manto); Mesoproterozoic intrusion and fault-related Ag-Pb-Zn and Cu-Ag veins; Mesozoic shear and vein gold, and associated placer deposits.

The Kootenay Arc is a 400 kilometre-long curved belt that includes Paleozoic to Mesozoic rocks of the Kootenay terrane and parts of the North American platform. Deposits include stratiform, laminated, to massive sulphides; replacement-style Irish-type, Besshi-type; Cu-Zn-rich VMS, and boron-enriched exhalites (Nelson et al., 2013); and Mesozoic precious-metal, and Cu-Au skarn mineralization.

The Quesnel, Slide Mountain and Okanagan exotic terranes accreted to the western margin of North America during the Mesozoic. Mineralization occurs as Ag-Pb-Zn±Au, Cu polymetallic vein; shear-hosted, stockwork and breccia deposits; replacement-type base metals; Cu-Au-Ag and base metal skarns; porphyry Cu-Mo; alkalic porphyry Cu-Au-Ag; Au-Ag epithermal vein; Zn-Pb bearing mesothermal quartz veins; precious metal, and base metal massive sulphides.

The Rocky Mountain Fold and Thrust belt consists mainly of mid-Proterozoic to Mesozoic sedimentary platform and craton margin deposits, which were detached and thrust eastward during Mesozoic to Tertiary terrane accretion. Siliciclastic, carbonate, and evaporitic rocks were uplifted and displaced northeastward, creating a classical thin-skinned fold-thrust belt, and a foreland basin. These upturned thrust sheets and foreland basin rocks host relatively easily mined and structurally thickened coal deposits, and industrial minerals such as gypsum, magnesite, silica, and phosphate.

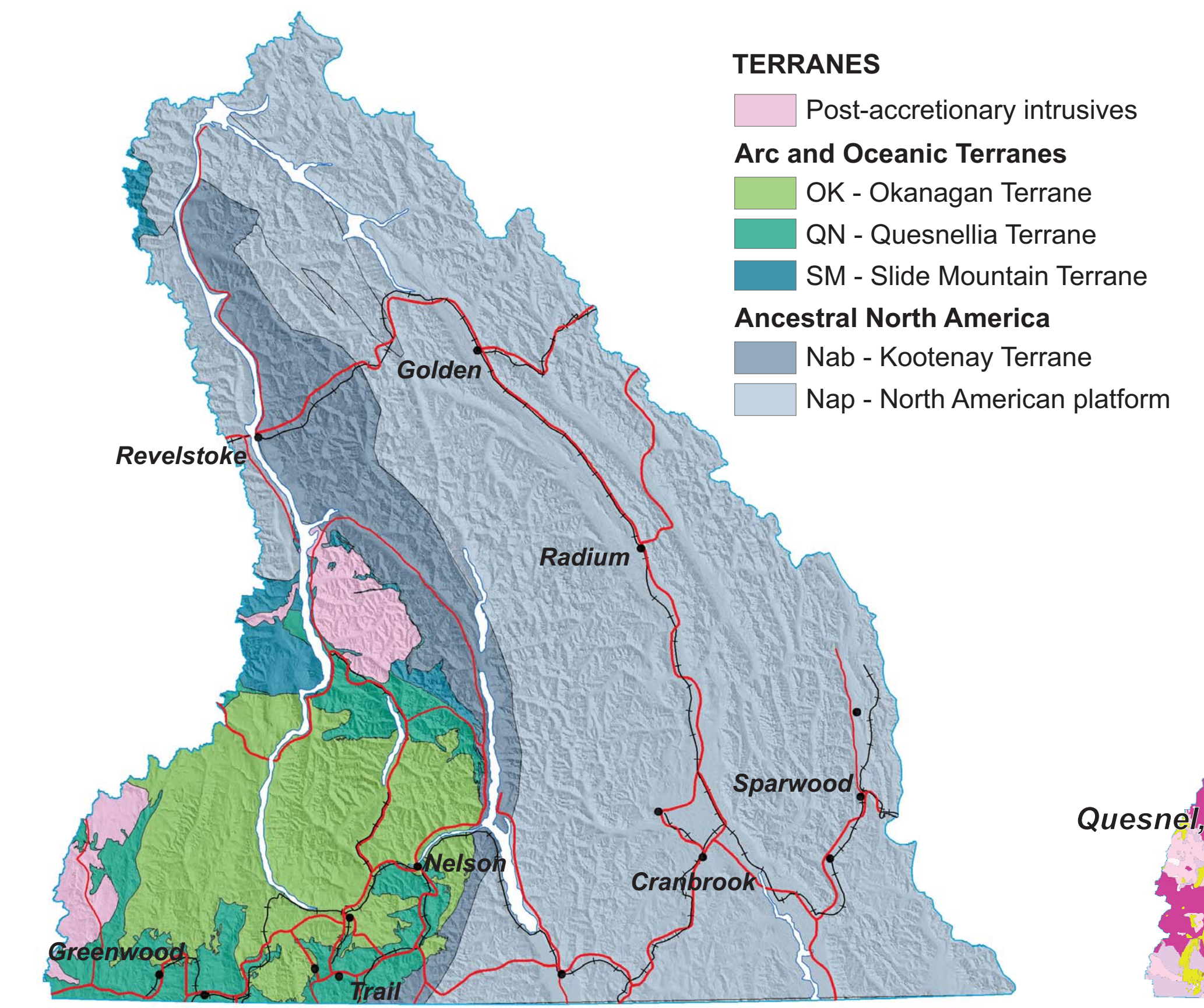


Fig 4. Terrane map (Modified from Nelson et al., 2013)

Fig 1. Exploration expenditures

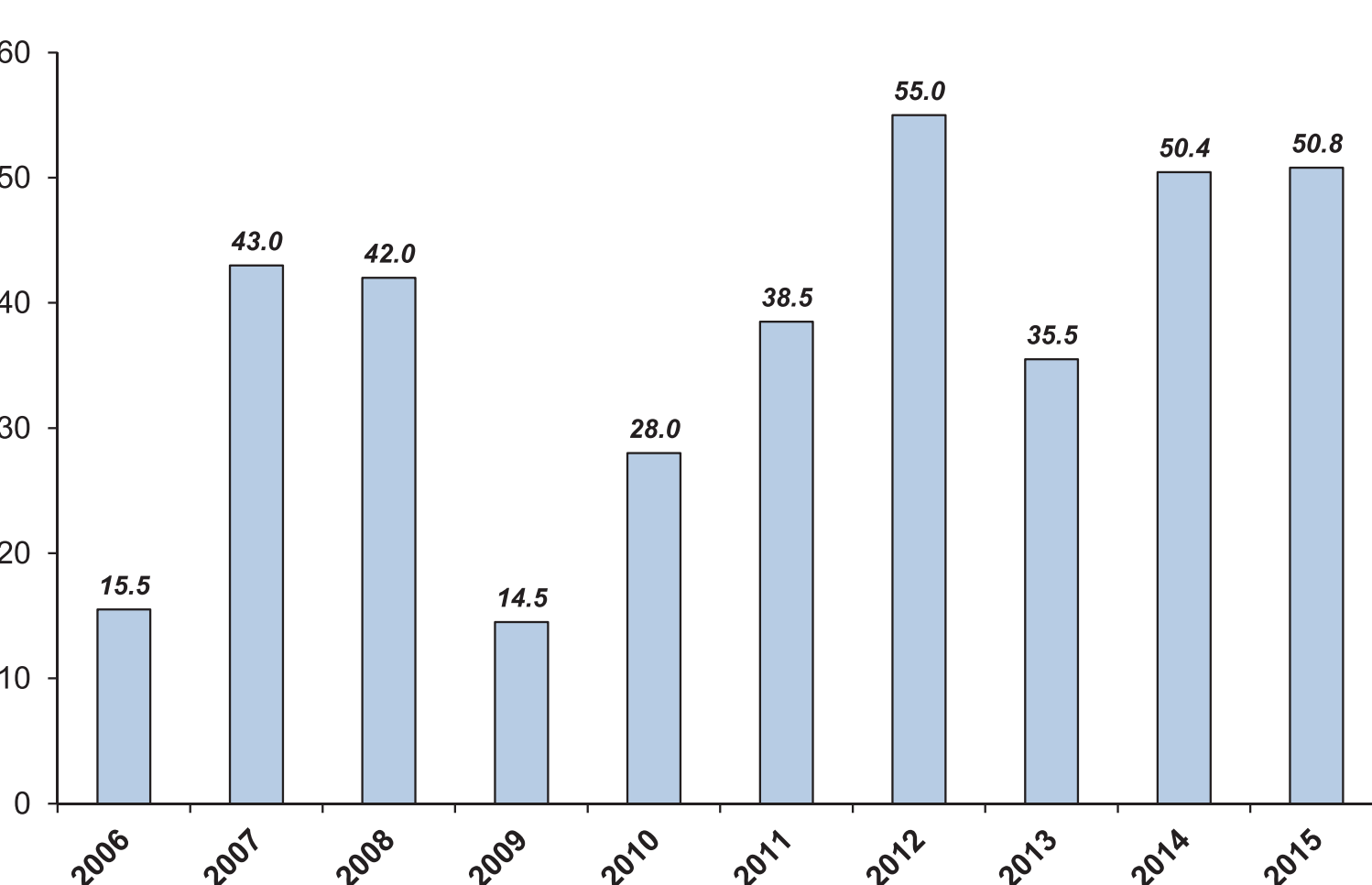


Fig 2. Drilling meters

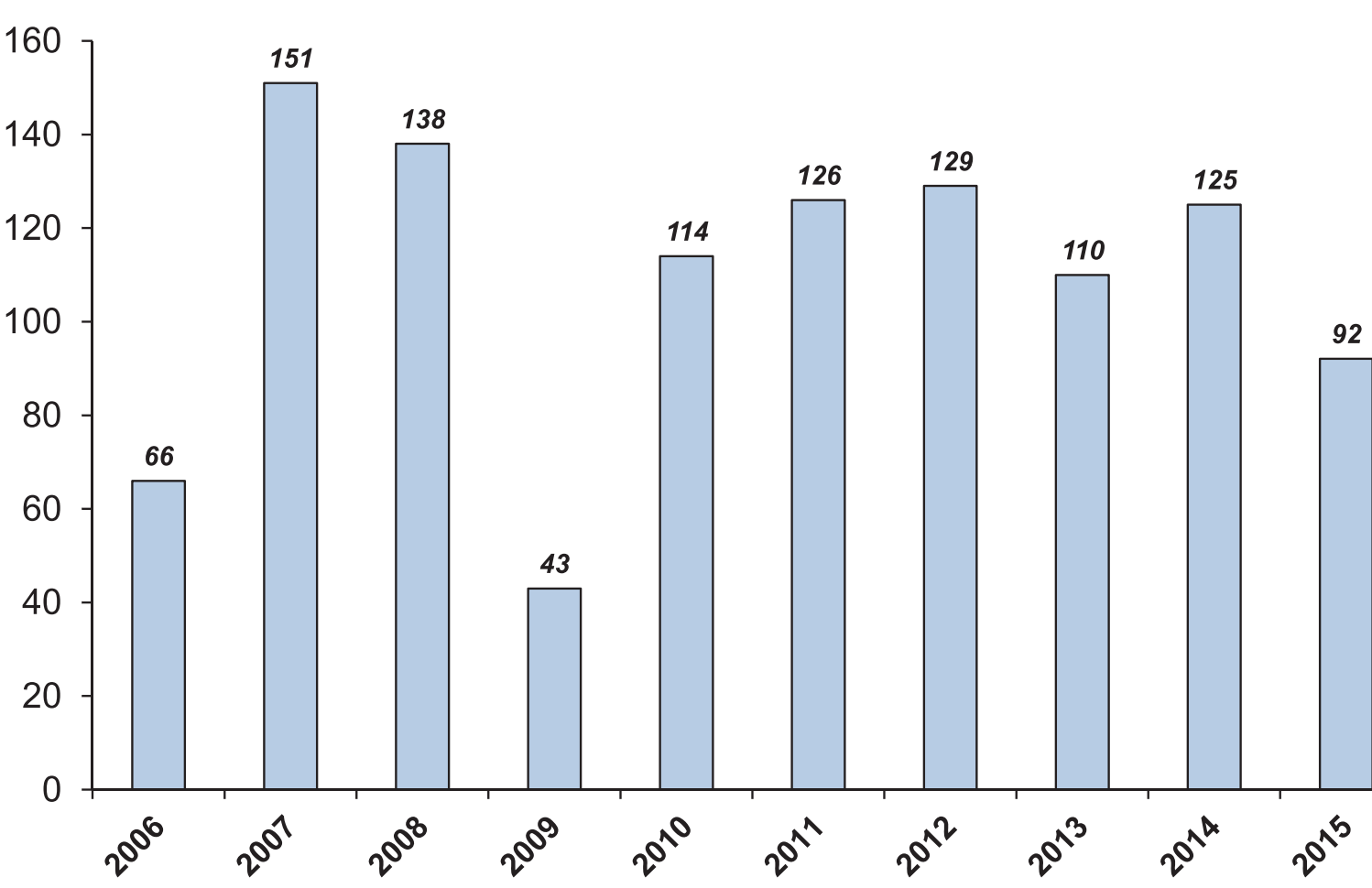


Fig 3. Project stages

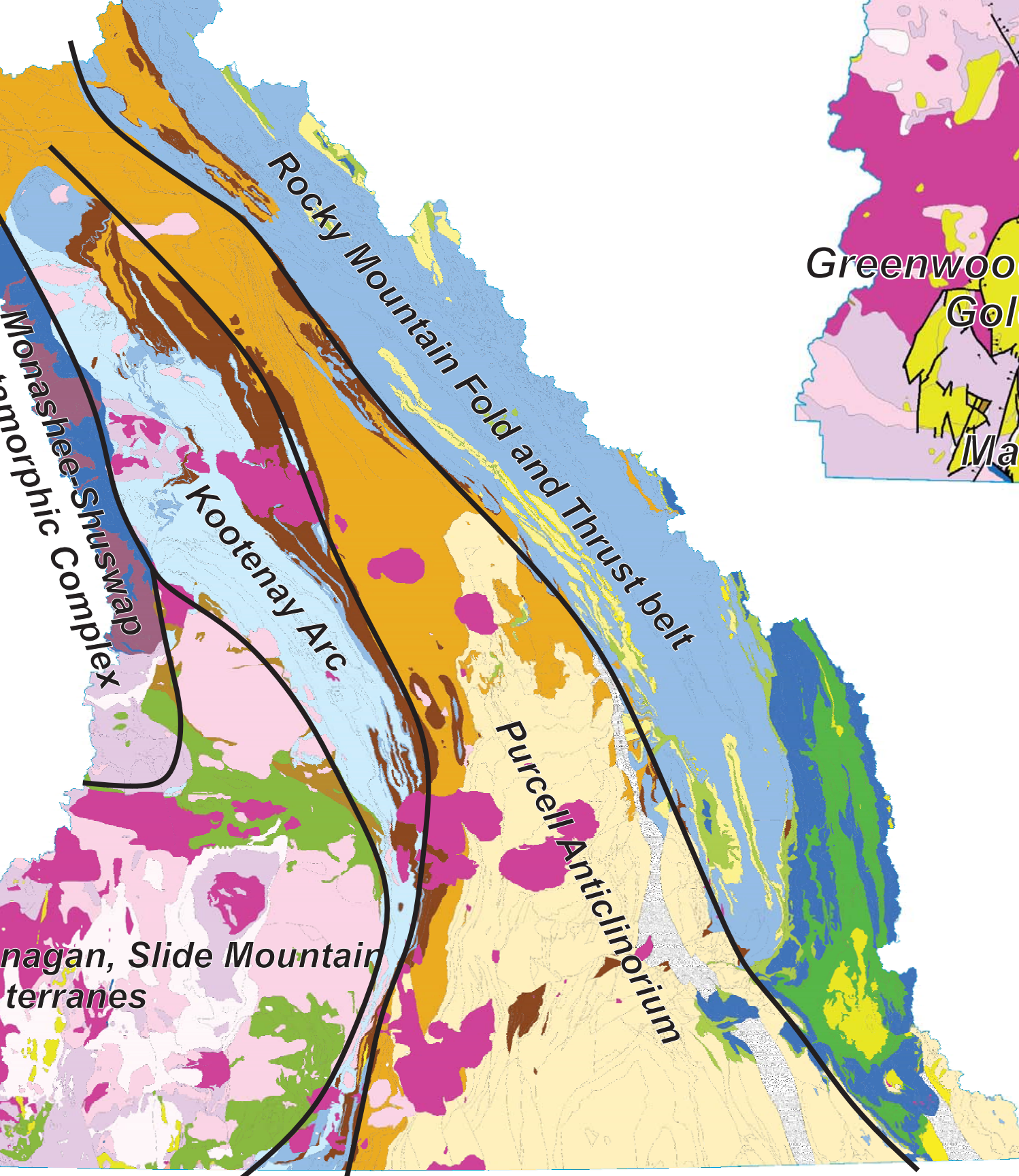
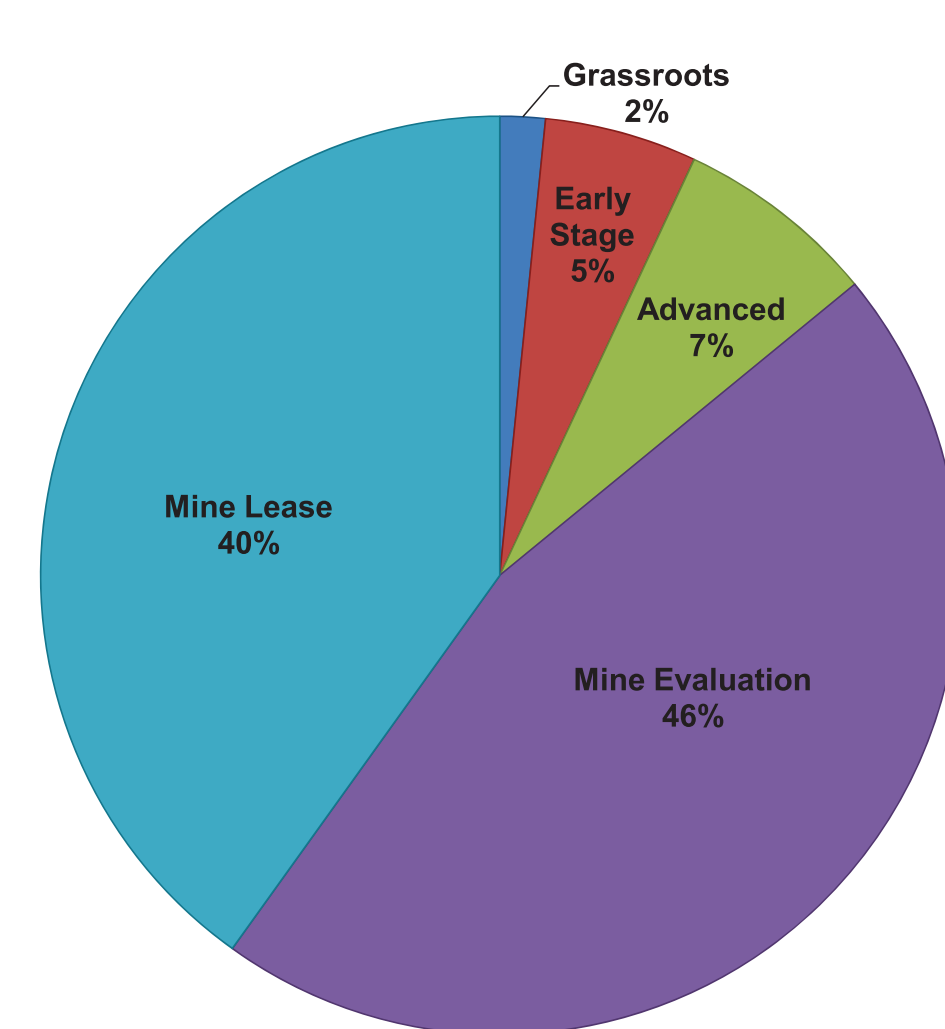


Fig 5b. Tectono-stratigraphic regions

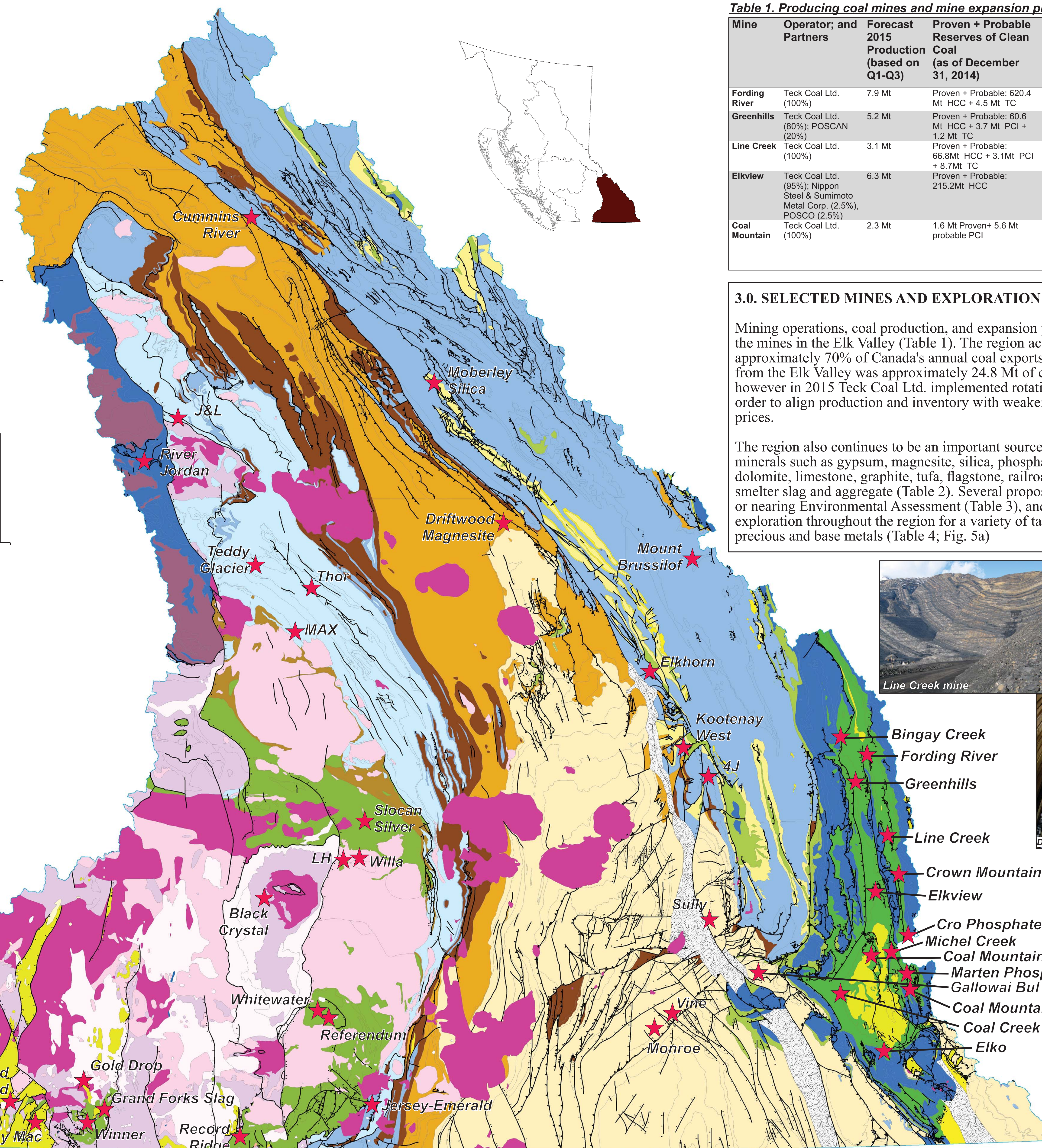


Fig 5a. Bedrock map of the Kootenay-Boundary region, and selected exploration and mining projects (2015)

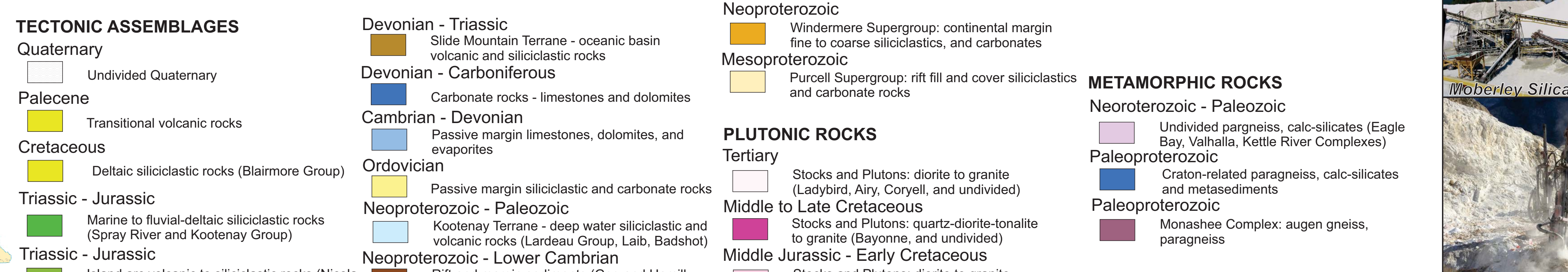


Table 1. Producing coal mines and mine expansion plans (2015)

Mine	Operator; and Partners	Forecast 2015 Production (based on Q1-Q3)	Proven + Probable Reserves of Clean Coal (as of December 31, 2014)	Major Mine Expansion Projects
Fording River	Teck Coal Ltd. (100%)	7.9 Mt	Proven + Probable: 620.4 Mt. HCC + 4.5 Mt. TC	EA approval of Swift expansion (2015); exploration drilling in active pits
Greenhills	Teck Coal Ltd. (80%); POSCAN (20%)	5.2 Mt	Proven + Probable: 60.6 Mt. HCC + 3.7 Mt. PCI + 1.2 Mt. TC	Cougar Pit Expansion (CPX) is preparing for pre-application of EA; environmental baseline
Line Creek	Teck Coal Ltd. (100%)	3.1 Mt	Proven + Probable: 66.8 Mt. HCC + 3.1 Mt. PCI + 8.7 Mt. TC	Burnt Ridge Extension (BRX) in pre-application of EA (2014); pre-stripping at Line Creek Phase II (2013 EA approval)
Elkview	Teck Coal Ltd. (85%); Nippon Steel & Sumitomo Metal Corp. (2.5%); POSCO (2.5%)	6.3 Mt	Proven + Probable: 215.2 Mt. HCC	Baldy Ridge Extension (BRE) in pre-application of EA (2014); exploration drilling in active pits; development progressing in new approved mining areas
Coal Mountain	Teck Coal Ltd. (100%)	2.3 Mt	1.6 Mt Proven + 5.6 Mt probable PCI	Coal Mountain Phase II (CMO2; Marten Wheeler) entered pre-application of EA (2014) but withdrawn late 2015; Mineable resource at CMO2 is nearing depletion and expected mine shut down in late 2017

Table 2. Selected industrial mineral mines (2015)

Mine	Operator	Commodity; deposit type	Forecast 2015 Production; Reserves	Comments
Mount Brussiloff	Baymag Inc.	Magnesite; hydrothermal sparry magnesite	220,000 t annually; 50 Mt proven	MgO, and MgOH; sediment-hosted sparry magnesite
Moberley Silica	Heemskirk Canada Ltd.	Silica; industrial use silica, frac sand	20 to 140 mesh frac sand (dry); Proven 8.9 Mt of 64% frac sand + Probable 4.6 Mt of 64% frac sand; OR Silica for industrial (dry); 12.8 Mt Proven + 0.7 Mt. Probable	\$26M capital cost for plant construction and upgrades to existing facility (for frac sand operation); 300,000 tonne per year capacity; Construction started on frac sand processing plant in 2014, commissioning expected 2017
Horse Creek Silica	HiTest Sand Inc.	Silica; industrial use, aggregate	Estimated: 3 Mt at 99.5% Silica (1987)	Variety of aggregate and industrial use products
Elkhorn	CertainTeed Gypsum Canada Inc.	Gypsum; evaporitic bedded gypsum	400,000 t annually; 20 Mt	5 years mine-life remaining; the company will replace production by developing the Kootenay West mine (in EA)
4J	Georgia-Pacific Canada Limited	Gypsum; evaporitic bedded gypsum	N/A; Processing stockpiled ore	Processing stockpiles; updating mine expansion plans
Black Crystal	Eagle Graphite Corp.	Graphite; metamorphic hosted flake graphite	Care and Maintenance Repolith: Measured + Indicated: 0.648 Mt at 1.83% fixed carbon; Calc-silicate: Indicated: 4.765 Mt at 1.21% fixed carbon	Exploration drilling to expand the resource; update geological model and pit design; process optimization at plant; produced sample of 99.995% pure spherulized graphite from flake graphite; product suitable for Li-Ion battery specifications
Winner; Friday Quarry	Roxul Inc.	Gabbrobasalt; crushed rock for mineral wool	Quarrying to supply feed stock for mineral wool plant	Crushing, screening, stockpiling; environmental
Grand Forks Slag	Granby River Mining Company Inc.	Slag/Silica; tailings from Grand Forks smelter dumps	Quarrying for abrasives and roofing granules	Crushing, screening; environmental

3.0. SELECTED MINES AND EXPLORATION PROJECTS

Mining operations, coal production, and expansion plans continue at the mines in the Elk Valley (Table 1). The region accounts for approximately 70% of Canada's annual coal exports. 2015 production from the Elk Valley was approximately 24.8 Mt of clean coal; however in 2015 Teck Coal Ltd. implemented rotating shutdowns in order to align production and inventory with weaker commodity prices.

The region also continues to be an important source of industrial minerals such as gypsum, magnesite, silica, phosphate, mineral wool, dolomite, limestone, graphite, tufa, flagstone, railroad ballast, rip rap, smelter slag and aggregate (Table 2). Several proposed mines are in, or nearing Environmental Assessment (Table 3), and there is ongoing exploration throughout the region for a variety of targets, including precious and base metals (Table 4; Fig. 5a)

Table 3. Selected proposed mines, and projects advancing towards Environmental Assessment application (2015)

Mine	Operator; and Partners	Commodity; deposit type	Resource (Measured and Indicated)	Work Program	Comments
Crown Mountain	NWP Coal Canada Ltd. (Jameson Resources Ltd.)	Coal (HCC and PCI); open-pit	HCC: 42.60 Mt Proven + 4.91 Mt Probable; PCI: 7.13 Mt Proven + 1.19 Mt Probable; HCC + PCI: 69.9 Mt. Measured + 6.0 Mt. Indicated (2014)	Feasibility studies; environmental and baseline work; mine design; permitting	Pre-application of EA (2014); 16-year mine life; 1.7 Mt/yr; review of pre-feasibility study identified upside in lower capital costs for contract mining and additional resources in Southern Extension
Michel Creek (Loop Ridge)	CanAus Coal Ltd.	Coal (HCC and PCI); open-pit and underground	HCC: 44.6 Mt Measured + 42.5 Mt Indicated; open-pit and underground (2015)	Drilling; trenching; environmental and baseline work; mine design; coal quality; permitting	Pre-application of EA (2015); Coal quality testing; updated geological model; drilling has identified 20 coal seams with cumulative thickness of 70m (14% of a 504 m section in the Mist Mountain Fm); PEA model indicates potential production of 3.4Mt/yr (=2.1Mt/yr saleable)
Coal Mountain Phase II (Marten Wheeler)	Teck Coal Ltd.	Coal (PCI and TC); open-pit and underground	PCI + Thermal: 114.3 Mt Measured + 97.3 Mt Indicated (2015)	Environmental and baseline work; mine design; permitting	Pre-application of EA (2014); Potential of 76.5 Mt; 34-year mine life; 2.25Mt/yr; EA withdrawn in late 2015
Coal Creek	CrowsNest Pass Coal Mining Ltd.	Coal (HCC and PCI); underground	HCC + PCI: 616 Mt in the upper 3 near-surface seams (2014)	Feasibility studies; geological modeling; resource evaluation; baseline studies	Proposed underground mine; review of the historical mine workings of Coal Creek colliery (1897 to 1958)
Bingay Creek	Centremount Coal Ltd.	Coal (HCC); open pit and underground	42.43 Mt. Measured + 52.9 Mt Indicated (2012)	Environmental baseline studies; Engineering and geotechnical evaluation for mine design; permitting	Pre-application of EA (2012); on hold; 39Mt; 20-year mine life; 2 Mt/yr
Kootenay West	CertainTeed Gypsum Canada Inc.	Gypsum; evaporitic bedded gypsum; quarry	North and South Quarries: Total 18.7 Mt (at average quality of 83-85%)	Environmental baseline work; mine design	Pre-application of EA (2014); 400,000 t/yr; 42-year mine life; blended product to market specifications
Driftwood Magnesite	MGX Minerals Inc.	Magnesite; hydrothermal sparry magnesite; quarry	-	Drilling; bulk sampling; environmental baseline work; metallurgical test work; lease application; mine design; preliminary plant design	Preliminary test work indicates recovery rates of 93.4% reverse flotation and removal of up to 70% silica and 30% calcium oxides
Galloway Bul River	Purcell Basin Minerals Inc.	Cu-Ag-Au±Pb±Zn±Cu; Ag veins; underground	90,720 t at 1.3% Cu, 0.31g/t Au, 21.77g/t Ag	Drift project proposal submitted to EA; Permitting; environmental baseline; mine plan and mine design; ARD/ML	Proposed restart of Bul River Mine; on care and maintenance
Slocan Silver (Silvana)	Klondike Silver Corp.	Ag-Pb-Zn±Au; polymetallic veins; underground	-	Engineering reports; underground mining structure and tailings storage facilities; environmental monitoring	Mill on care and maintenance; work focused on upgrades identified in 2014 engineering and environmental reports

Table 4. Selected exploration projects (2015)

Property	Operator	Commodity; deposit type	Work program	Comments
Gold Drop	Ximen Mining Corp.	Au-Ag-Pb-Zn±Cu; vein, alkalic intrusion-associated Au	Trenching; mapping; sampling	Chip sample results up to 0.60 m grading 43.6 g/t Au, 141 g/t Ag; and 0.55 m grading 56.2 g/t Au, 259 g/t Ag; grab sample grading 159 g/t Au, 744 g/t Ag, 70 ppm Cu, and 1.7% Pb
Greenwood Gold	Grizzly Discoveries Inc.	Au-Cu-Pb-Zn±Ag±Mo; Cu-Au-Ag skarn, polymetallic vein, Au vein, porphyry	Mapping; sampling; geological evaluation	Option agreement with KG Exploration (Canada) Inc; extensive mapping with numerous targets
May Mac	Golden Dawn Minerals Inc.	Au-Ag-Pb-Zn±Cu; Cu-Au-Ag skarns, polymetallic veins, Au veins	Drilling (2,000m); mapping; rock and channel sampling;	Channel sampling: 0.87m grading 12.97 g/t Au, 34 g/t Ag; 0.2 m grading 36.37 g/t Au, 43 g/t Ag; 0.4 m grading 17.07 g/t Au, 11 g/t Ag; 0.4 m grading 4.46 g/t Au, 529 g/t Ag; Drilling intersected gold-bearing vein and stockwork system with lead and zinc sulphides, assays pending
LH	Magnum Goldcorp Inc.	Cu-Ag-Au; subvolcanic, skarn, Au-veins	Drilling (11 DDH); SP and IP/magnetometer survey	Phase I drilling: 16.9 m grading 13.58 g/t Au, including 10.9 m grading 20.61 g/t Au; 11m grading 20.66 g/t Au; results from Phase II drilling are pending
Vine	PJX Resources Inc.	Pb-Zn-Ag±Au; polymetallic vein, SEDEX	Drilling (20 DDH; 5000 m); gravity survey; geophysical and geological modeling	Infilled gravity survey grid; detailed geophysical and geological model
Monroe	Sonoro Metals Corp.	Pb-Zn-Ag±Au, Cu, SEDEX	Drilling (1114 m); petrographics; mapping	Drilling on UTEM anomaly; encountered tourmalinized breccia zones
Sully	Santa Fe Metals Corp.	Pb-Zn-Ag±Au; Gravity anomaly, sediment-hosted	Mapping; magnetic surveys; geophysical modeling	Mass models suggest two gravity anomalies may be stratiform sulphide mineralization; complex faulting on property
Cummins River	MMG Limited	Pb-Zn-Ag±Cu; sediment-hosted	Stratiform sulphides; soil survey followed up on conductive and magnetic anomalies from VTEM; Zn-Pb-Mn anomaly in soil survey	Heliborne VTEM (623 line-km); soil and rock geochemistry; mapping
River Jordan	Silver Phoenix Resources Inc.	Zn-Pb-Ag; Broken Hill, SEDEX, Irish-type carbonate-hosted	Drilling (494 m); mapping; sampling	1.85 m grading 1.27% Pb, 6.04% Zn, 12.0 ppm Ag; 1.48 m grading 4.01% Pb, 11.6% Zn, 33.3 ppm Ag
J & L	International Inc.	Ag-Pb-Zn±Au; SEDEX, Irish-type carbonate-hosted, polymetallic veins	Engineering and environmental baseline studies; metallurgical test work; preliminary economic assessment	Care and maintenance underground mine; process optimization; upgrades to facilities
Thor	Taranis Resources Inc.	Ag-Pb-Zn±Au; polymetallic veins and breccia, stratiform manto	Panel sampling; surveying and sampling stockpiles, environmental baseline studies	Panel sampling at SIF zone: 17.6 m grading 30.59 g/t Au; Panel sampling at Gold Pit: 2.04 m grading 52.4 g/t Au, 1.528 g/t Ag, 1.39% Pb, 0.08% Zn and 1.64 m grading 14.3 g/t Au, 254.9 g/t Ag, 0.99% Pb, 0.52% Zn
Teddy Glacier Spider Mine	Jazz Resources Inc.	Ag-Pb-Zn±Au; polymetallic veins	Metallurgical test work (flotation); ML/ARD; bulk sample permitting; environmental baseline studies	10.2 m grading 24.98 g/t Au with elevated bismuth; 2.75 m grading 0.45% WO ₃ ; 4.5 m grading 0.5% WO ₃ ; 3.35 m grading 0.52% WO ₃ ; 2.65 m grading 0.59% WO ₃ ; 4 m grading 0.35% WO ₃ ; 6.45 m grading 0.33% WO ₃ ; 0.65 g/t Au; 5.15m grading 0.47% WO ₃
Jersey-Emerald	Margaux Resources Inc.	Pb-Zn-Ag±W, Au, Mo, Bi; stratiform replacement, skarn	Dewatering underground workings at Emerald; mapping; sampling; geological modeling	Acquisition of the MAX Mine and mill facilities; plan to process ore from the Willis, estimated mine life of approximately 4.1 years at 500 t/day
Willia	Discovery Ventures Inc.	Ag-Pb-Zn ±Au-Cu-Mo; subvolcanic, polymetallic veins, porphyry Mo, Au-skarn	Preliminary Economic Assessment; geological modeling; mine design; MAX facility upgrades; environmental baseline studies	Plan to process ore from the Willis, estimated mine life of approximately 4.1 years at 500 t/day
Referendum/Whitewater	Braveheart Resources Inc.	Au-Ag-Pb-Zn±Mo; polymetallic veins, Au-veins	Trenching; bulk sampling (1,000 t at Referendum; 100 kg at Whitewater); milling and flotation	Projected gold recoveries of 90% from preliminary flotation testing; further results pending
Record Ridge/Midnight	West High Yield (WHY) Resources Ltd.	Au-Ag-Pb-Zn, Mg; polymetallic veins, ultramafic-hosted talc, magnesite	VLF-SP surveys; mapping; sampling; environmental baseline	Identified drill targets and plan on bulk sampling at the Midnight and Record Ridge properties
Marten Phosphate	Fertoz Ltd.	Phosphate; upwelling	Mapping; sampling; XRF; environmental baseline; permitted bulk sample	XRF of stockpiles: 24 - 27% P ₂ O ₅ product shipped for direct spreading on agricultural area
Cro Phosphate	HighBrix Manufacturing Inc.	Phosphate; upwelling	Drilling (7 DDH); trenching; bulk sampling	Product shipped for direct spreading on agricultural area
Eiko	Pacific American Coal Limited	Coal (HCC, PCI)	Mapping; sampling; geological modeling; field reconnaissance to locate historic adits and drilling; JORC compliant resource	Mapping of 5 coal seams over the property; 3 seams have hard coking coal quality, 2 seams have PCI coal

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