The big faults in northern Idaho and what we know about them

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INTRODUCTION

Faults at the surface in northern Idaho are mostly within Belt Supergroup strata and igneous rocks that intrude them. Many probably have long and complex histories that involve basement and accommodation of Belt basin subsidence (Harrison and others, 1974; Winston, 1986b). Some moved during Jurassic through Cretaceous and perhaps Paleocene contraction, and were reactivated or newly formed during Eocene extension. The following summary lists the more important faults roughly from north to south.

1. Moyie fault, a compressional structure within the Purcell anticlinorium. It continues to the northeast in Canada as the Moyie-Dibble Creek dextral reverse fault (Benvenuto and Price, 1979). In northern Idaho it places older, east-facing rocks on the west against younger, west-facing rocks on the east. It is steep to east dipping; a Cambrian dolomite fault sliver suggests late backsliding (Miller and Burmester, 2003). It ends to the south at the Hope fault (Fillipone and Yin, 1994).

2. Spokane Dome mylonite zone, a thick tops-east mylonite zone. It might be equivalent to the basal décollement of the Rocky Mountain fold and thrust belt (Rhodes and Hyndman, 1984; Doughty and others, 1998; Doughty and Price, 1999). It may also have accommodated tectonic unroofing during Eocene extension (Rehrig and others, 1987).

3. Eastern Newport fault, a thin tops-west mylonite zone and chlorite breccia that truncates the Spokane Dome mylonite zone (Miller, 1971; Rhodes and Hyndman, 1984; Harms and Price, 1992; Doughty and Price, 1999).

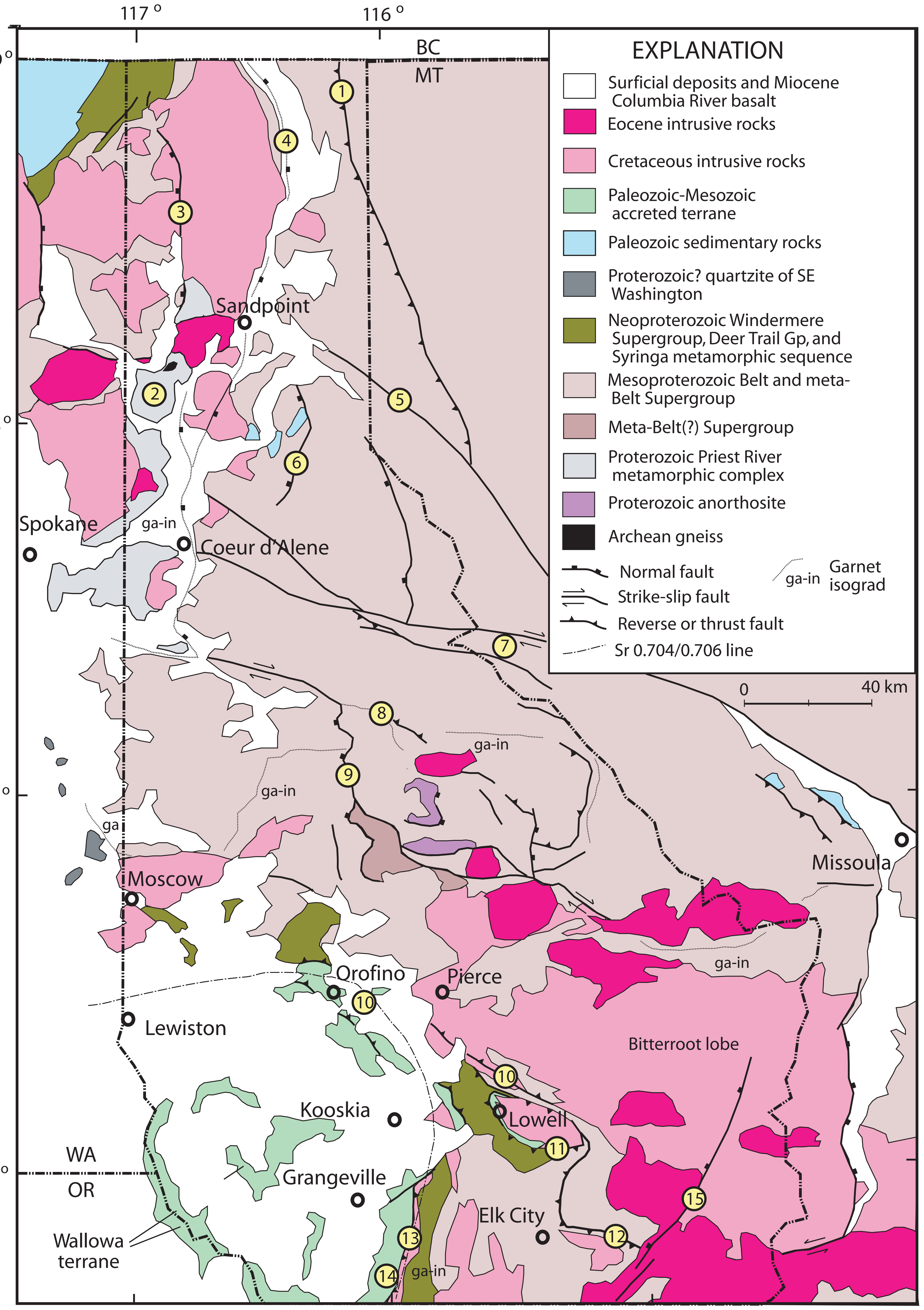
4. Purcell trench, a steep extensional structure that appears to drop younger (or less metamorphosed) rocks on the east side against amphibolite-grade metamorphic rocks of the Priest River complex and the Spokane Dome mylonite zone (Rhodes and Hyndman, 1988; Doughty and Price, 2000). The southern segment runs from near (?) the St Joe fault to near the Hope fault north of Sandpoint.

5. Hope fault, which places older rocks to the north against younger rocks to the south. Activity during deposition of the Prichard Formation may account for difference in thickness of mafic sills across it (Harrison and Jobin, 1963), but it appears to have posed no barrier to a sill near the bottom of the Ravalli Group, which is found at nearly the same stratigraphic level on both sides of the fault (Burmester and others, 2004a,b). To the southeast it is the southern limit of the Moyie fault and the Libby thrust belt (Kleinkopf, 1997), which, together with its long, straight trace, suggests transcurrent movement during regional contraction, e.g., Late Jurassic – Early Cretaceous NW-SE shortening and left-lateral tranpression (Price and Sears, 2001). However, structural evidence documents only dip slip (Fillipone and Yin, 1994).

6. Cascade and Packsaddle faults, presumably west-dipping normal faults with younger rocks on west side; related to Neoproterozoic rifting(?) or just Eocene movement(?) (Griggs, 1973; Lewis and others, 2002). These and faults with similar orientation but smaller displacement appear antithetic to and may have been active concurrent with the Purcell Trench fault.

7. Lewis and Clark Line, a WNW zone with a long history of movement that consists of (1) more northwesterly structures with down-dip lineations, which are mineralized and part of underemphasized compressional history of the line, and (2) the more westerly Osburn fault, which is a steep late (Eocene?) brittle fault with apparent right-lateral motion (Hobbs and others, 1965; Harrison and others, 1974; Bennett and Venkatakrishnan, 1982; Wavra and others, 1994; Winston, 1986a and b; Sears and others, 1989; White, 1998). Unlike the compressional fault systems, the late normal and right lateral faults are straight, have wide gouge zones, and are topographically well expressed (Lonn and McFaddan, 1999). Thinner Revett stratigraphic units north than south of the fault may reflect down-to-the-south motion during sedimentation (Mauk and White, 2004) or significant displacement juxtaposing different parts of the Belt basin. Yin and others (1998) found no kinematic indications of strike slip movement on the Osburn, Ninemile, Placer Creek, or Hope faults, and suggested that they are late Cretaceous thrusts reactivated by mid-Tertiary extension.

8. Hoyt Mountain thrusts, a poorly mapped southwest-directed thrust system associated with overturned SW-directed folds (Reid and others, 1981; Lewis and others, 1999).



9. St. Joe-White Rock-Benton Creek-Kelly Forks fault system, a right-lateral Eocene transfer system from Spokane dome southeast toward Bitterroot mylonite that may have had earlier left-lateral history (Seyfert, 1984; Doughty and Sheriff, 1992; Kell and Childs, 1999; Lewis and others, 2000; McMacken and Doughty, 2004; Burmester and others, 2004c). Southeast extent uncertain; motion may have transferred southwest to Glade Creek fault.

10. Orofino shear zone, Ahsahka thrust, and Glade Cr. fault system, a southwest-directed mylonite zone with some late brittle motion along Glade Creek portion (Pitz and Thiessen, 1985; Davidson, 1990; Lewis and others, 1998; Payne and McClelland, 2002; Schmidt and others, 2003; McClelland and Oldow, 2004). Southeast extent unknown, but probably connects to Green Mountain fault or is intruded by Bitterroot lobe of Idaho batholith; originally recognized by Yates (1968) and termed the trans-Idaho discontinuity.

11. Lowell thrust, a recently recognized structure (Lund and others, 2005) that exposes a slice of Wallowa terrane well east of the Salmon River suture zone.

12. Green Mountain fault, which places Elk City metamorphic sequence and 1380 Ma A-type granites over Meadow Creek metamorphic sequence. Fault may have once continued southeast and connected to the Brushy Gulch fault prior to intrusion of Eocene plutons (Lewis and others, 1990; Lewis and others, 1998).

13. Salmon River suture zone (also Western Idaho suture zone), the original boundary between accreted Wallowa terrane and continental North America; Mesozoic (Hyndman and Talbot, 1976; Jones and others, 1977; Davis and others, 1978; Lund and Snee, 1988; Selverstone and others, 1992; Manduca and others, 1993; Fleck and Criss, 2004; Gray and Oldow, 2005)

14. Western Idaho shear zone, a broader zone of deformation along Salmon River suture zone that post-dates accretion and has modified the suture zone (McClelland and others, 2000; Tickoff and others, 2001; Giorgis and others, 2005)

15. Bargamin Creek fault, a little studied down-on-west normal fault and major linear feature that influences the drainage of the Salmon River (Lewis and others, 1990).

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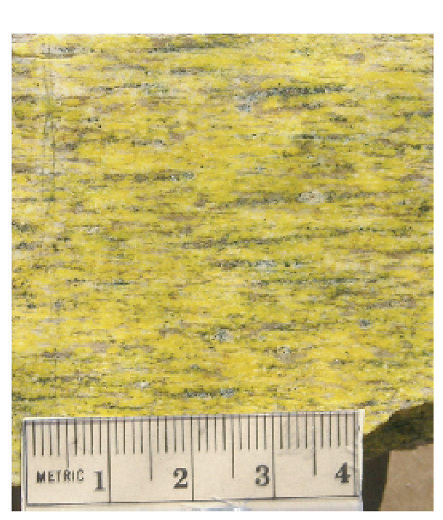
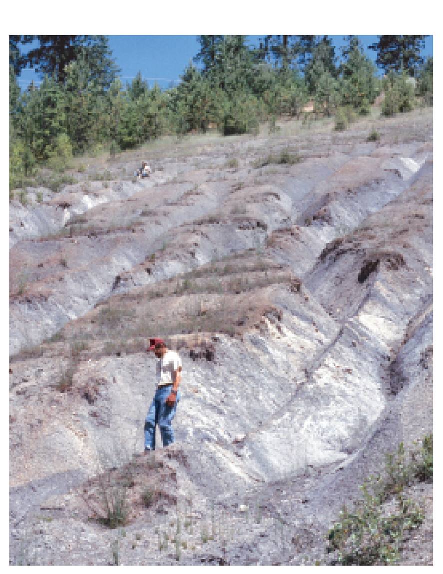


48.5 Ma L-tectonite from Benton Creek fault



Fault gouge in the Osburn fault zone