



# Fabric studies from the western Idaho shear zone, Sweet-Ola region, Idaho

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## Abstract

The western Idaho shear zone (WISZ) is a transpressional dextral shear zone that juxtaposes continental North America and the accreted Blue Mountain terranes. The WISZ is interpreted as a shear zone that overprints the original suture zone. The WISZ varies in orientation along strike, with the northern (McCall) segment striking NS and the southern (Owyhee) segment striking NNE. The change in orientation of the WISZ occurs just north of Sage Hen Reservoir.

This study focusses on exposed basement rocks near Sweet-Ola, Idaho, located south of Sage Hen Reservoir. These are the westernmost exposed basement rocks, as the voluminous Columbia River Basalts group cover most basement rocks to the west. Field data and microstructural analysis suggest that the deformed basement rocks are part of the WISZ. The composition of both a porphyritic orthogneiss and hornblende-bearing tonalite (Payette River tonalite), are similar to igneous units located elsewhere in the shear zone. The fabrics at Sweet-Ola have downdip lineations and steeply E-dipping, NNE-oriented foliations, consistent with expected fabrics in the WISZ. We identify the Sweet-Ola region as the southernmost exposure of the WISZ located north of the western Snake River plain.

## Location

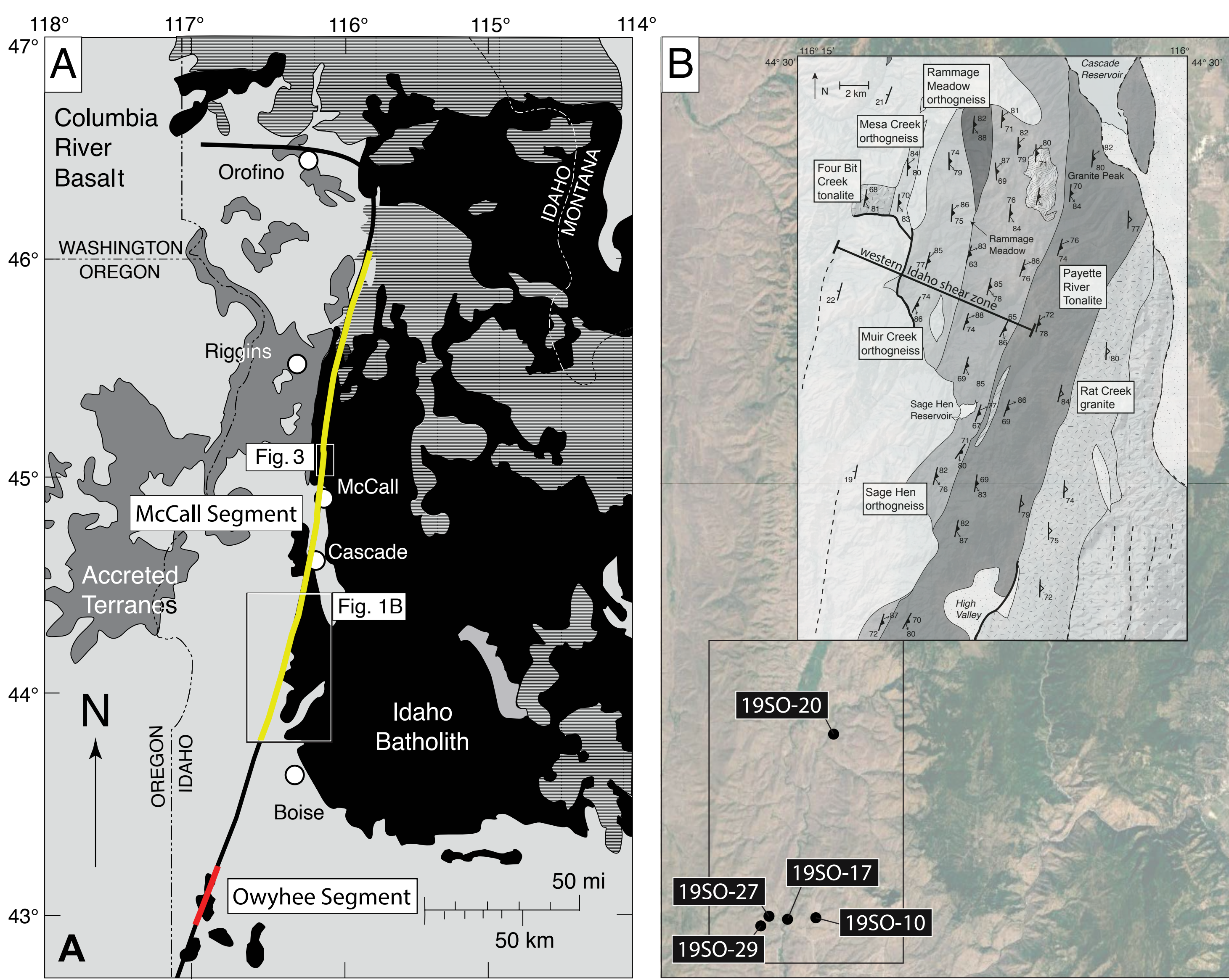


Figure 1: (A) Location of western Idaho shear zone in Idaho, eastern Oregon, and eastern Washington (Braudy et al., 2017). WISZ is divided into northern (McCall) segment and the southern (Owyhee) segment. (B) Field area with the location of selected samples showing relation to geologic bedrock map from Braudy et al., 2017.

## References

Benford, B., Crowley, J., Schmitz, M., Northrup, C.J., and Tikoff, B., 2010. Mesozoic magmatism and deformation in the northern Owyhee Mountains, Idaho: implications for along-zone variations for the western Idaho shear zone. *Lithosphere*, v. 2, p. 93-118, doi:10.1130/L176.1.  
Blake, D.E., Gray, K.D., Giorgis, S., and Tikoff, B., 2009. A tectonic transect through the Salmon River suture zone along the Salmon River Canyon in the Riggins region of west-central Idaho, in O'Connor, J.E., and Madin, I.P., eds. *Volcanoes to Vineyards: Geologic Field Trips through the Dynamic Landscape of the Pacific Northwest*. Geological Society of America Field Guide 15, p. 357-385.  
Braudy, N., Gaschnig, R.M., Wilford, D., Vervoort, J.D., Nelson, C.L., Davidson, C., Kahn, M.J., and Tikoff, B., 2016. Timing and deformation conditions of the western Idaho shear zone West Mountain, west-central Idaho. *Lithosphere*, doi:10.1130/L519.1.  
Tikoff, B., Kello, P., Manduca, C., Markley, M.J., and Gillaspay, J., 2001. Lithospheric and crustal reactivation of an ancient plate boundary: The assembly and disassembly of the Salmon River Suture zone, Idaho, USA. *Geological Society Special Publication*, v. 186, p. 213-231, doi:10.1144/GSL.SP.2001.186.01.13.

## What characterizes the western Idaho shear zone?

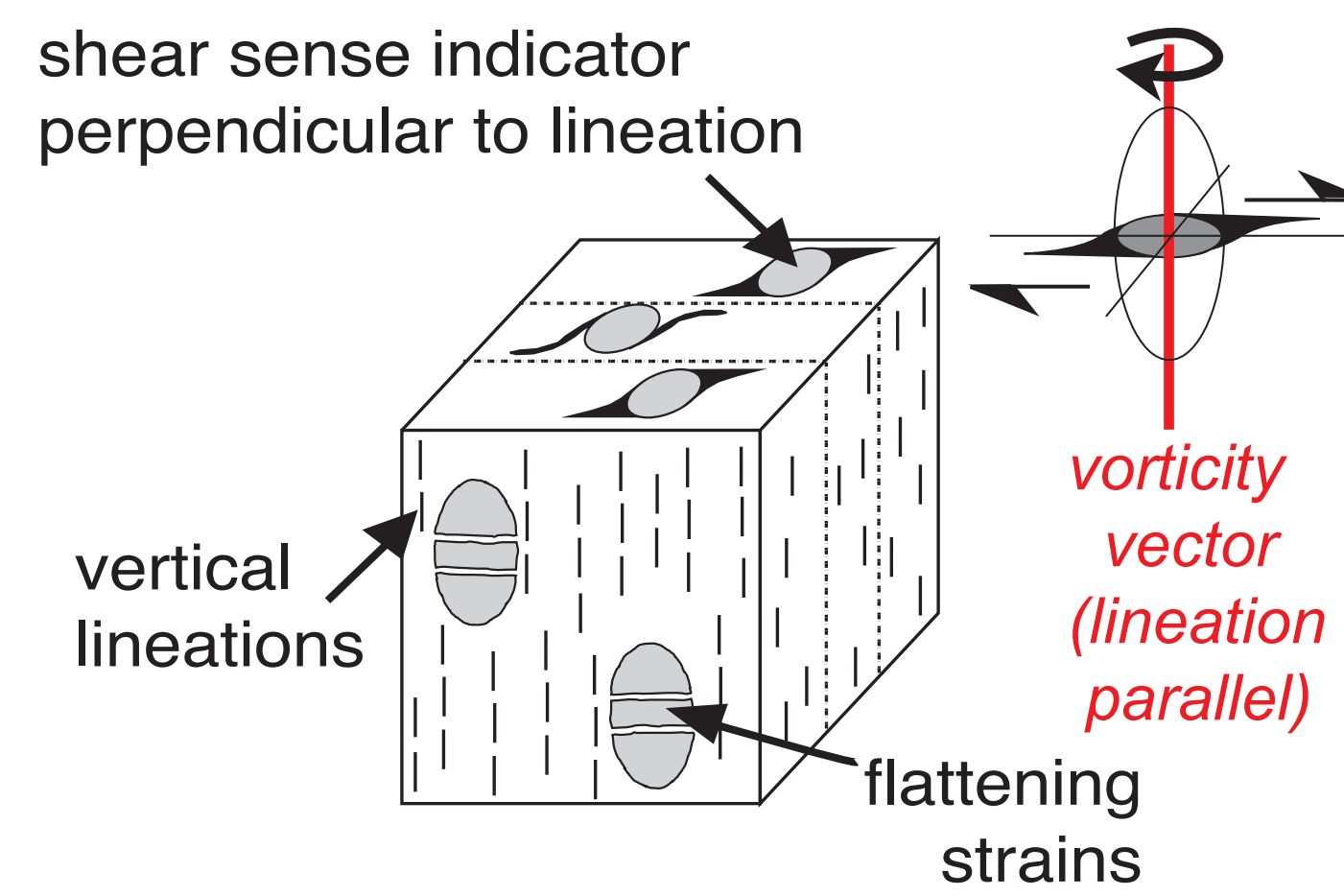


Figure 2: Schematic diagram demonstrating the orientation of fabrics and kinematic indicators in the WISZ

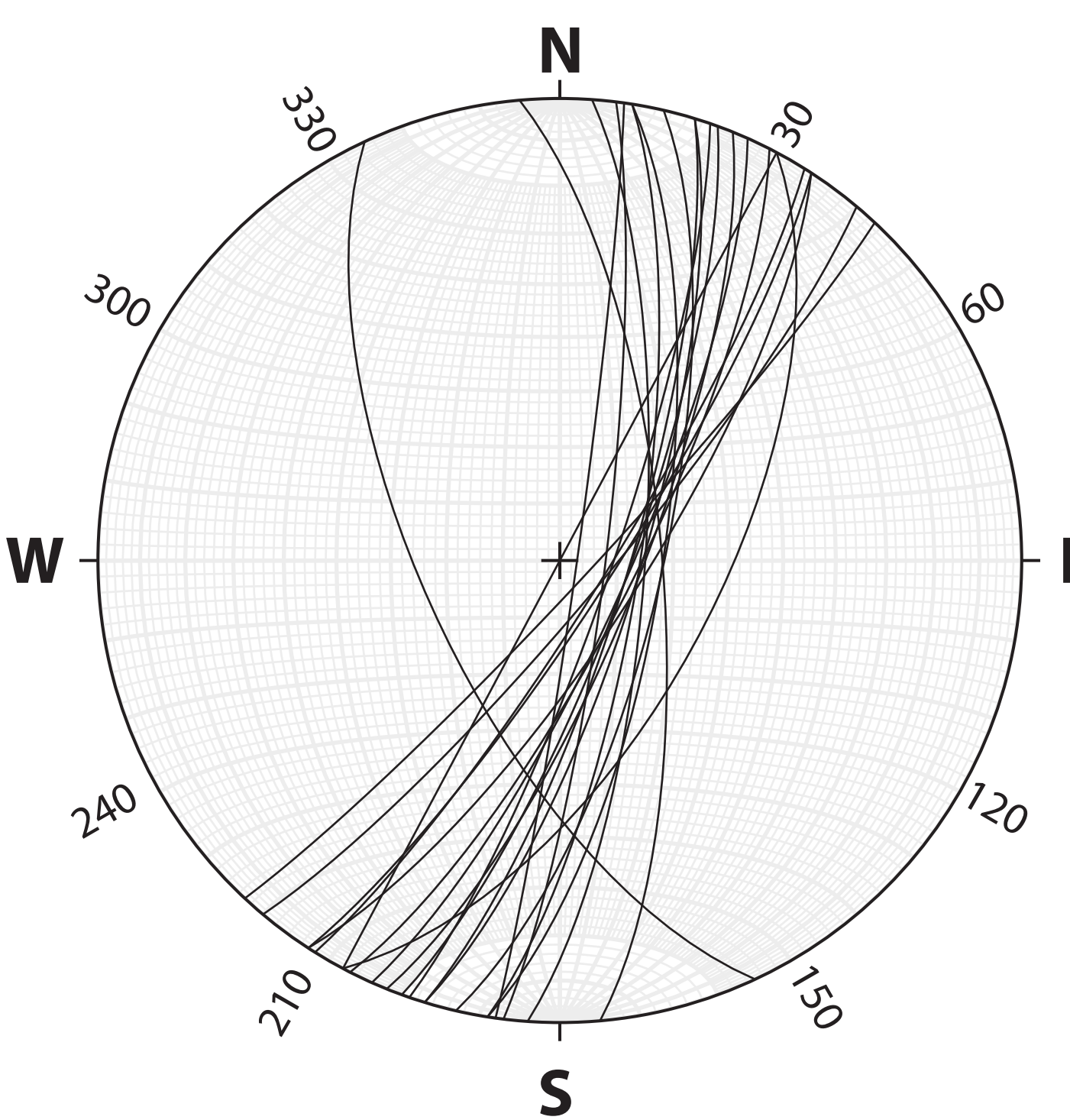


Figure 3: Equal-area, lower-hemisphere plots showing the orientation of foliation samples from Sweet-Ola

### Overall

- Transpressional Dextral Shear kinematics
- Forms sharp boundary between accreted terranes and cratonic North America
- Aligned with <sup>87</sup>Sr/<sup>86</sup>Sr isopleth
- 5-8 km wide zone comprised mostly of orthogneiss units
- Steeply dipping foliation and down-dip foliation
- Overprints Salmon River Suture Zone
- Formed ~105 to 90ma

### McCall Segment

- North-South orientated fabrics
- Along strike variation occurs near Sage Hen Reservoir
- Well developed fabrics

### Owyhee Segment

- North-Northeast orientated fabrics
- Weak fabrics

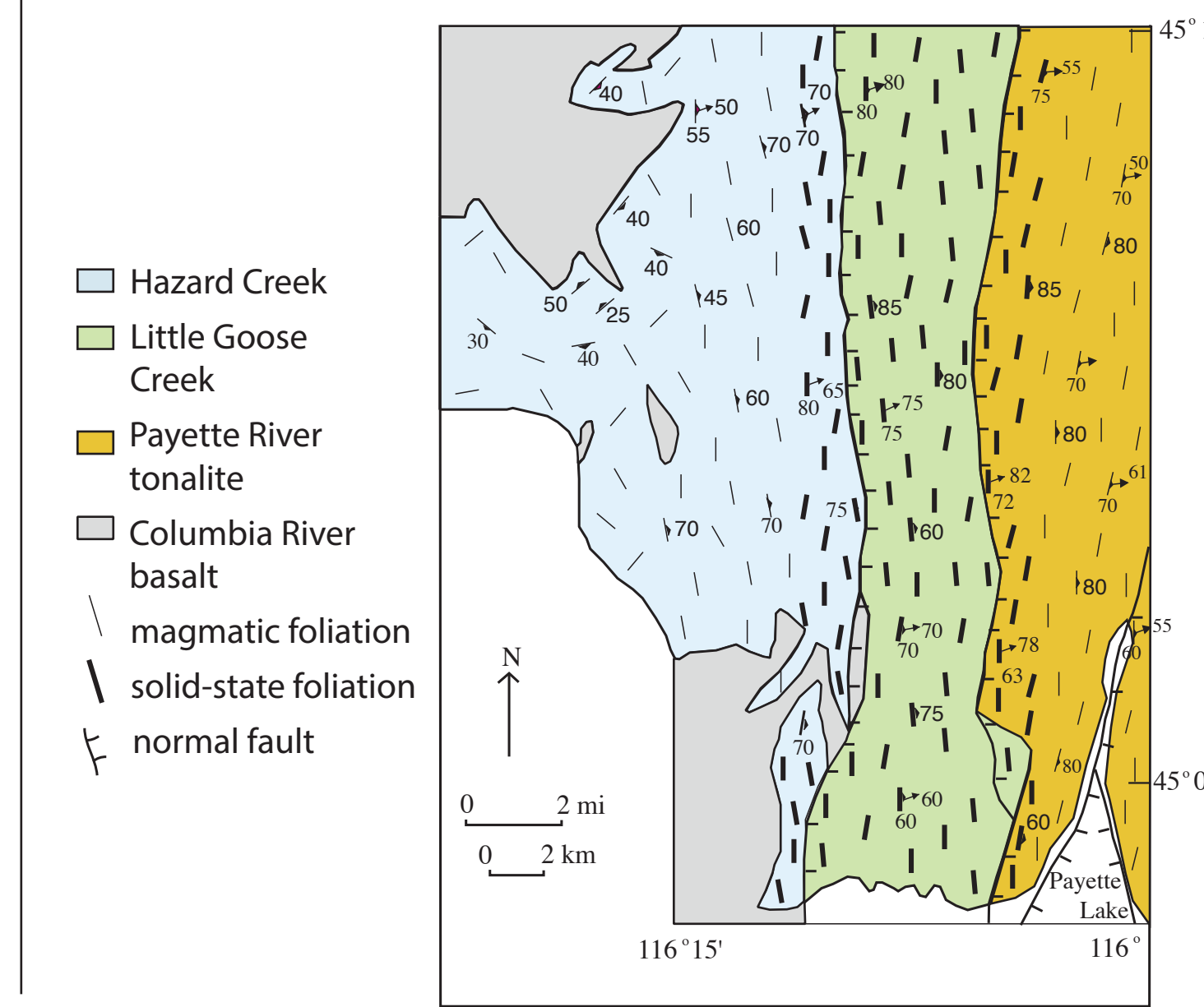


Figure 4: Geologic map of the McCall region of the WISZ (from Tikoff et al., 2001)

## Geological History (in an E-W Cross-Section)

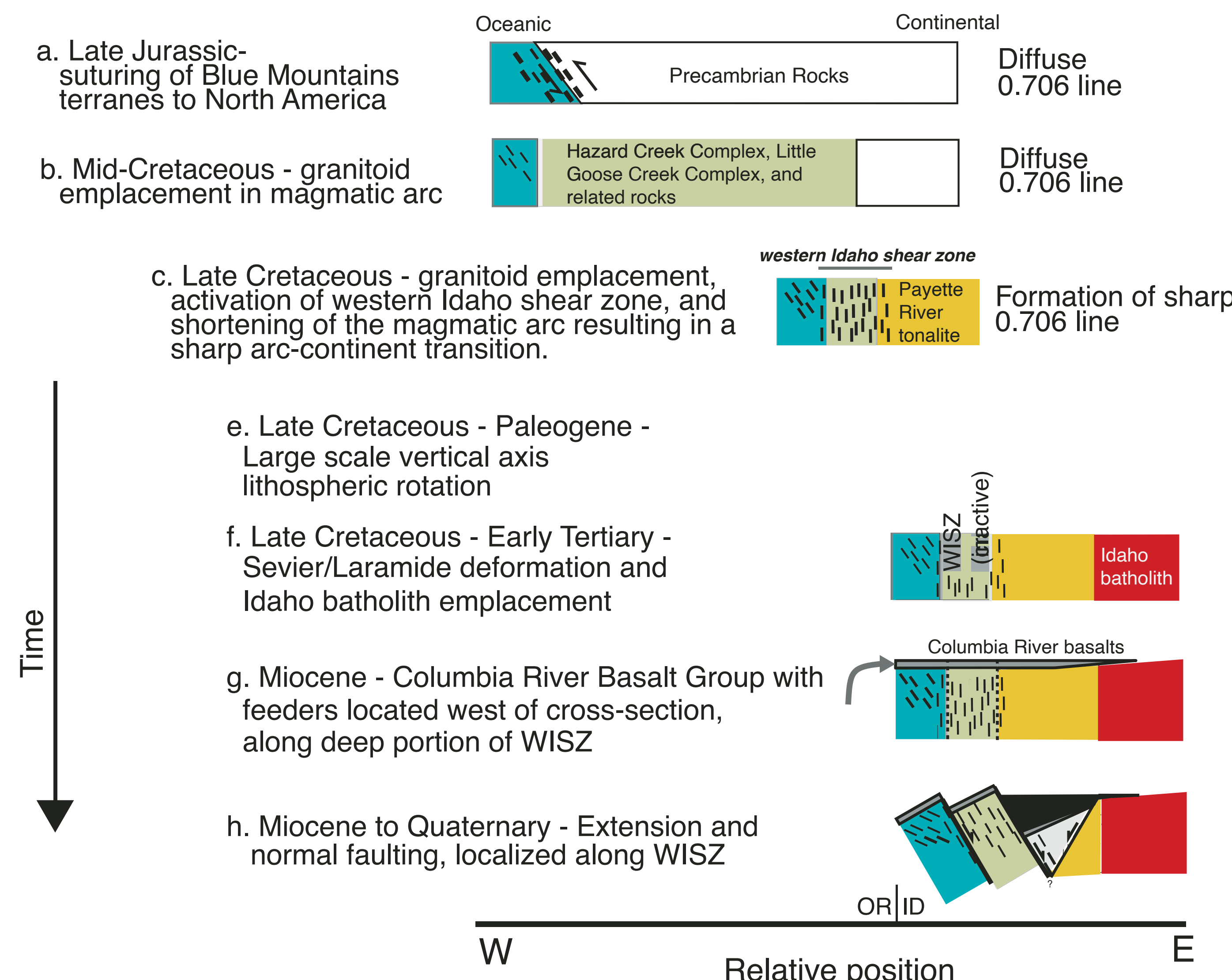
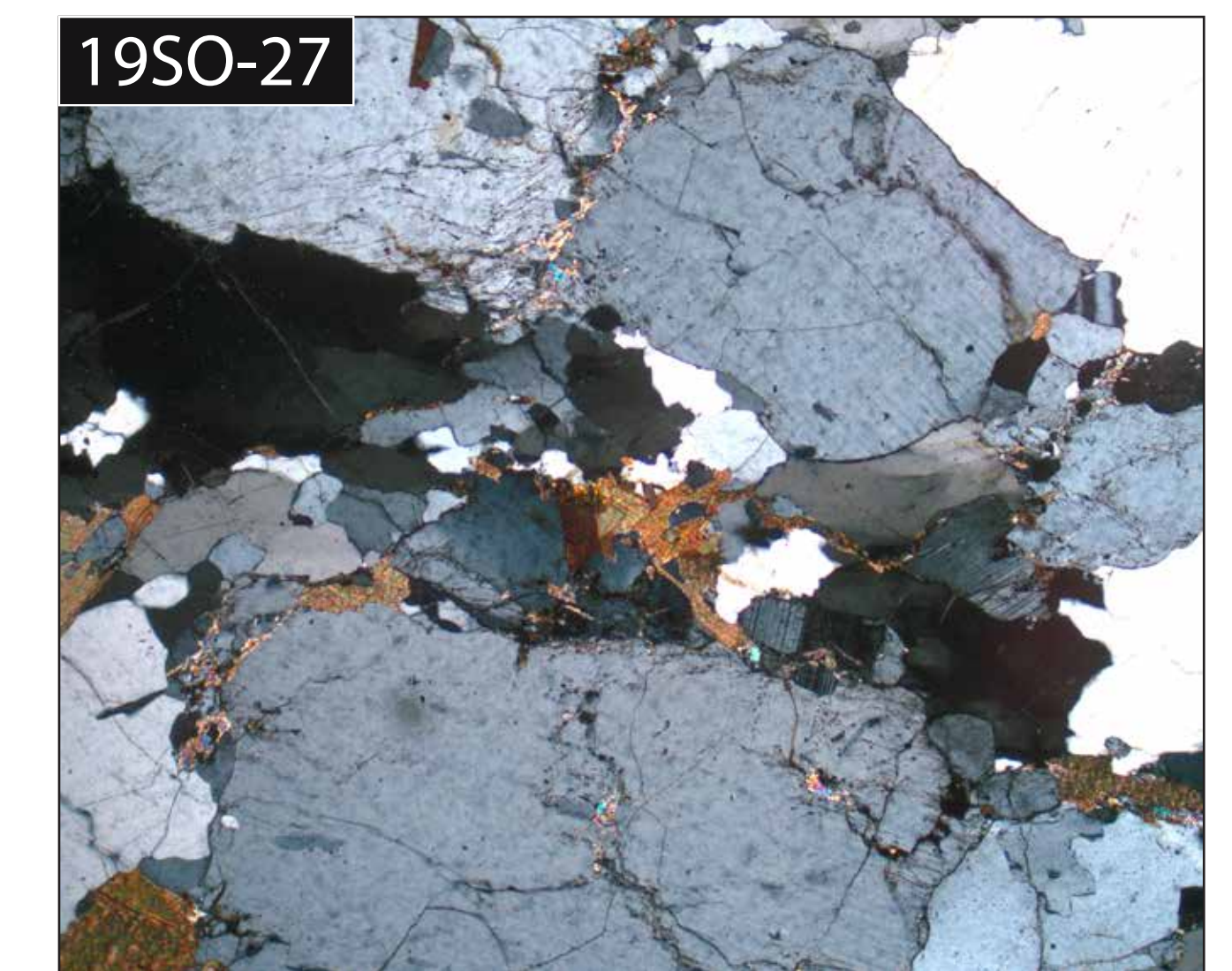


Figure 5: Schematic evolution of the Salmon River suture zone and WISZ (modified from Blake et al., 2009)

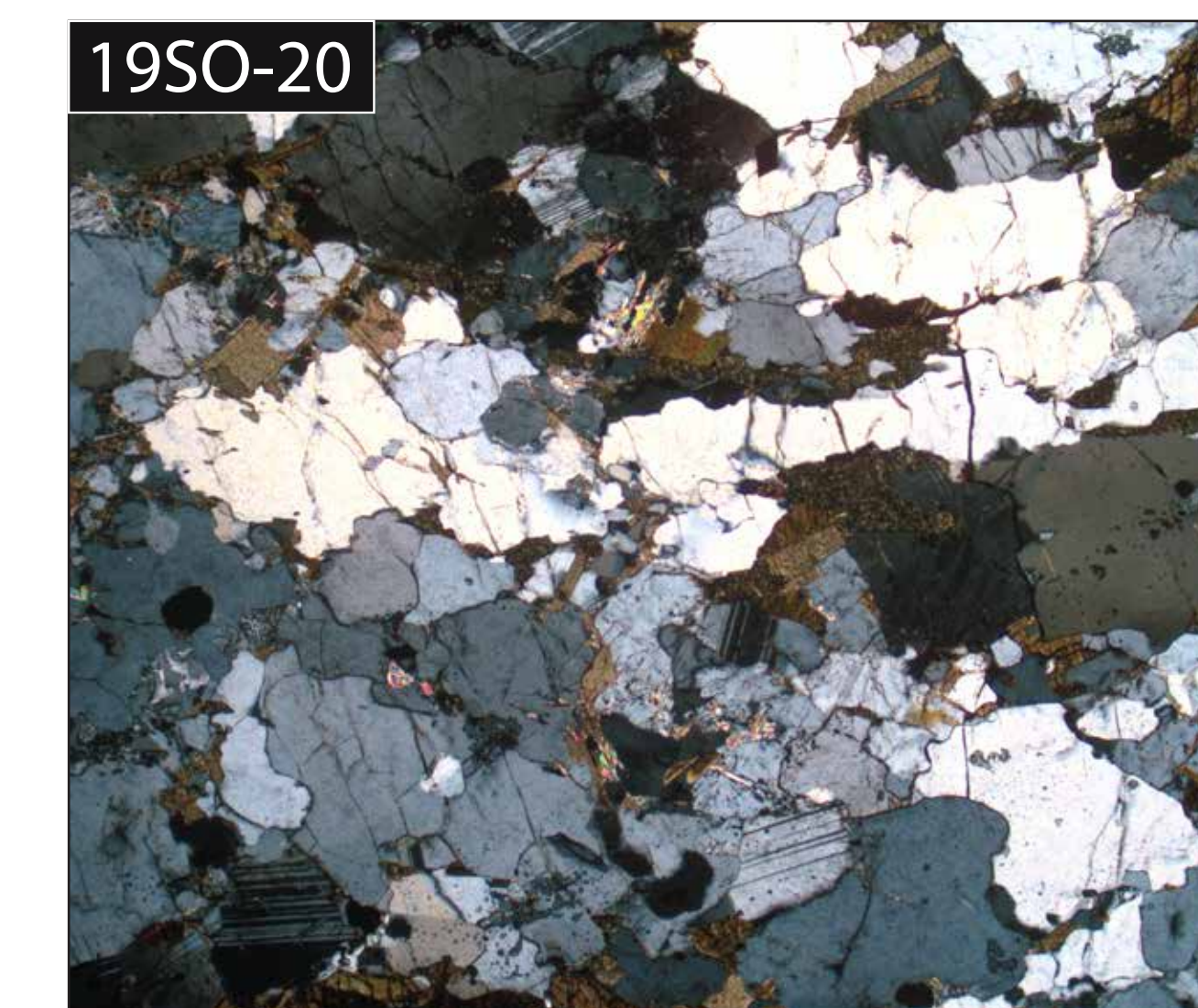
## Microstructures



Little Goose Creek equivalent orthogneiss-significant solid-state deformation



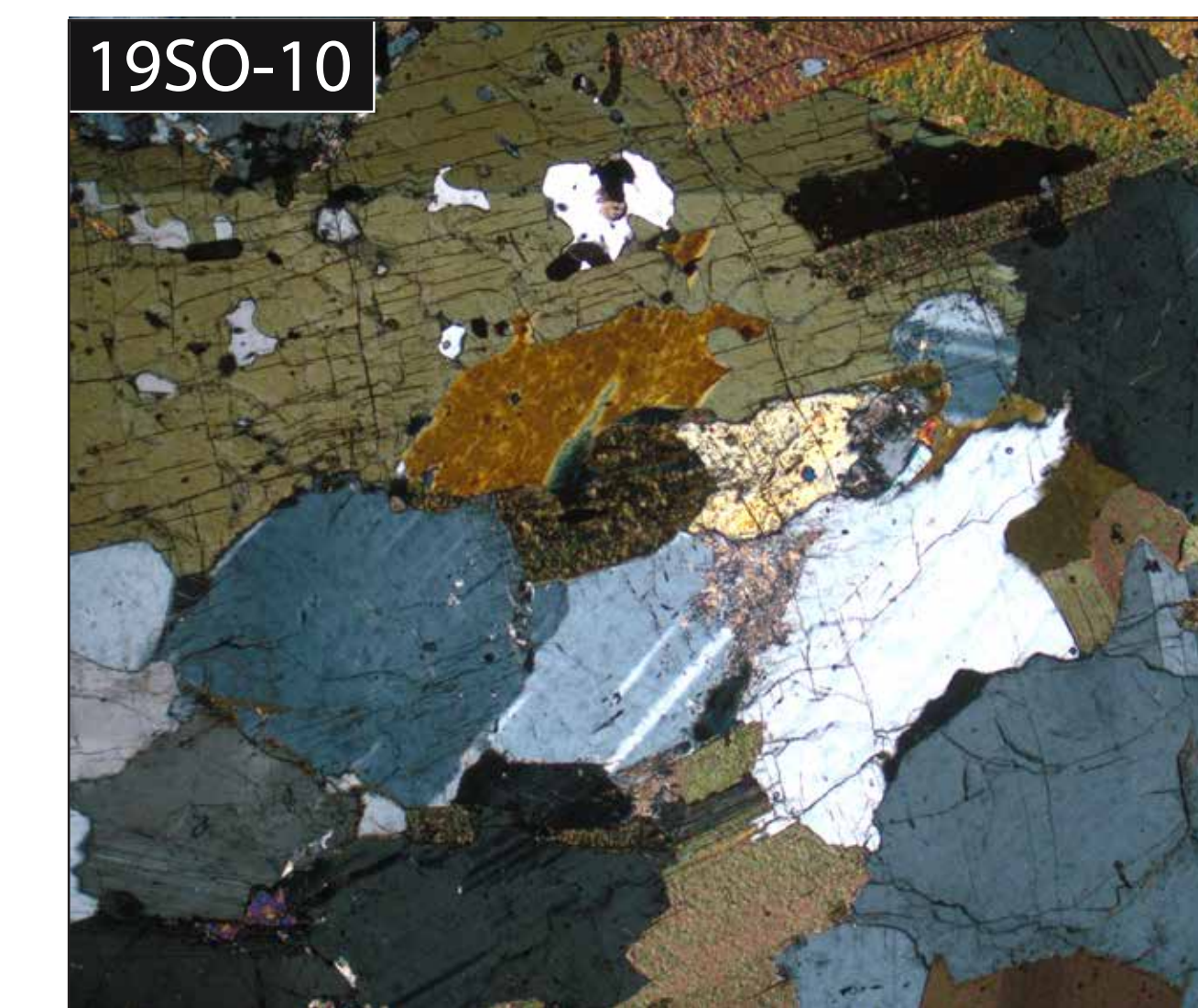
Little Goose Creek equivalent orthogneiss-significant solid-state deformation



Little Goose Creek equivalent orthogneiss-significant solid-state deformation



Little Goose Creek equivalent orthogneiss-significant solid-state deformation



Payette River Tonalite-minor solid-state deformation

Figure 6: Microstructure of units in the study area. The Little Goose Creek equivalent orthogneiss contains primarily plagioclase feldspar, quartz, potassium feldspar, and biotite. These samples show significant solid-state deformation at high T deformation. Deformation includes ribboned quartz grains and deformation twins in feldspars. The Payette River Tonalite contains plagioclase feldspar, quartz, biotite, hornblende, and potassium feldspar. This sample shows only minor solid-state deformation.

## Conclusions

The data presented here indicates that WISZ deformation occurred in the Sweet-Ola region, Idaho.

- Field data showing NNE-striking foliation with downdip lineation is consistent with the along-strike variation of the WISZ and the patterns of deformation found south of Sage Hen Reservoir.
- The units present (porphyritic orthogneiss and hornblende-bearing tonalite) are compositionally similar to other igneous units deformed by the WISZ.
- The fabrics found in the microstructures of the Little Goose Creek equivalent orthogneiss units are more comparable to well-developed solid-state fabrics of the McCall segment than to the weak solid-state fabrics found in the Owyhee. This result suggests that the finite strain is a result of along strike variations, with decreasing strain to the south, and not a function of the orientation of the shear zone.

## Acknowledgments

Special thank you to Professor Tikoff for his advising of this study and to Sarah Trevino for cutting billets for thin sections.