

PS Preliminary Quantification of Neogene Extension Across the Owyhee Plateau Of SW Idaho*

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Abstract

The Owyhee Plateau of southwestern Idaho appears to be remarkably unextended compared to all adjacent areas of the Great Basin and western and eastern Snake River Plain. It is notable for (1) being the only area along the Yellowstone-Snake River Plain hotspot track that is not apparently extended, and (2) located at the intersection between the distinctive West Snake River Plain graben and the surrounding Basin and Range extensional province. Adjacent parts of the hotspot track are characterized by prominent half-graben filled by silicic and mafic volcanic rocks erupted proximally when the loci of time-transgressive extension and magmatism were coincident - but there is no evidence of this in the Owyhee Plateau in spite of the presence of voluminous silicic volcanism c. 16 – 10 Ma. Our question: Do the Miocene volcanic successions of the Owyhee Plateau simply bury and obscure “classic” Basin and Range structural architecture that is evident in the surrounding region? We focus our investigation on documenting the occurrence, lengths, and orientations of extensional faults and putative extensional fracture systems (initially mapped as lineaments) on the Owyhee Plateau using the latest high-resolution NAIP airphoto imagery and NED 1/3 minute DEMs. Then, using the same methodology, we will map adjacent more-extended domains in the Snake River Plain and northern Great Basin to quantify geometric and fault length-throw relationships. Preliminary data suggest that the Owyhee Plateau has not extended homogeneously, and rather its margins transition into the adjacent extensional regime; moreover, some areas display two extensional fabrics and we expect that cross-cutting relationships will be identifiable, thereby providing relative dating of extension outside the Plateau. These results will not only improve our understanding of the co-evolution of the cSRP and Basin and Range, but also the nature and development of syn-volcanic rift basins in general. Given the increasing importance of volcanic rifted margins as hydrocarbon reservoirs in the North and South Atlantic, there is a need

to improve our understanding of the structural and stratigraphic architectures of such basins to aid in interpretation of 2D and 3D geophysical data.

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- (1) being the only area along the Yellowstone-Snake River Plain hotspot track that is not apparently extended, and
- (2) located at the intersection between the distinctive West Snake River Plain graben and the surrounding Basin and Range extensional province.

Adjacent areas are characterized by prominent half-graben filled by Neogene volcanic rocks erupted proximally when the lobe of time-transgressive extension and magmatism were coincident - but there is no evidence of this in the Owyhee Plateau in spite of the presence of voluminous silicic volcanism c. 16 - 10 Ma.

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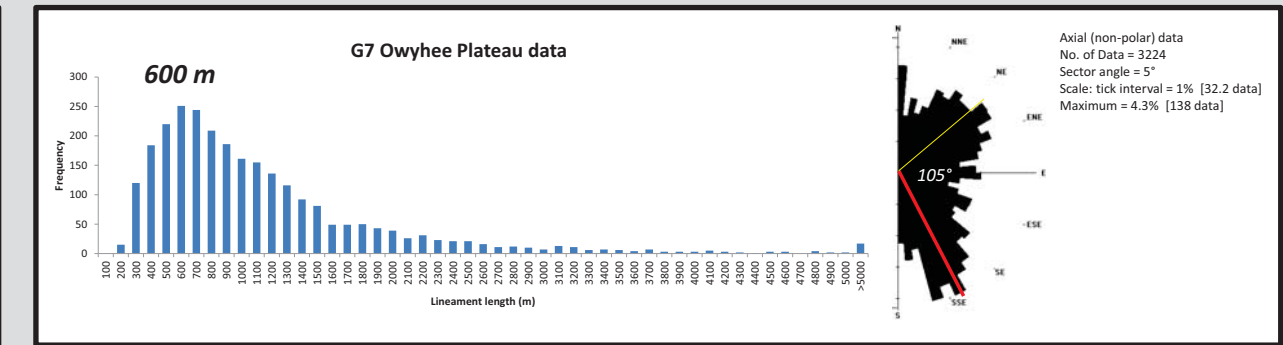
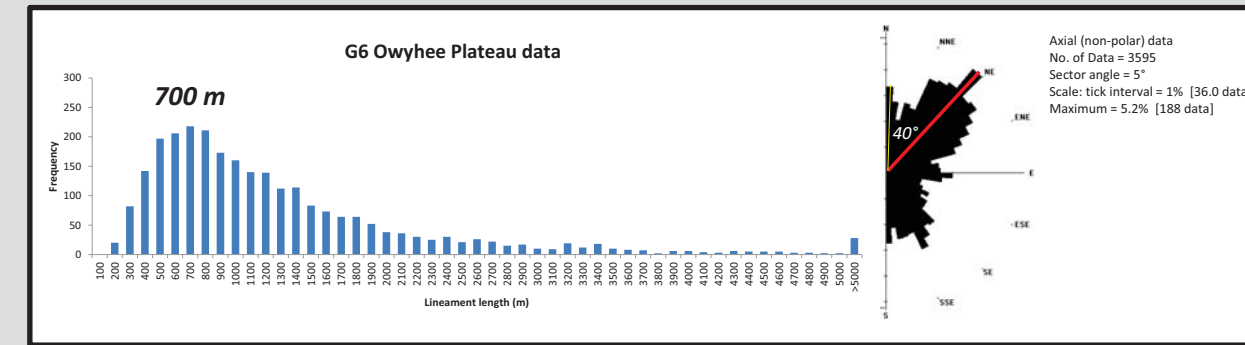
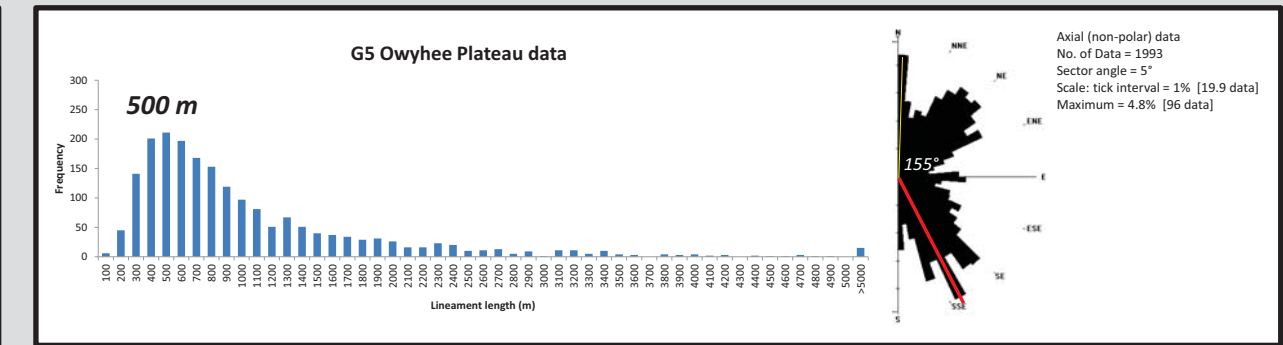
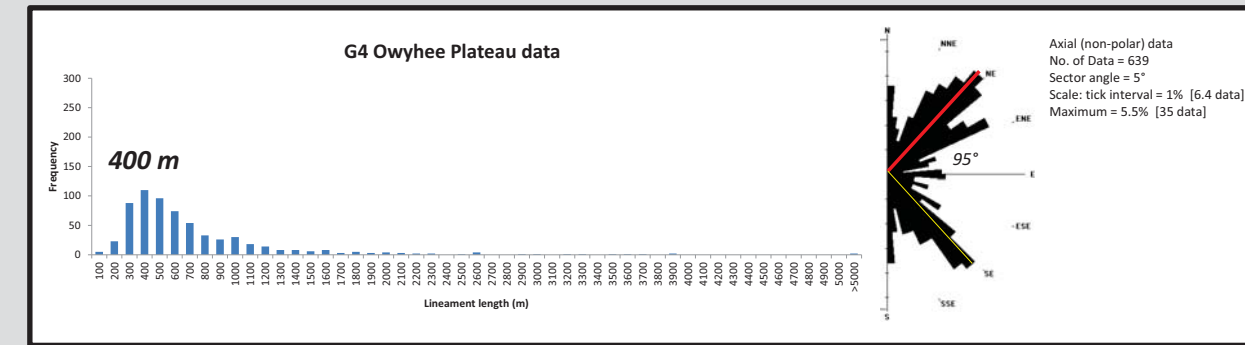
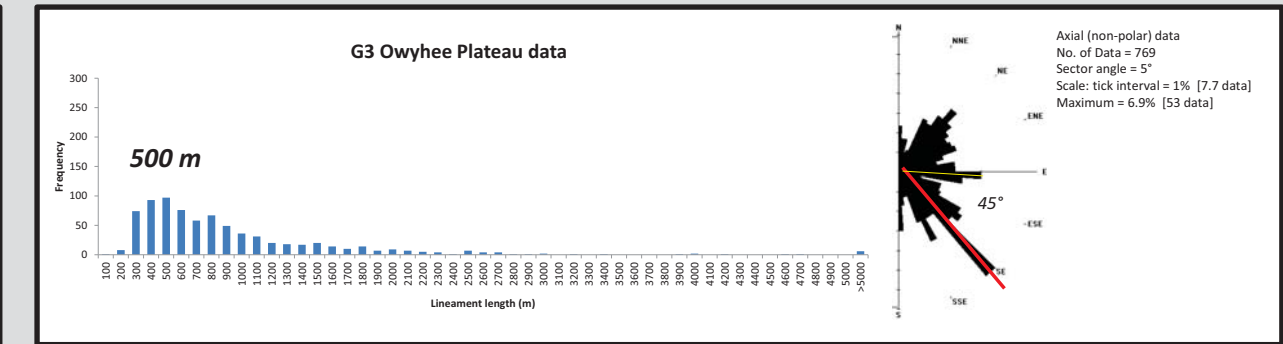
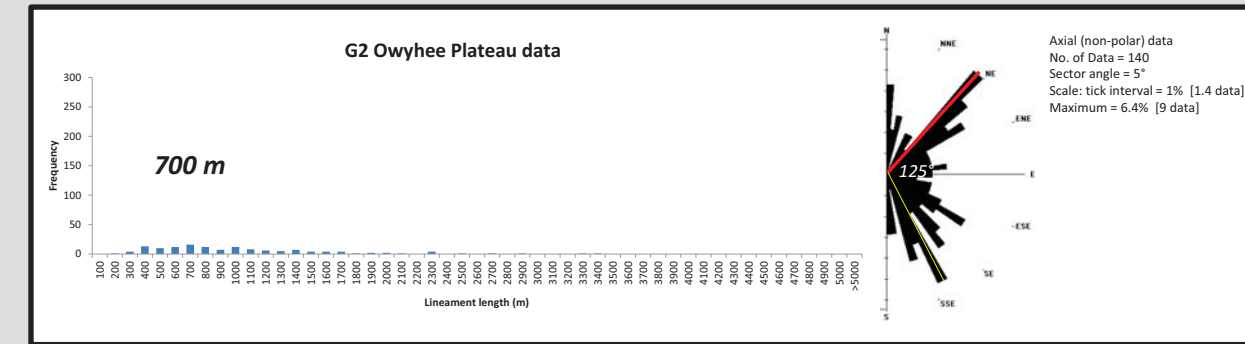
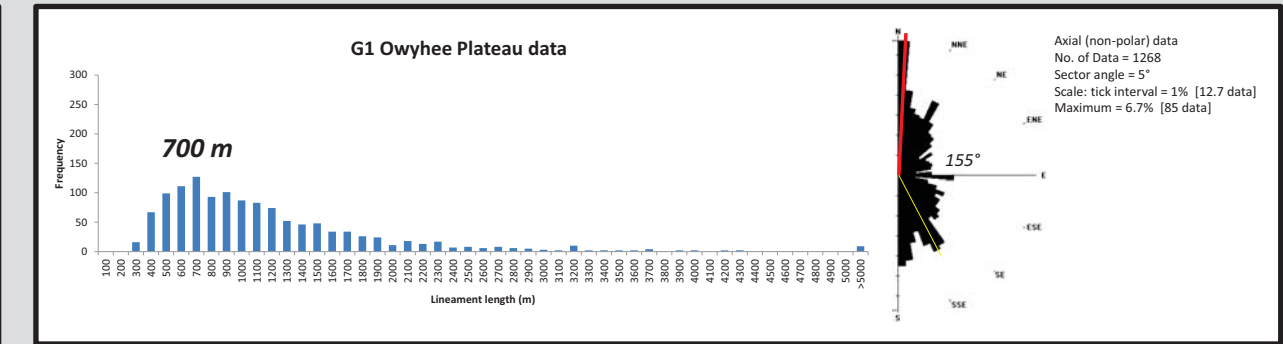
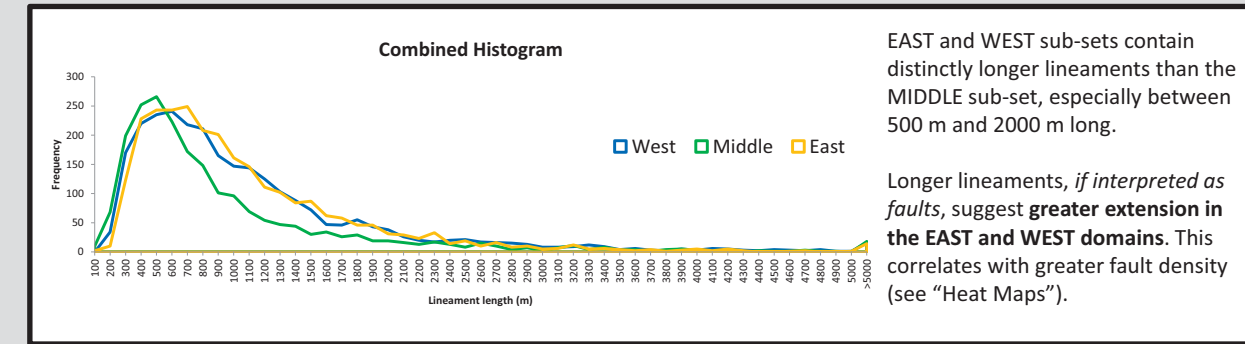
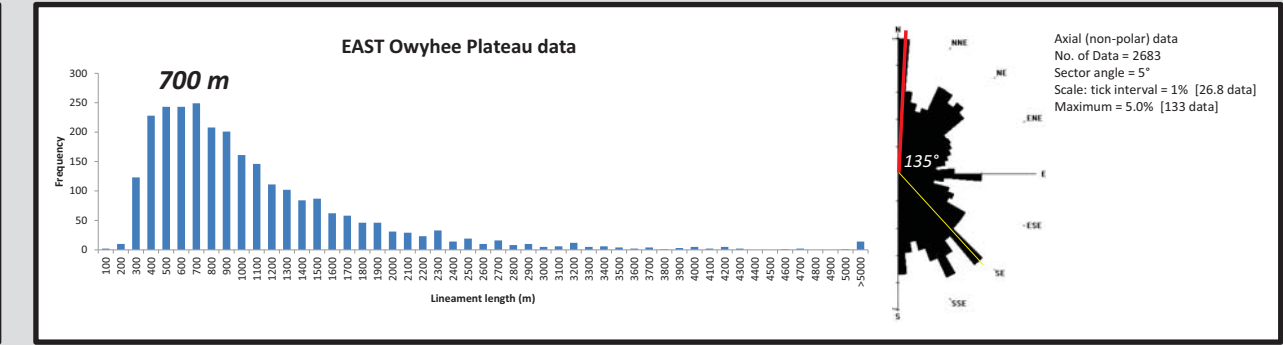
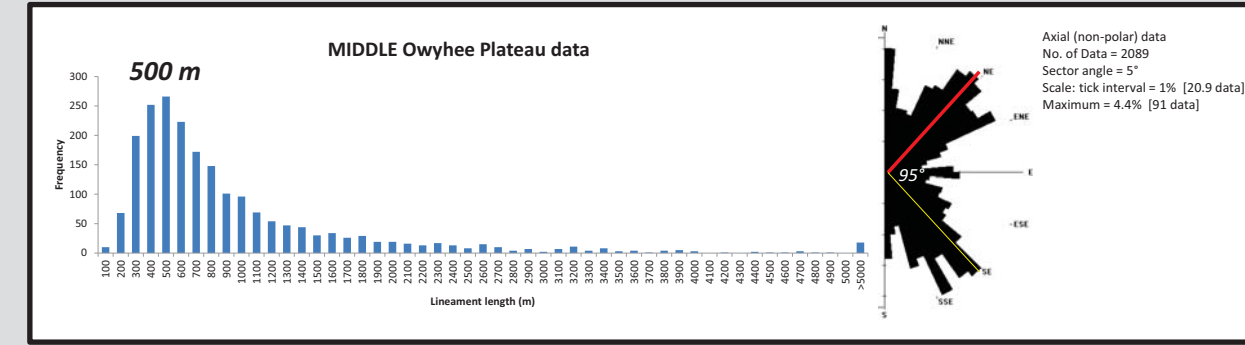
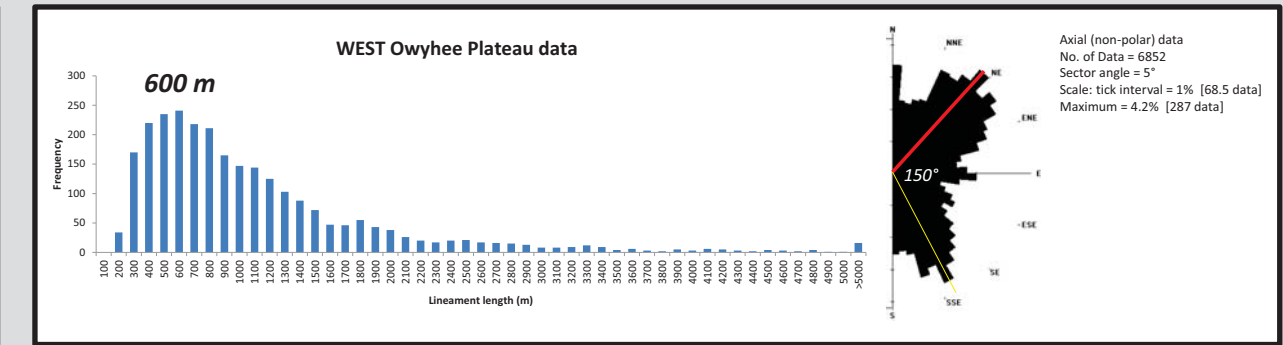
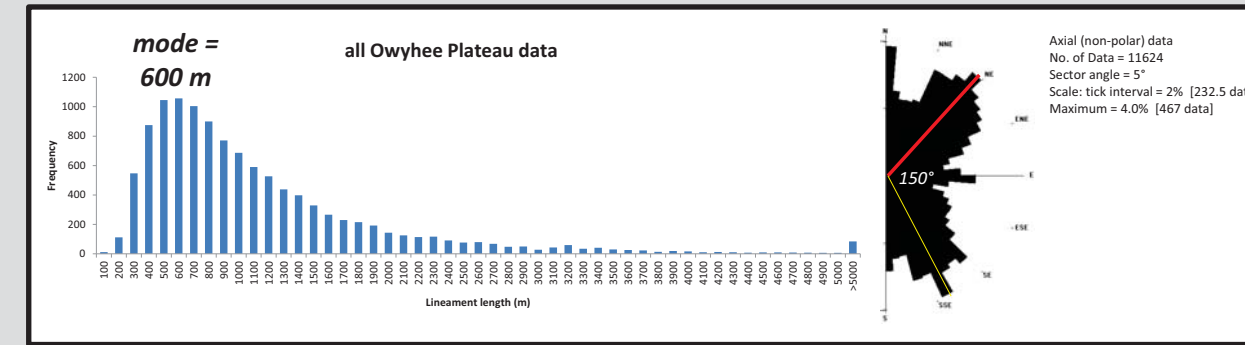
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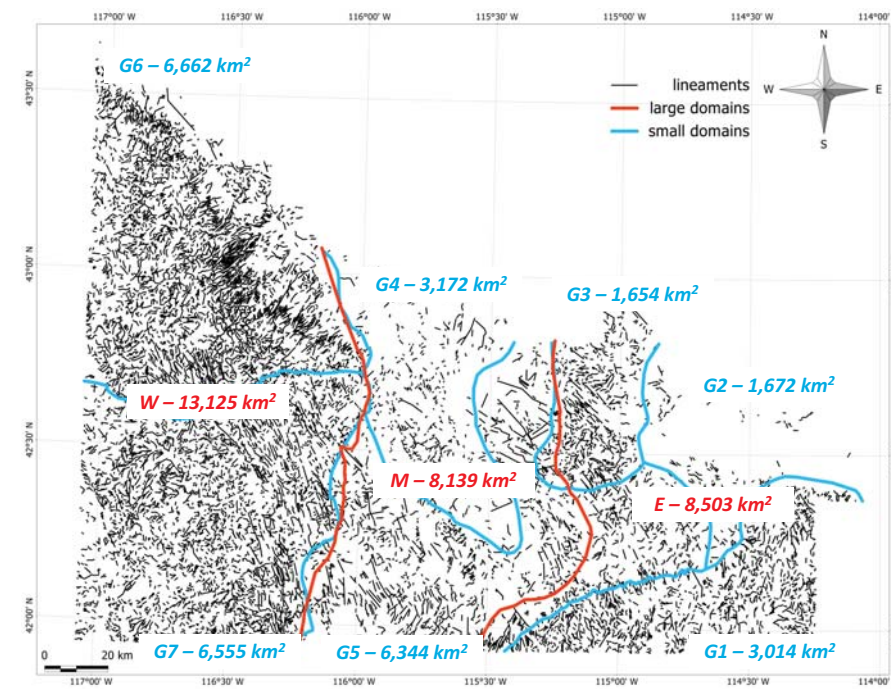
Lineaments are mapped by eye into ArcMap focusing on rectilinear drainages, scarps, and linear topographic features. Know faults and lithological contacts were ignored at this stage to avoid bias.

Sub-sets of the lines generated can be interrogated for geometric (rose diagrams), length (histograms), and areal density ("heat maps").

Data Analysis

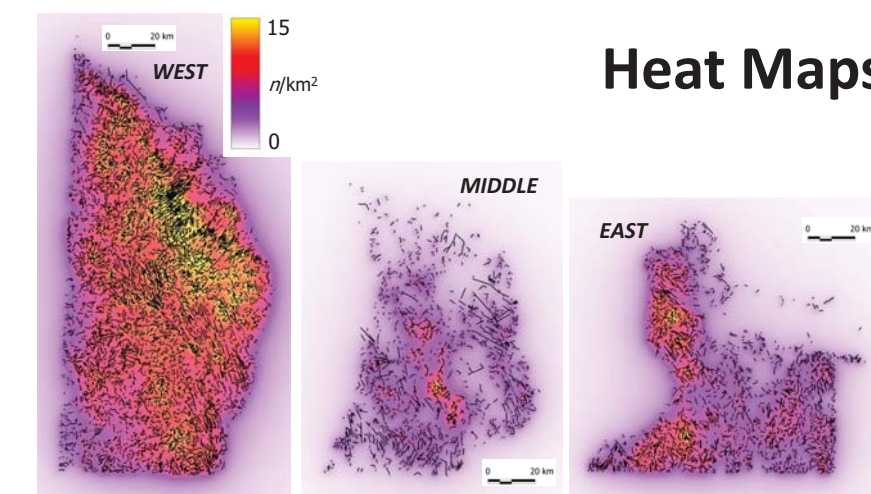


Lineament Mapping



We have divided, by eye, the analyzed area into two levels of sub-domains: three large (>8,000 km²) eastern, middle, and western domains; and seven small (<6,000 km²) "gerrymandered" (G1-7) sub-domains. Divisions were made by visual assessment of lineament density only: orientation and line length were not considered.

Heat Maps



Lineament areal density (i.e. 1/2 * n lineament tip-points per km²) is shown in "heat maps" generated in Manifold GIS.

"Hot spots" of high lineament density (>10/km²) are identified in all three large domains, coincident with parts of G1, G3, G4, and G6.

Summary

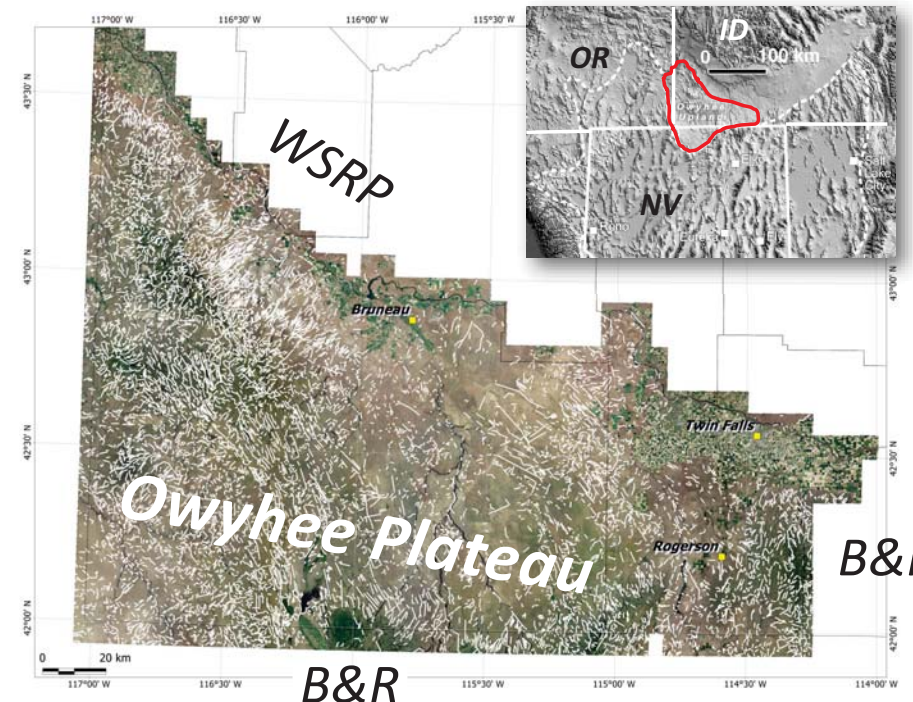
Preliminary data suggest that the Owyhee Plateau has not extended homogeneously, and rather there is a middle domain of limited extension (few lineaments, short lineaments). This domain does not correlate with distinctive surface geology.

The eastern and western domains appear more extended (more, longer lineaments) with lineament trends more typical of the adjacent Basin and Range areas (NE and SSE).

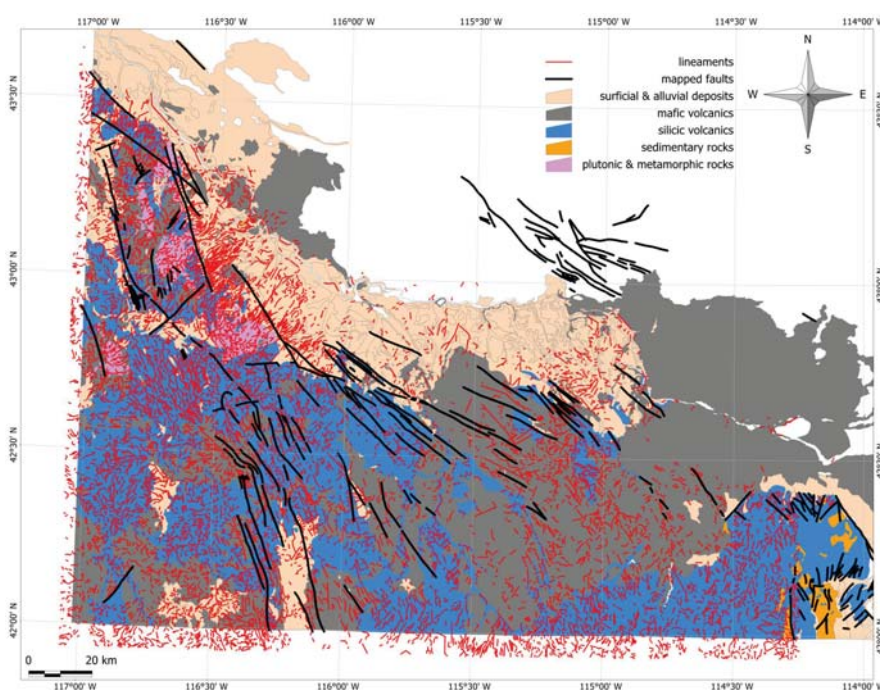
These data will be compared to the adjacent B&R in north-central NV and west SRP graben.

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Andrews GDM, Branney MJ, Bonnicksen B, McCurry M (2008) - Rhyolitic ignimbrites in the Rogerson Graben, southern Snake River Plain volcanic province: volcanic stratigraphy, eruption history and basin evolution. *Bull. Volc.*, v. 90, p. 269-291.
Rodgers DW, Ore HT, Bobo RT, McQuarrie N, Zentner N (2002) - Extension and subsidence of the eastern Snake River Plain, Idaho. Tectonic and Magmatic Evolution of the Snake River Plain Volcanic Province: Idaho Geol. Surv. Bull., v. 30, p. 121-155.



Overlay of mapped lineaments on the National Agricultural Imagery Program (NAIP) base images of Owyhee and Twin Falls counties, southwestern Idaho. The Owyhee Plateau underlies the majority of Owyhee and western Twin Falls counties, and extends into adjacent parts of southeastern Oregon and north-central Nevada (not shown).



Simplified geology of the Owyhee Plateau region (Idaho Geological Survey digital database).