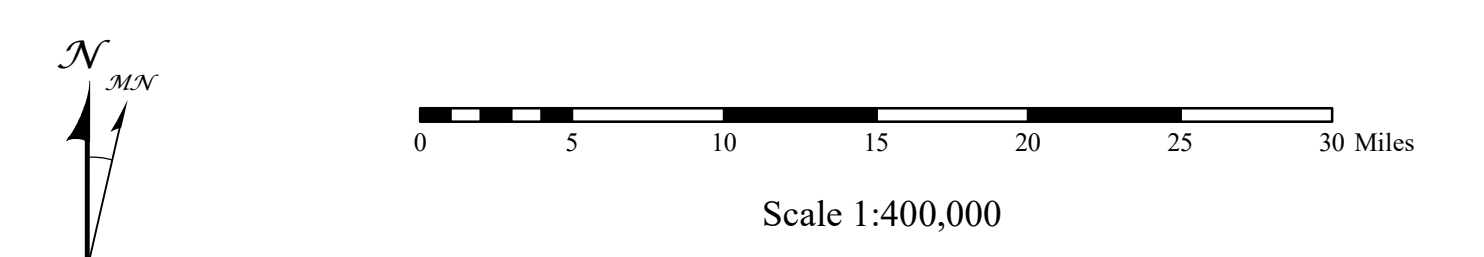


Interpreting the past, providing for the future



# Bedrock Geology - Powder, Tongue, and Northeast River Basins Wyoming, Montana, Nebraska, and South Dakota

compiled by  
Jacob D. Carnes, James E. Stafford, Andrea M. Loveland and James R. Rodgers



## Explanation

- Interstate highway
- U.S. highway
- State highway
- Normal fault—dotted where concealed
- Thrust fault—dotted where concealed
- Line of cross section
- City or town
- Township boundary
- County boundary
- Lake or reservoir
- River or creek
- State boundary

## Bedrock Geology

- |  |  |  |
|--|--|--|
| <p><b>Quaternary</b></p> <ul style="list-style-type: none"> <li>Qa Alluvium and colluvium</li> <li>Qc Gravel, pebbles, and fine deposits</li> <li>Qd Glacial deposits</li> <li>Qe Landslide deposits</li> <li>Qf Date sand and loess</li> <li>Qg Surficial deposits, undivided</li> </ul> <p><b>Quaternary-Tertiary</b></p> <ul style="list-style-type: none"> <li>Qta Terrace gravels</li> <li>Qtm Upper Miocene rocks</li> <li>Qtl Lower Miocene rocks</li> <li>Qtn Lower Miocene and Upper Oligocene rocks</li> <li>Qtw White River Formation</li> <li>Qtd Dune and dune facies (terrestrial and lacustrine igneous rocks)</li> <li>Qtr Wagon Bed Formation</li> <li>Qta Alluvial terraces and extrusive igneous rocks</li> <li>Qtr Wagon Bed Formation</li> <li>Qtd Dune and dune facies (terrestrial and lacustrine igneous rocks)</li> <li>Qtr Wagon Bed Formation</li> <li>Qtd Dune and dune facies (terrestrial and lacustrine igneous rocks)</li> <li>Qtr Wagon Bed Formation</li> </ul> <p><b>Tertiary</b></p> <ul style="list-style-type: none"> <li>Tm Upper Miocene rocks</li> <li>Tl Lower Miocene rocks</li> <li>Tn Lower Miocene and Upper Oligocene rocks</li> <li>Tw White River Formation</li> <li>Td Dune and dune facies (terrestrial and lacustrine igneous rocks)</li> <li>Tr Wagon Bed Formation</li> <li>Ta Alluvial terraces and extrusive igneous rocks</li> <li>Ttr Wagon Bed Formation</li> <li>Ttd Dune and dune facies (terrestrial and lacustrine igneous rocks)</li> <li>Ttr Wagon Bed Formation</li> <li>Ttd Dune and dune facies (terrestrial and lacustrine igneous rocks)</li> <li>Ttr Wagon Bed Formation</li> </ul> <p><b>Mesozoic</b></p> <ul style="list-style-type: none"> <li>Ml Laramie Formation</li> <li>Mf Frontier Formation, Fox Hills Sandstone, Morrison Formation, and Bearpaw and Lewis Shales</li> <li>Mh Fox Hills Sandstone</li> <li>Mk Fox Hills Sandstone and Lewis Shale</li> <li>Mn Fox Hills Sandstone and Bearpaw Shale</li> <li>Mt Morrison Formation and Lewis Shale</li> <li>Mw Mesaverde Group</li> <li>Mx Cody Shale</li> <li>My Frontier Formation</li> <li>Mz Frontier Formation and Mowry and Thermopylae shales</li> <li>Maa Pierre Shale</li> <li>Mab Niobrara Formation</li> <li>Mac Carlile Shale</li> <li>Mad Carboniferous Formation and Belle Fourche and Mowry shales</li> <li>Maq Mowry Shale</li> <li>Mam Mowry and Thermopylae shales</li> <li>Man Niobrara Sandstone and Shell Creek Shale</li> </ul> <p><b>Cretaceous</b></p> <ul style="list-style-type: none"> <li>Crk Cheyenne and Morrison formations (W-SW or Brown Sage Group or Morrison Formation (W))</li> <li>Crn Cheyenne, Morrison, and Sundance formations</li> <li>Crj Cheyenne, Morrison, Sundance, and Ogallala Spring formations</li> <li>Crk Cheyenne and Morrison formations (W-SW or Brown Sage Group or Morrison Formation (W))</li> <li>Crn Cheyenne, Morrison, and Sundance formations</li> <li>Crj Cheyenne, Morrison, Sundance, and Ogallala Spring formations</li> </ul> <p><b>Jurassic</b></p> <ul style="list-style-type: none"> <li>Jup Sandstone and Ogallala Spring formations</li> </ul> <p><b>Triassic</b></p> <ul style="list-style-type: none"> <li>Ttr Chugwater and Divisadero formations</li> <li>Tc Chugwater Formation</li> </ul> | <p><b>Mesozoic and Paleozoic</b></p> <p><b>Triassic-Ferruginous</b></p> <ul style="list-style-type: none"> <li>Tf Cheyenne and Gossage Egg formations</li> <li>Tsp Spearfish Formation</li> <li>Tge Gossage Egg Formation</li> </ul> <p><b>Paleozoic</b></p> <ul style="list-style-type: none"> <li>Pf Paleozoic units, undifferentiated</li> <li>Pp Phosphatic Formation and related rocks</li> <li>Pm Minakata Limestone and Opache Shale</li> </ul> <p><b>Ferruginous-Pennsylvanian</b></p> <ul style="list-style-type: none"> <li>Ff Ferruginous Formation</li> <li>Fm Mansfield Formation</li> <li>Fp Permian-Mississippian</li> <li>Fm Enidop Sandstone and Arden Formation</li> </ul> <p><b>Mississippian</b></p> <ul style="list-style-type: none"> <li>Mm Madison Limestone or Group</li> <li>Md Madison Limestone or Darcy Formation</li> <li>Mg Greenway Formation</li> <li>Mp Palisades and Englewood limestones</li> </ul> <p><b>Ordovician-Devonian</b></p> <ul style="list-style-type: none"> <li>Od Madison Limestone and Big Horn Dolomite</li> <li>Ork Whetstone Dolomite, and Wintrop and Big Horn Dolomite, Galatin Limestone, and Fort Union formations, and Fairbank Sandstone (W)</li> <li>Ork Big Horn Dolomite</li> </ul> <p><b>Cambrian</b></p> <ul style="list-style-type: none"> <li>Cc Cambrian rocks</li> </ul> <p><b>Precambrian</b></p> <ul style="list-style-type: none"> <li>Pc Pelitic schists, marble, granite gneiss, layered amphibolites, and felsic gneiss</li> <li>Ar Archaean</li> <li>Jr Granite and minor amounts of metamorphic rocks</li> <li>Am Amphibolites, hornblende gneiss, basalt gneiss, quartzite, and other igneous, metamorphic, and pelitic schists</li> <li>Qz Quartzite to quartz monzonite</li> <li>Gp Gabbro gneiss complex</li> </ul> | <p><b>Montana Geologic Units (continued)</b></p> <p><b>Paleozoic (continued)</b></p> <p><b>Pennsylvanian</b></p> <ul style="list-style-type: none"> <li>Pf Ferruginous units, undifferentiated</li> <li>Md Mississippian units, undifferentiated</li> <li>Ork Ordovician</li> <li>Ork Ordovician units, undifferentiated</li> </ul> <p><b>Nebraska Geologic Units</b></p> <p><b>Cenozoic</b></p> <p><b>Tertiary</b></p> <ul style="list-style-type: none"> <li>Ta Ashland Group</li> <li>Tr White River Group</li> </ul> <p><b>Cretaceous</b></p> <ul style="list-style-type: none"> <li>Cr Pierre Shale</li> </ul> <p><b>South Dakota Geologic Units</b></p> <p><b>Cenozoic</b></p> <p><b>Quaternary</b></p> <ul style="list-style-type: none"> <li>Qa Alluvium</li> <li>Qc Terrace deposits</li> <li>Qd Landslide deposits</li> </ul> <p><b>Tertiary</b></p> <ul style="list-style-type: none"> <li>Tt Tachyite intrusive rocks</li> </ul> <p><b>Mesozoic</b></p> <p><b>Cretaceous</b></p> <ul style="list-style-type: none"> <li>Cr Pierre Shale</li> <li>Cr Niobrara Formation</li> <li>Cr Greenhorn Formation</li> <li>Cr Belle Fourche Shale</li> <li>Cr Mowry Shale, Niobrara Sandstone, and Shell Creek Shale</li> <li>Cr Inyan Kara Group</li> </ul> <p><b>Jurassic</b></p> <ul style="list-style-type: none"> <li>Jm Morrison Formation, Vintrop Sandstone, Sundance Formation, and Ogallala Spring Formation</li> </ul> <p><b>Mesozoic and Paleozoic</b></p> <p><b>Triassic-Ferruginous</b></p> <ul style="list-style-type: none"> <li>Tf Spearfish Formation</li> </ul> <p><b>Paleozoic</b></p> <p><b>Pennsylvanian</b></p> <ul style="list-style-type: none"> <li>Pf Minakata Limestone and Opache Shale</li> </ul> <p><b>Ferruginous-Pennsylvanian</b></p> <ul style="list-style-type: none"> <li>Ff Ferruginous Formation</li> <li>Fm Mansfield Formation</li> <li>Fp Permian-Mississippian</li> <li>Md Madison Group</li> </ul> <p><b>Ordovician-Cambrian</b></p> <ul style="list-style-type: none"> <li>Ork Whetstone Limestone, and Wintrop and Darcy/Dolomite</li> </ul> <p><b>Precambrian</b></p> <ul style="list-style-type: none"> <li>Pc Whetstone Limestone, and Wintrop and Darcy/Dolomite</li> <li>Pg Pegmatite</li> <li>Msh Metashale</li> <li>Mg Metagneiss</li> </ul> |
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Map Projection: Universal Transverse Mercator (UTM), zone 13  
False Easting: 500000, False Northing: 0  
Central Meridian: -106.0 degrees West  
Linear Unit: Meter  
Horizontal Datum: North American Datum of 1983 (NAD 83)

Map layout by James R. Rodgers and James E. Stafford  
Map edited by Suzanne C. Lahr

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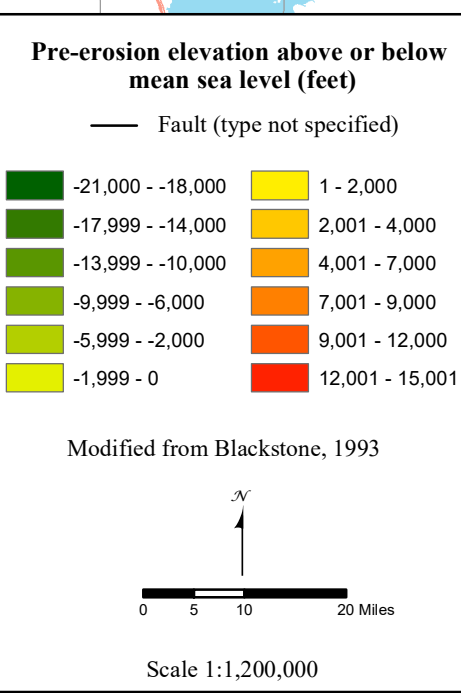
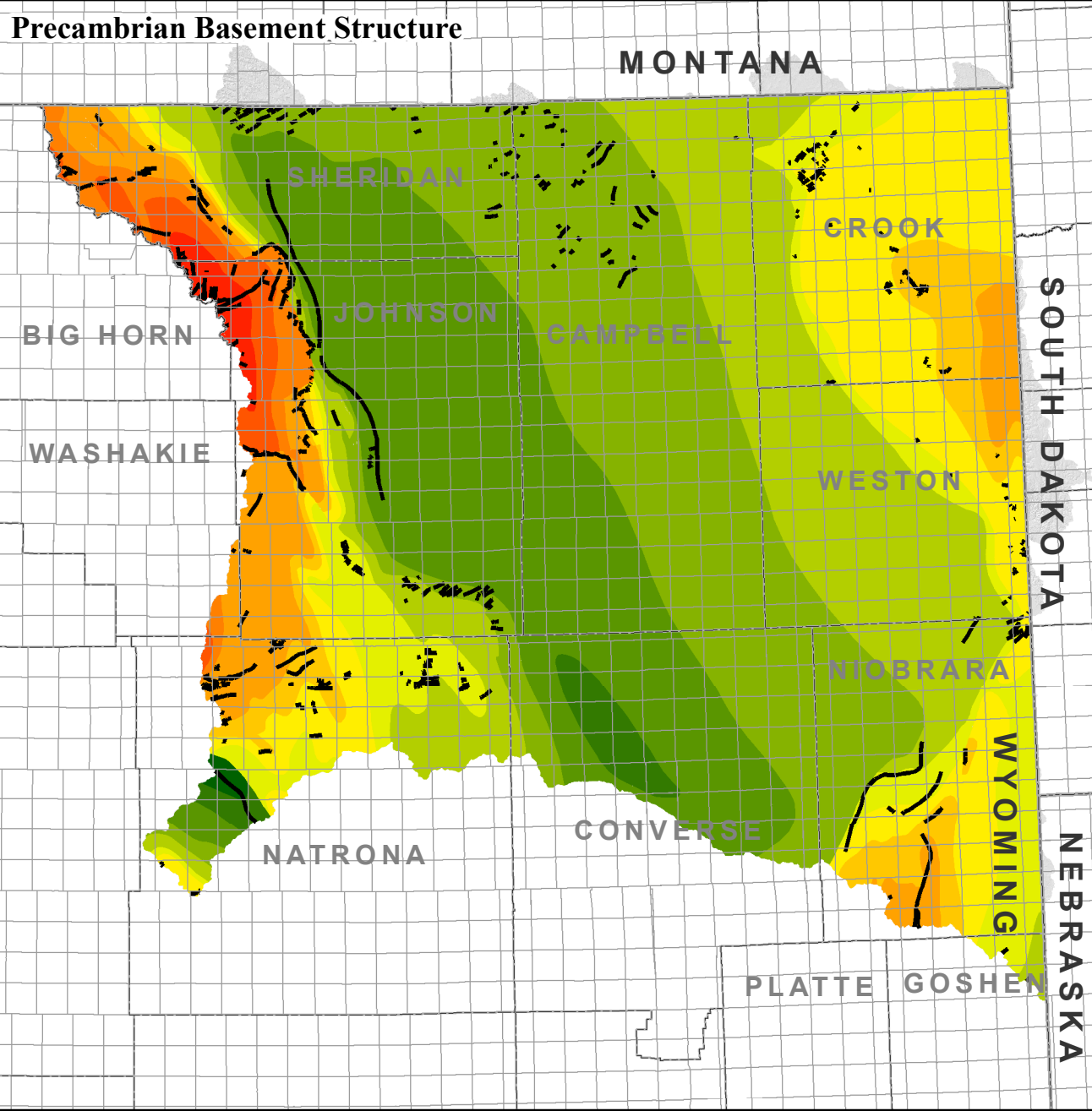
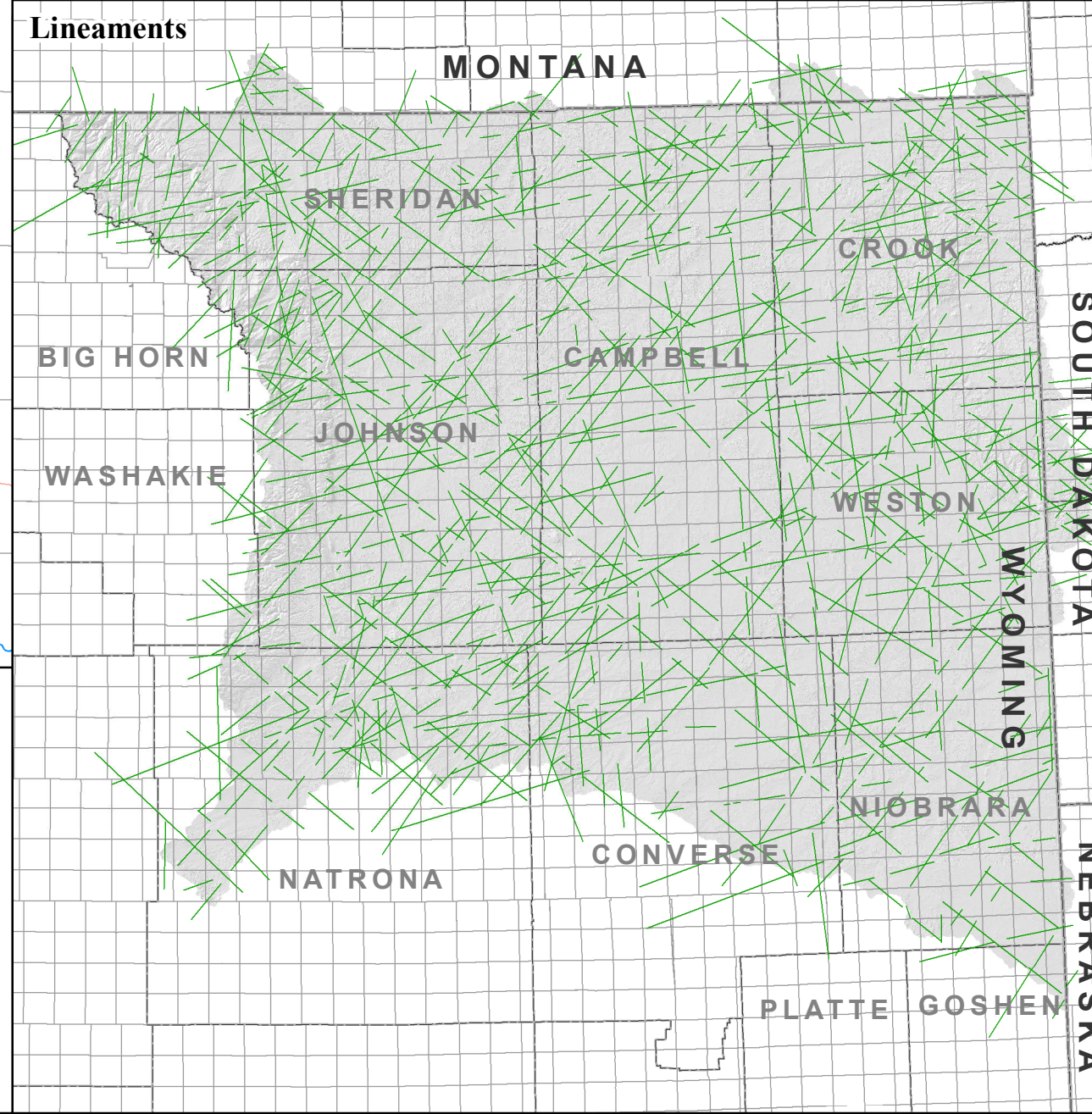
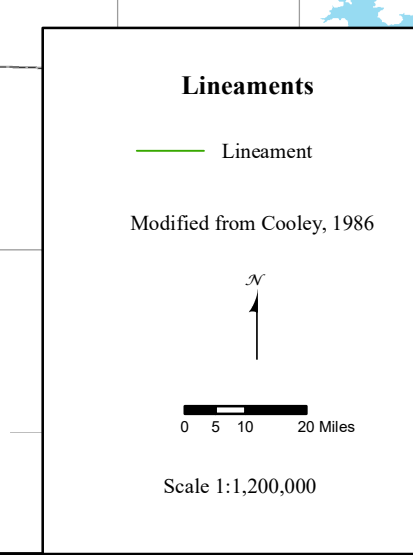
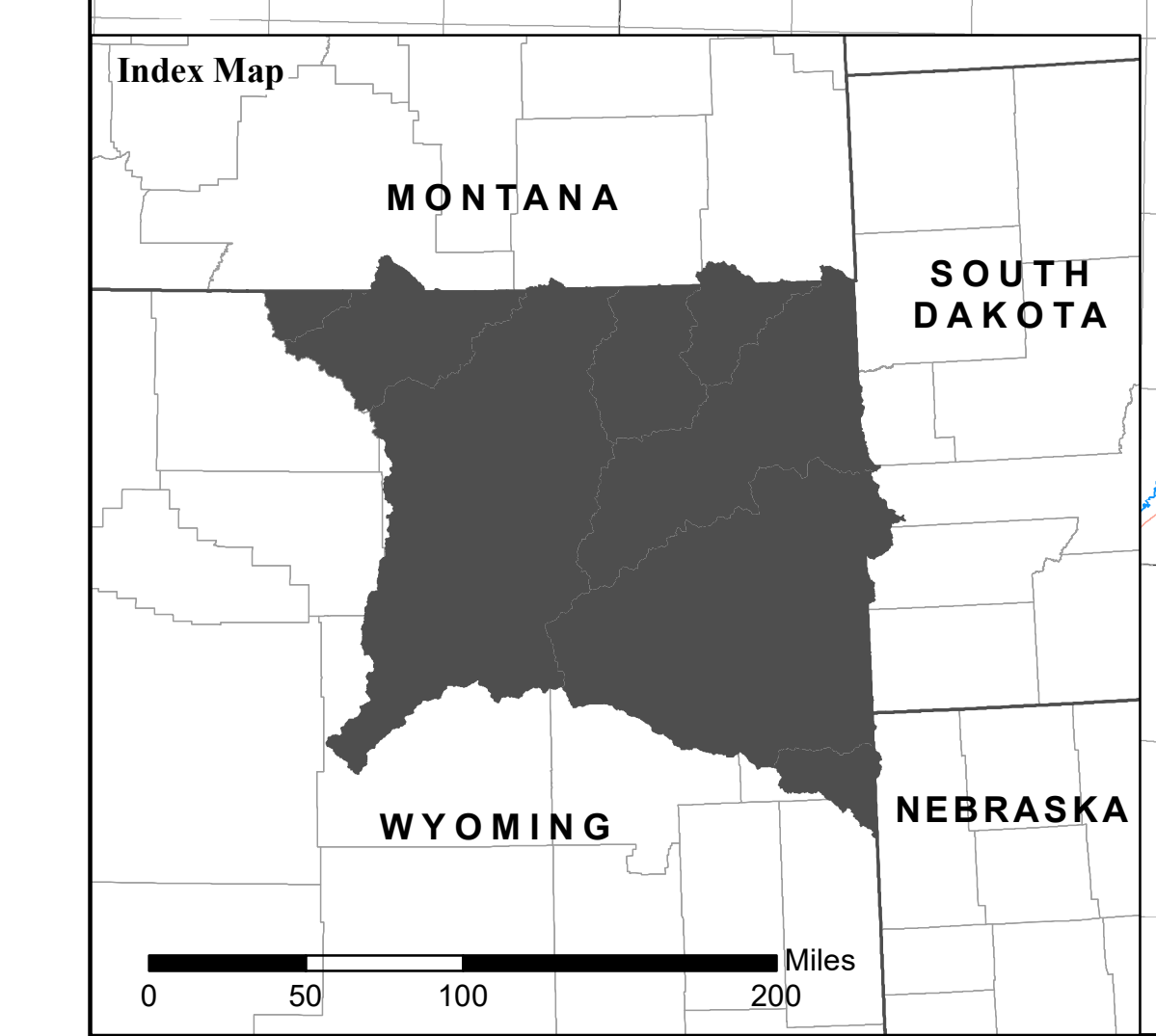
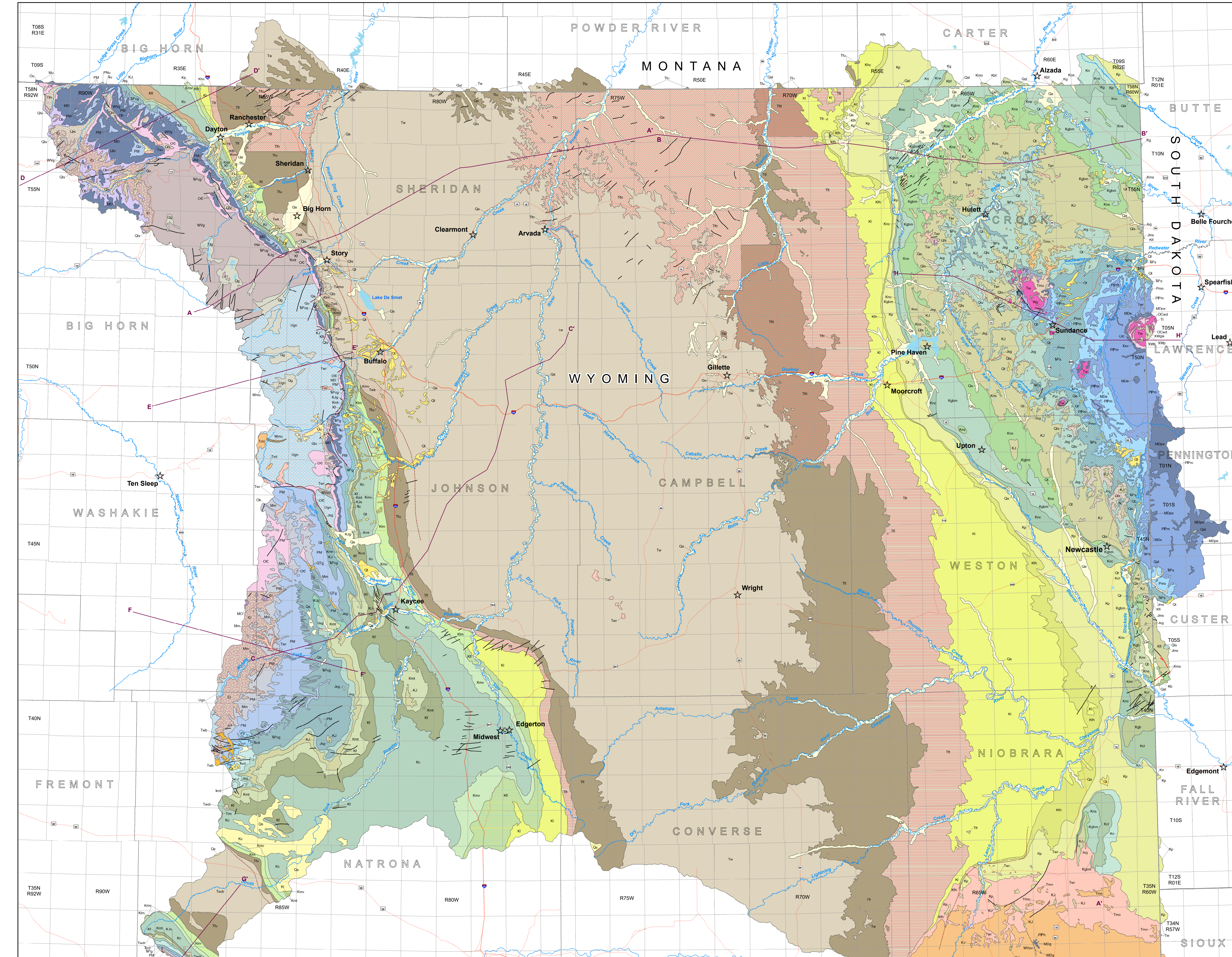
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**Line of Cross Section Index**

A-A'	Figure 4-2
B-B'	Figure 4-3
C-C'	Figure 4-4
D-D'	Figure 4-5
E-E'	Figure 4-6
F-F'	Figure 4-7
G-G'	Figure 4-8
H-H'	Figure 4-9
I-I'	Figure 4-10
J-J'	Figure 4-11