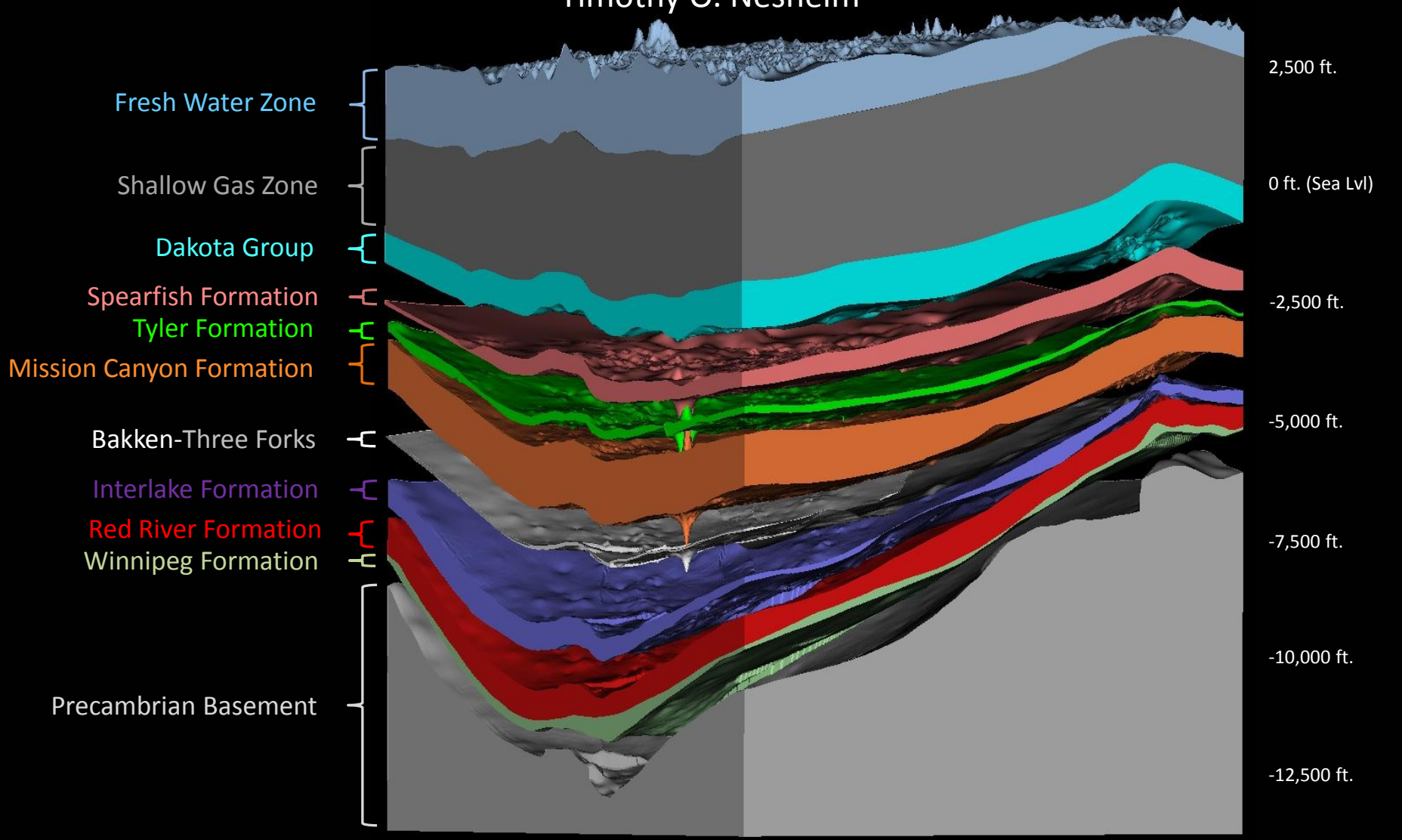
Three-Dimensional Geologic Model of Southwestern North Dakota

Timothy O. Nesheim



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Three-Dimensional Geologic Model of Southwestern North Dakota

-The main intent of this publication is to display the three-dimensional shape and thickness of Williston Basin geological units in southwestern North Dakota.

-The geological formations and groups modeled by this project were generated using primarily geophysical log tops (from oil & gas wells) within the computer program Petra.

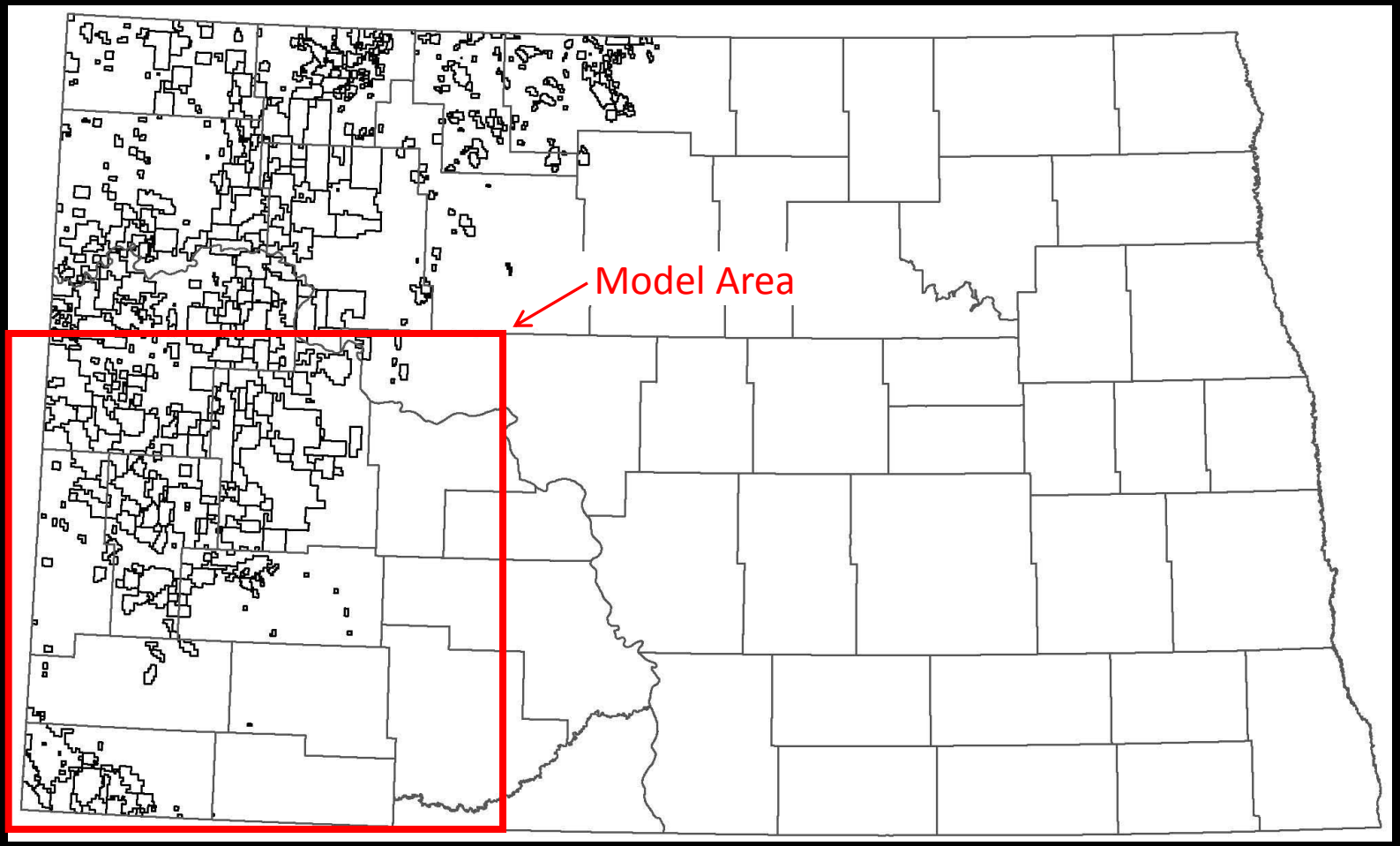
-The geological surfaces in this model were produced by anywhere from several thousand data points (e.g. Madison Formation) to less than a hundred data points (e.g. Precambrian). Questionable data points (geophysical log tops) were removed.

-Vertical exaggeration is used throughout most of this publication to help emphasize the subtle structural features within the Williston Basin of North Dakota.

-Several estimated control points where added to each layer in the southwestern corner of the model area to better define the structure of the Cedar Creek Anticline.

-Multiple estimated control points where added to the Precambrian surface throughout the model area.

Distribution of Oil & Gas Fields in North Dakota



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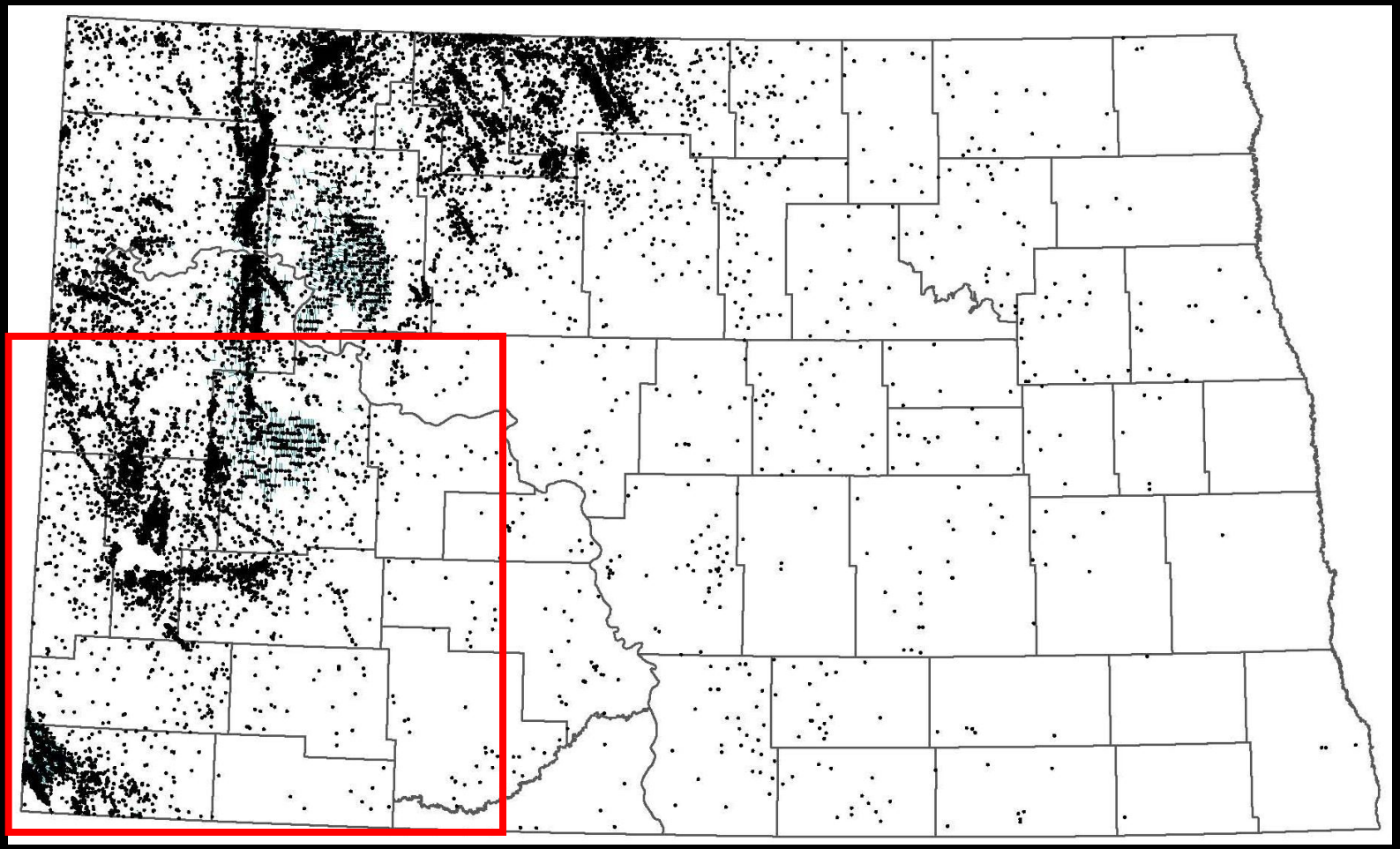
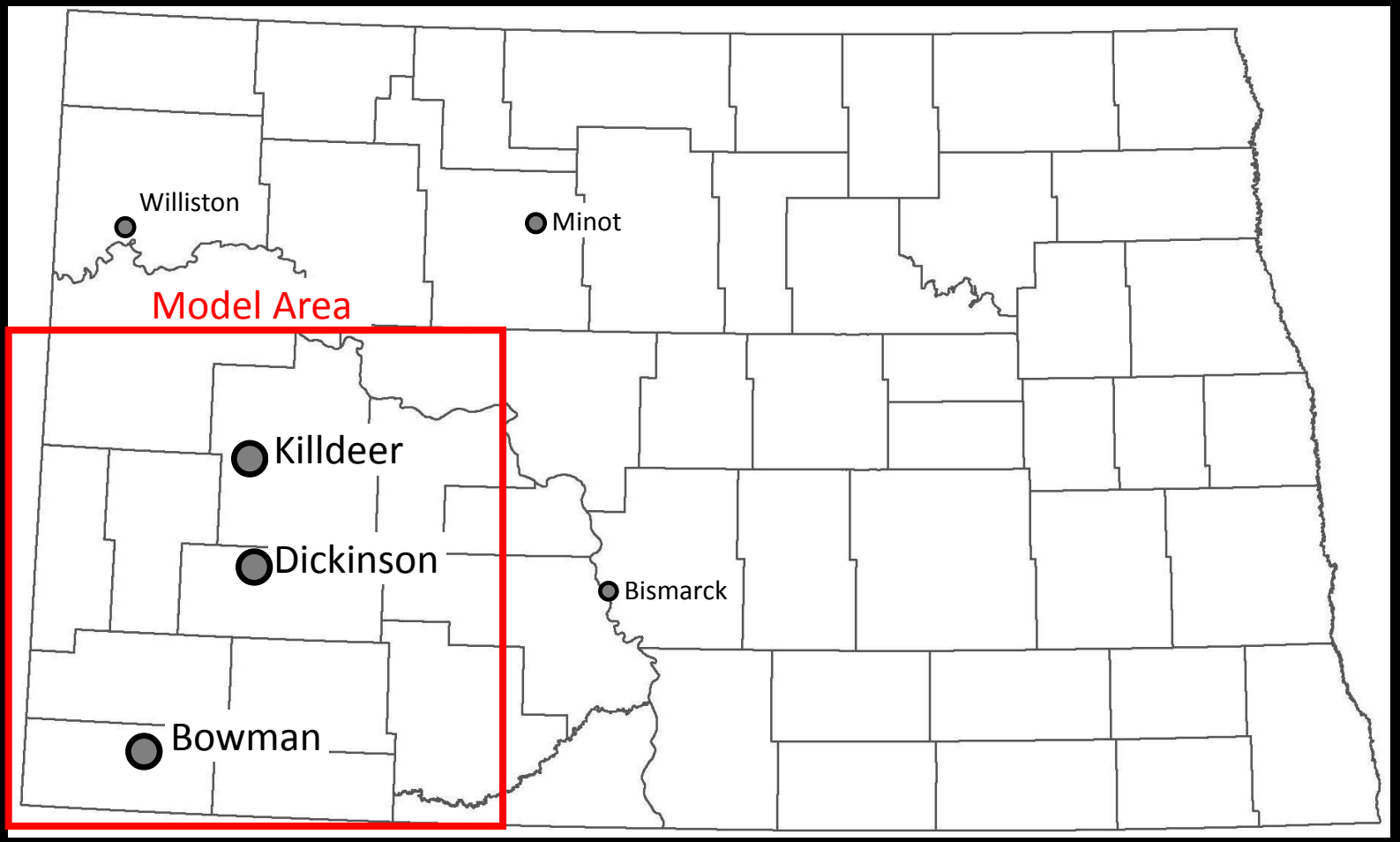
>16,000 Oil & Gas wells have been drilled in North Dakota



-Black dots show the location of oil and gas wells drilled in North Dakota



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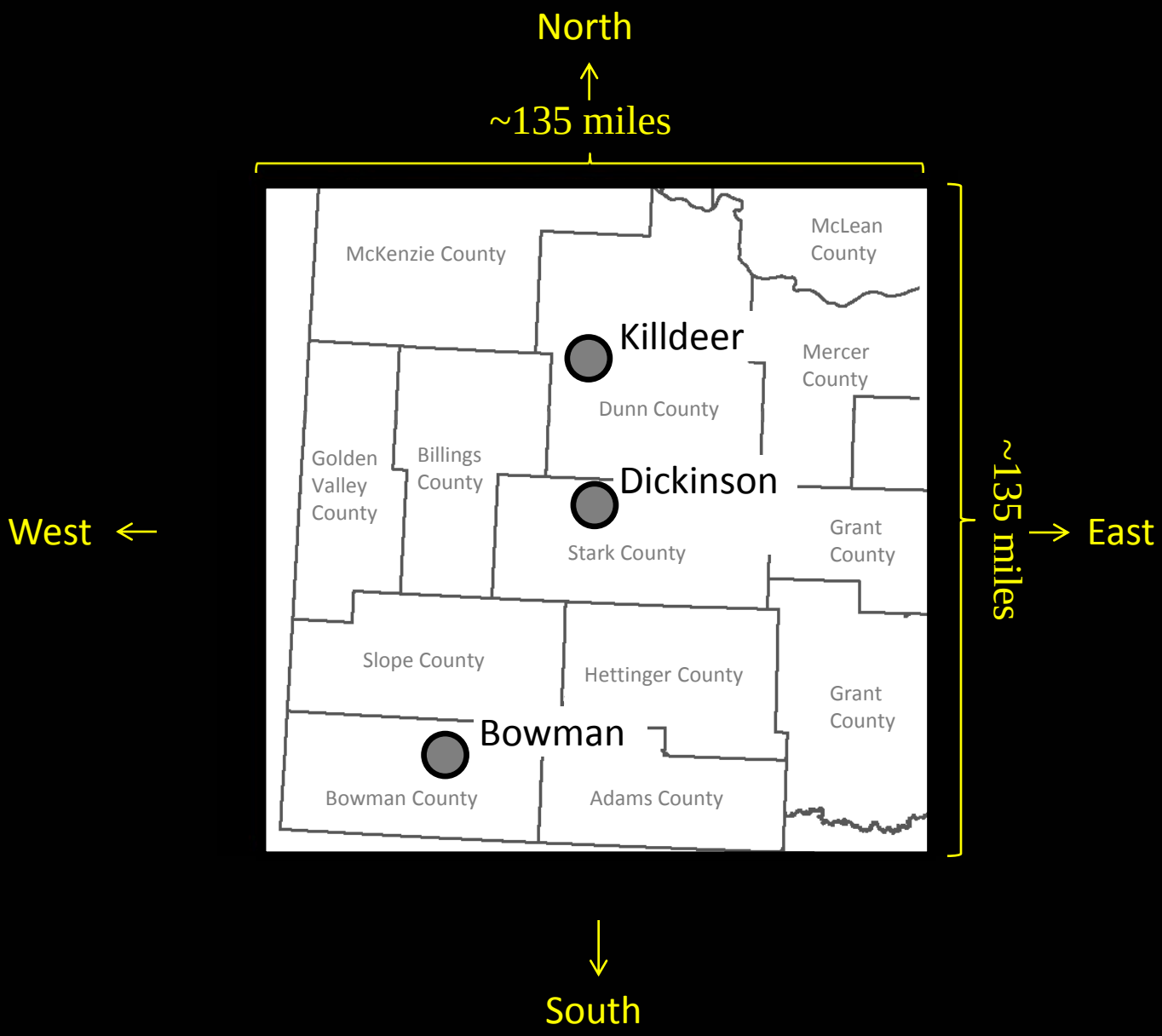

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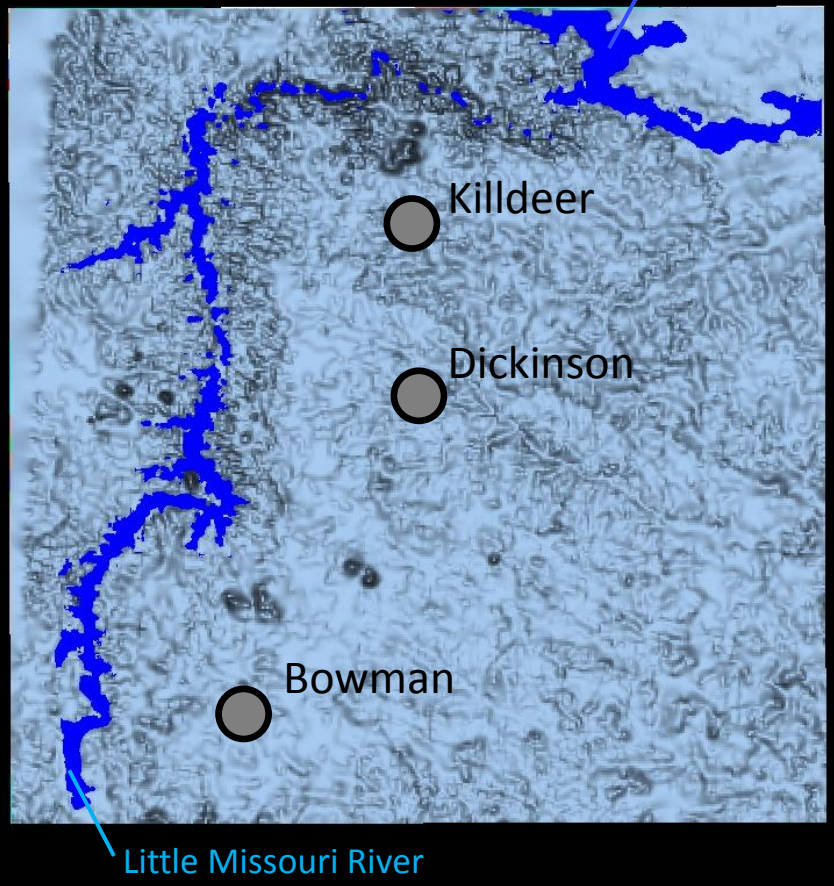

West ←

→ East

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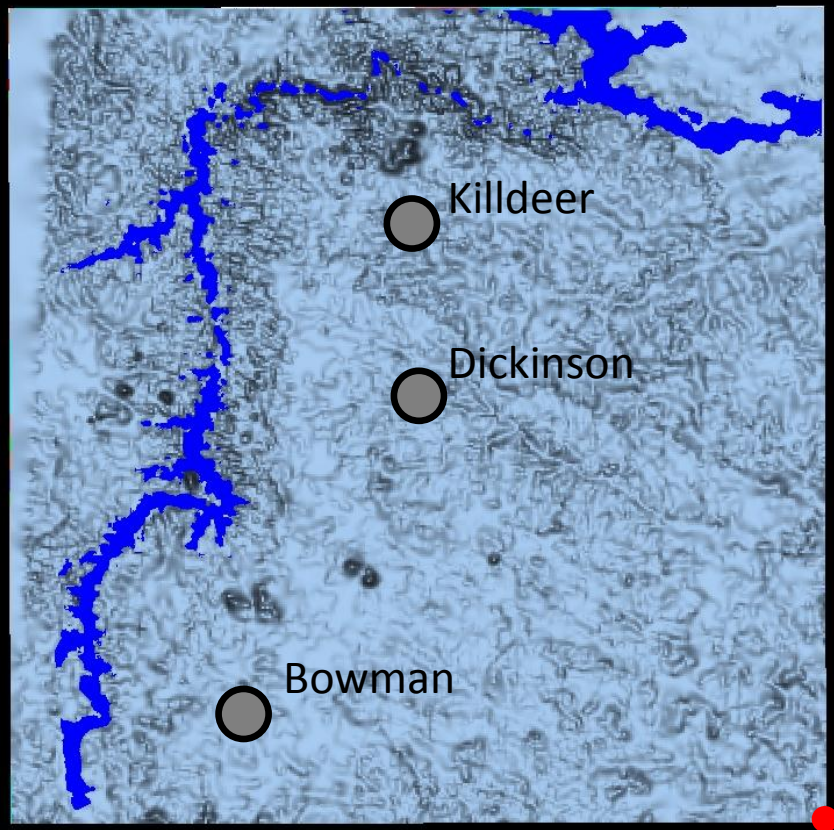

West ←

→ East

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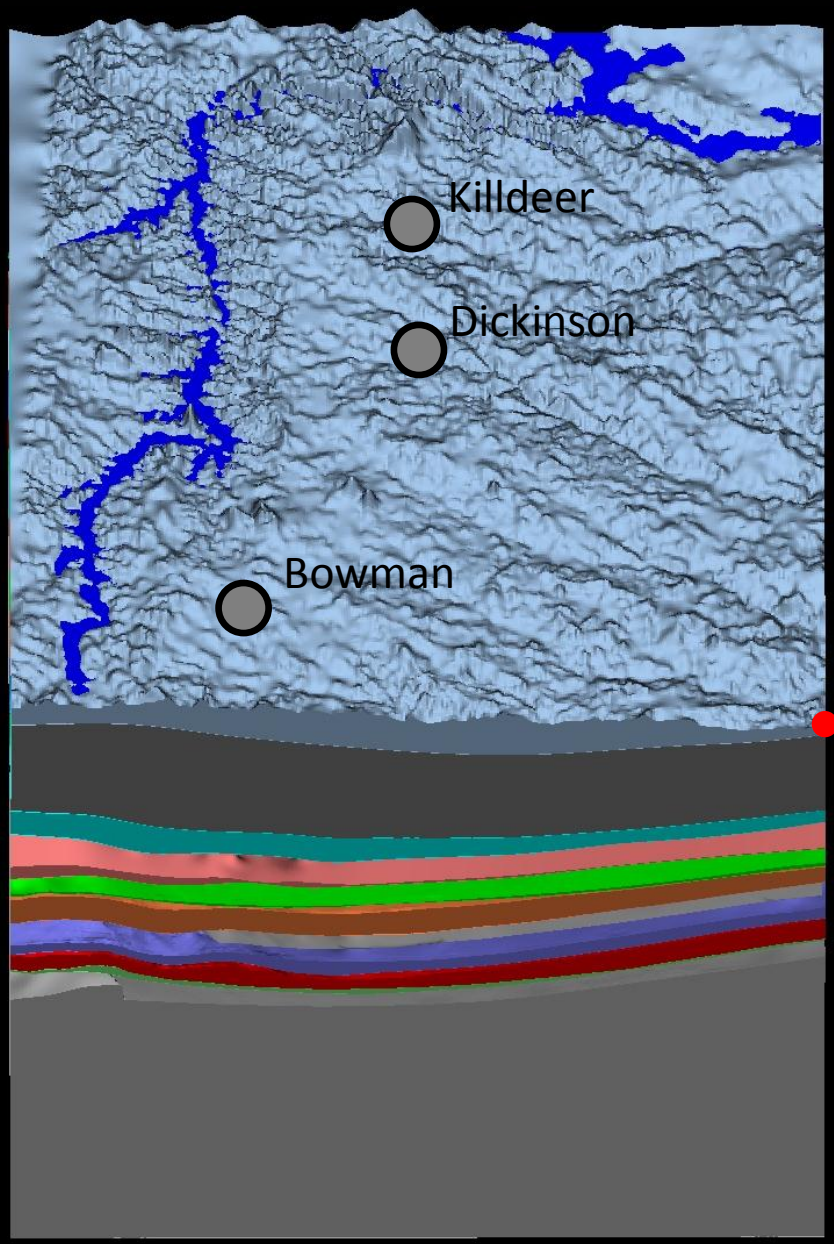

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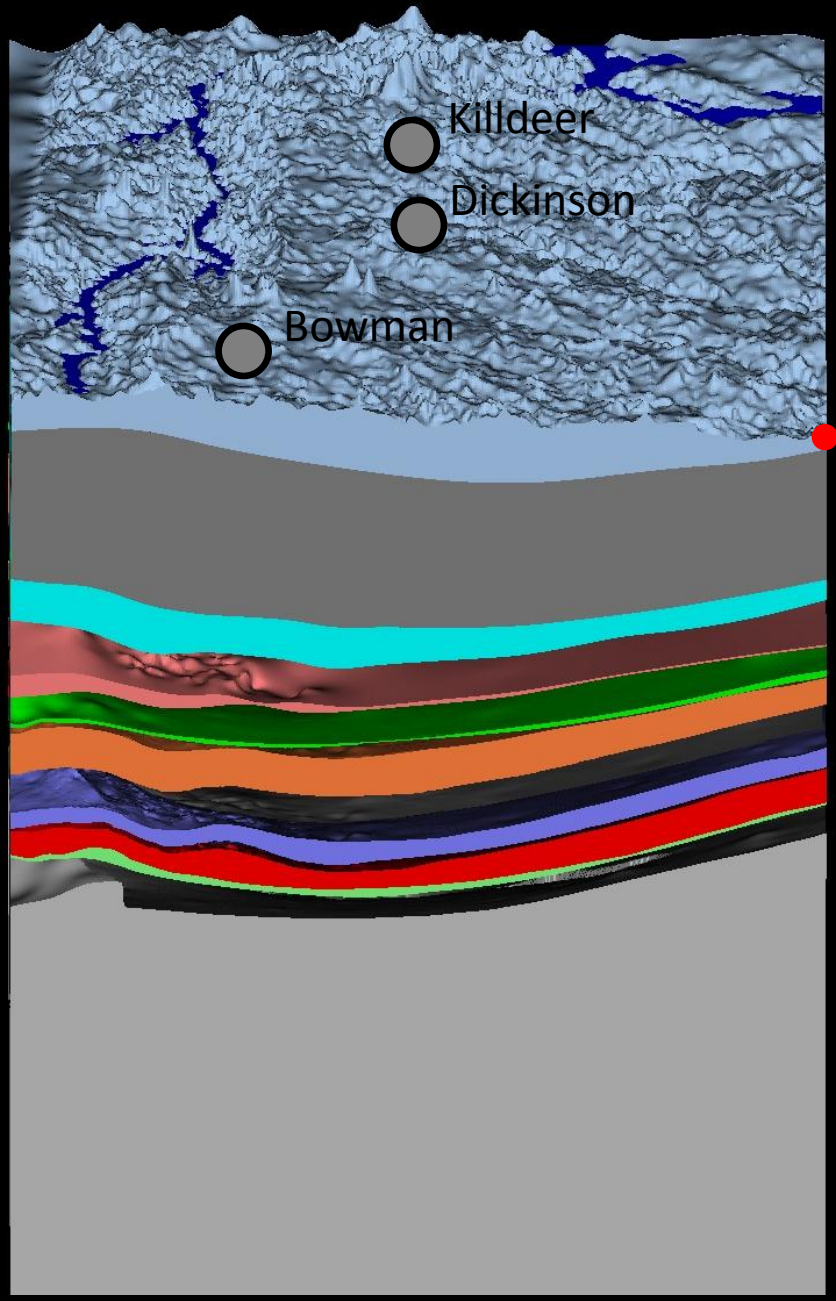

West ←

→ East

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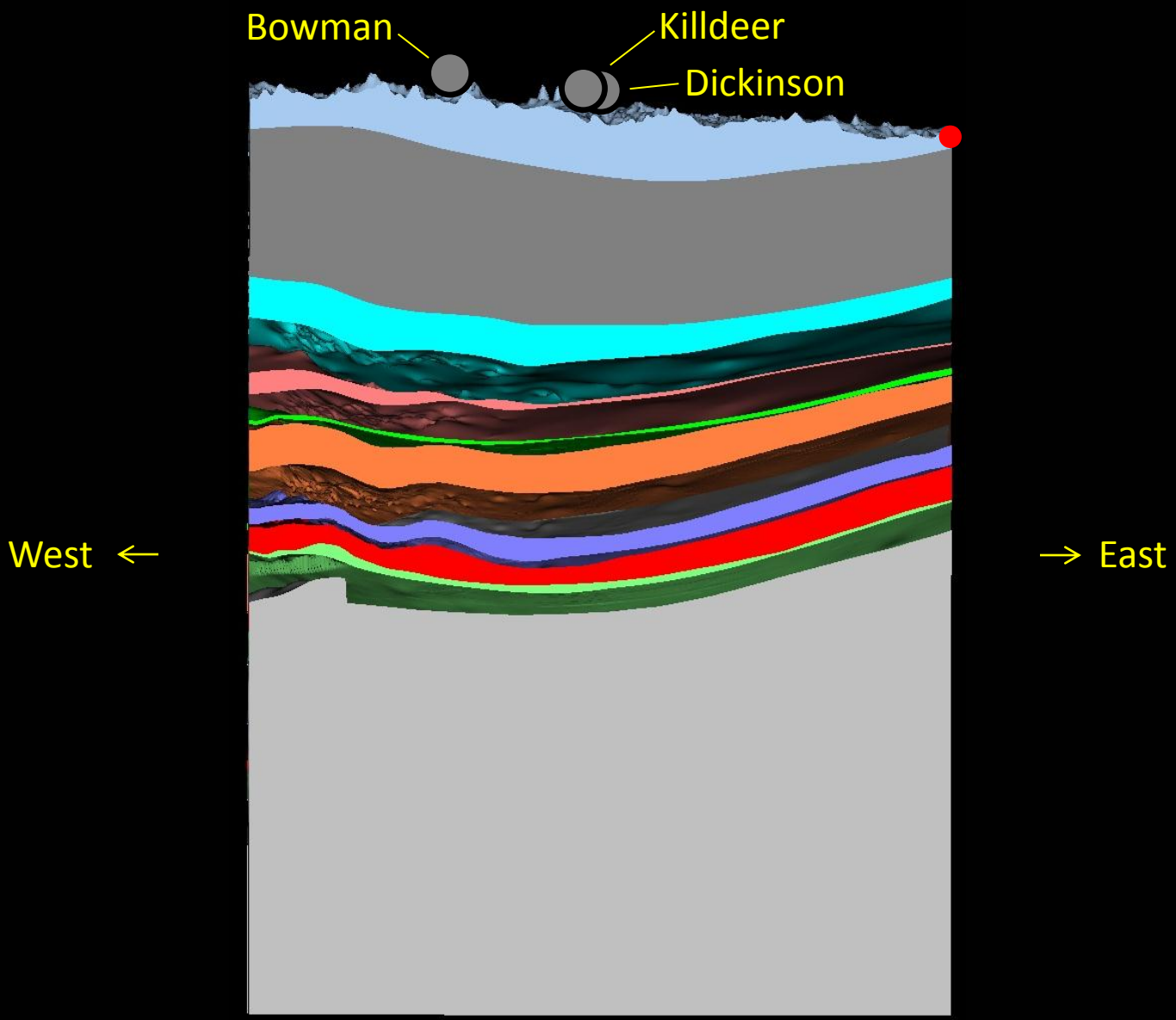

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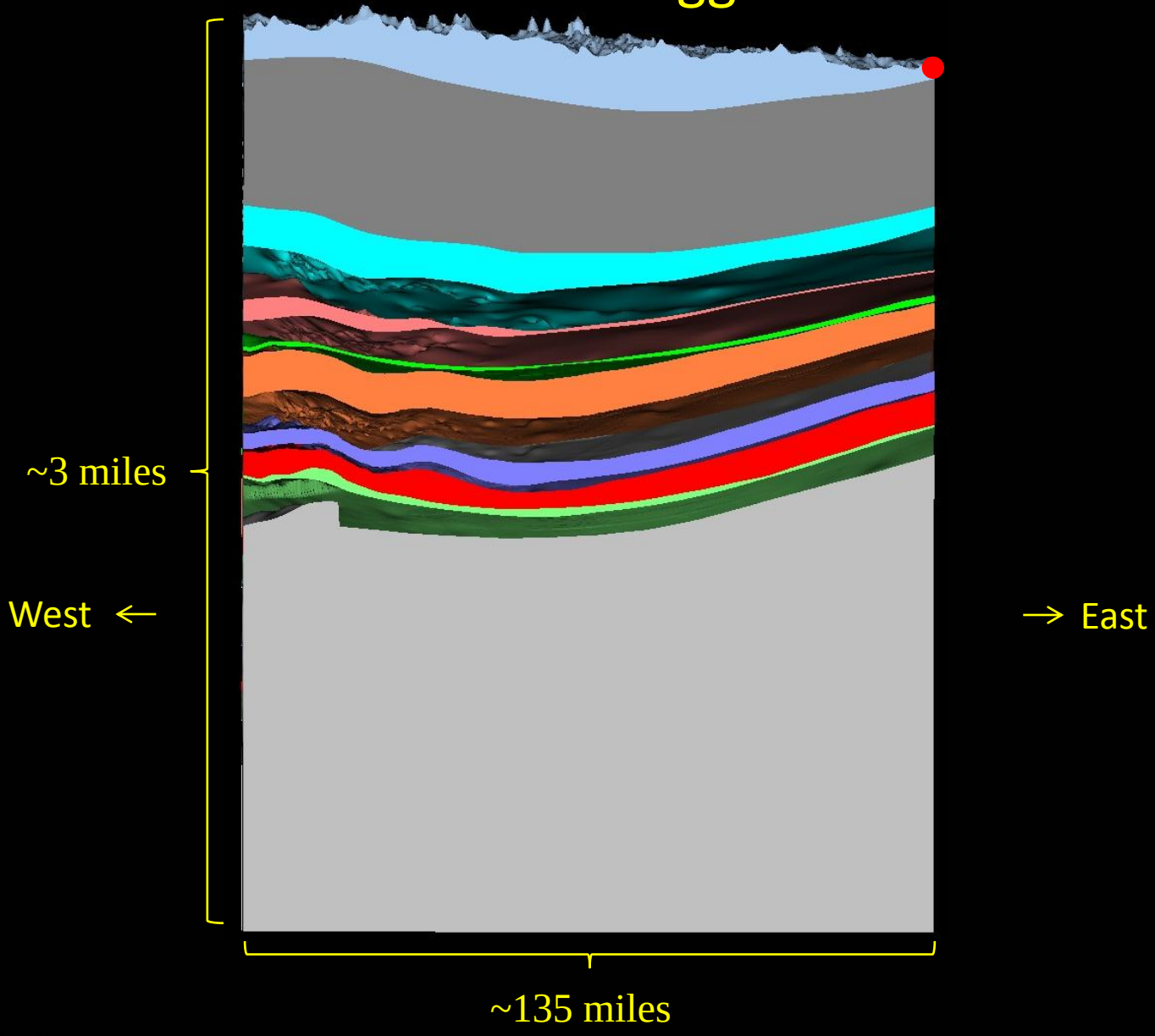
50:1 Vertical Exaggeration



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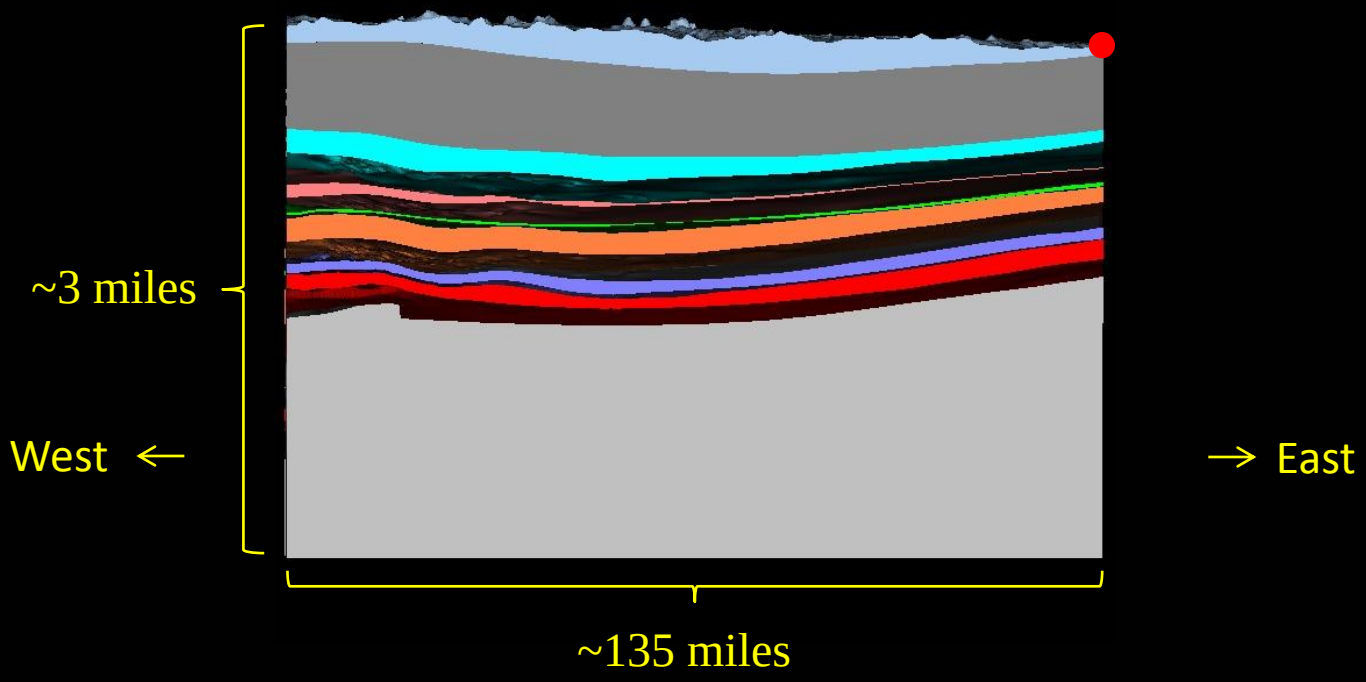
25:1 Vertical Exaggeration



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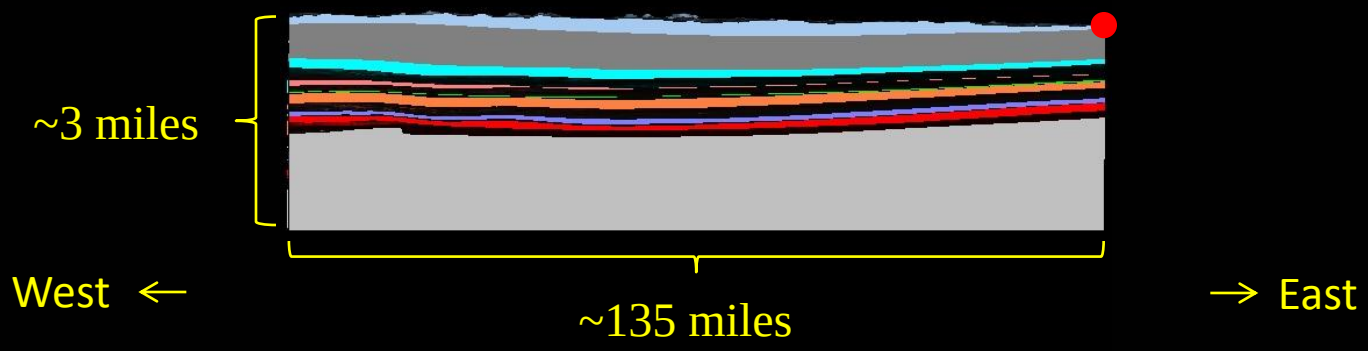
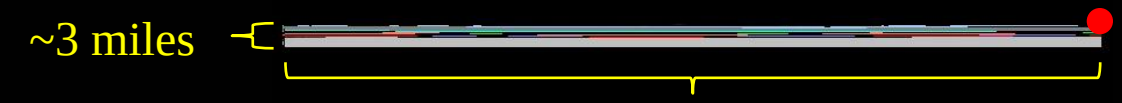
10:1 Vertical Exaggeration



1:1 Vertical Exaggeration

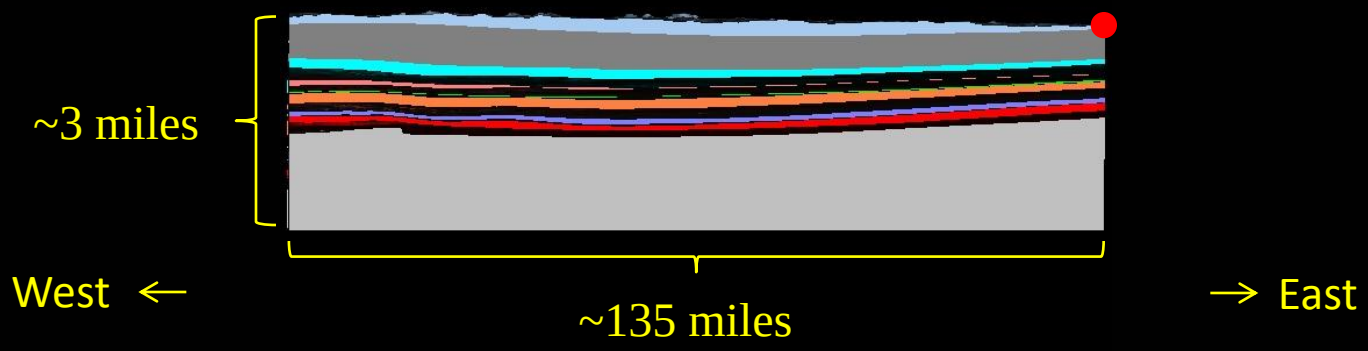


~135 miles

West ←

→ East

10:1 Vertical Exaggeration



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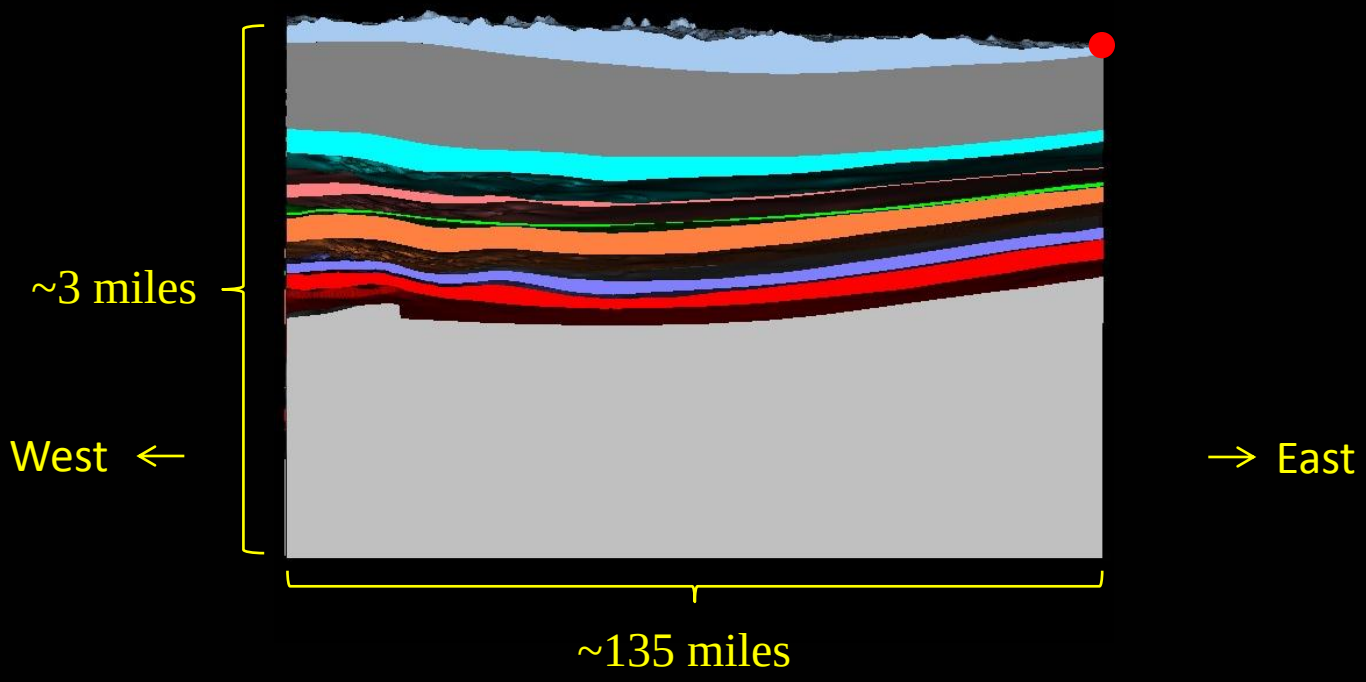

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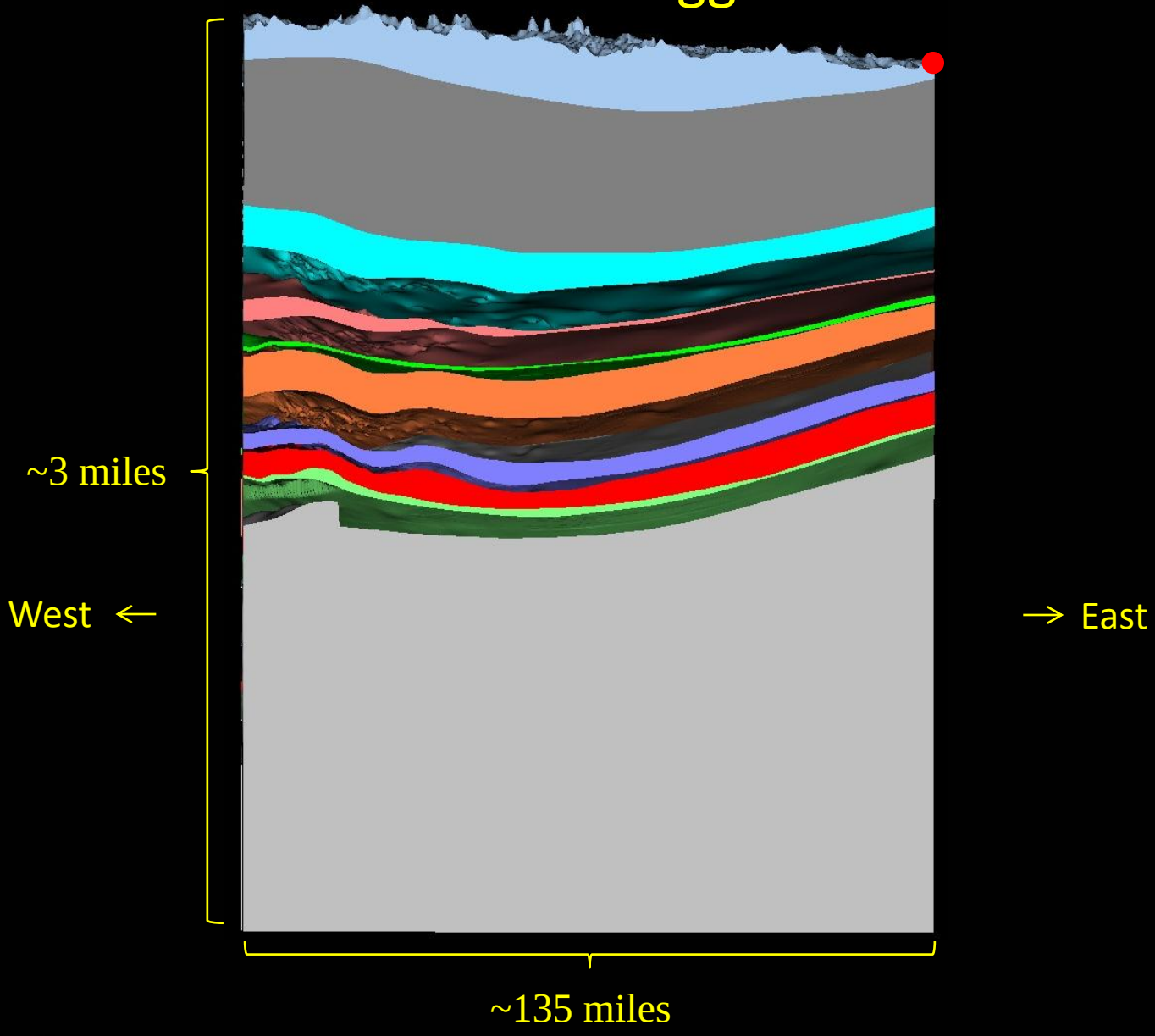

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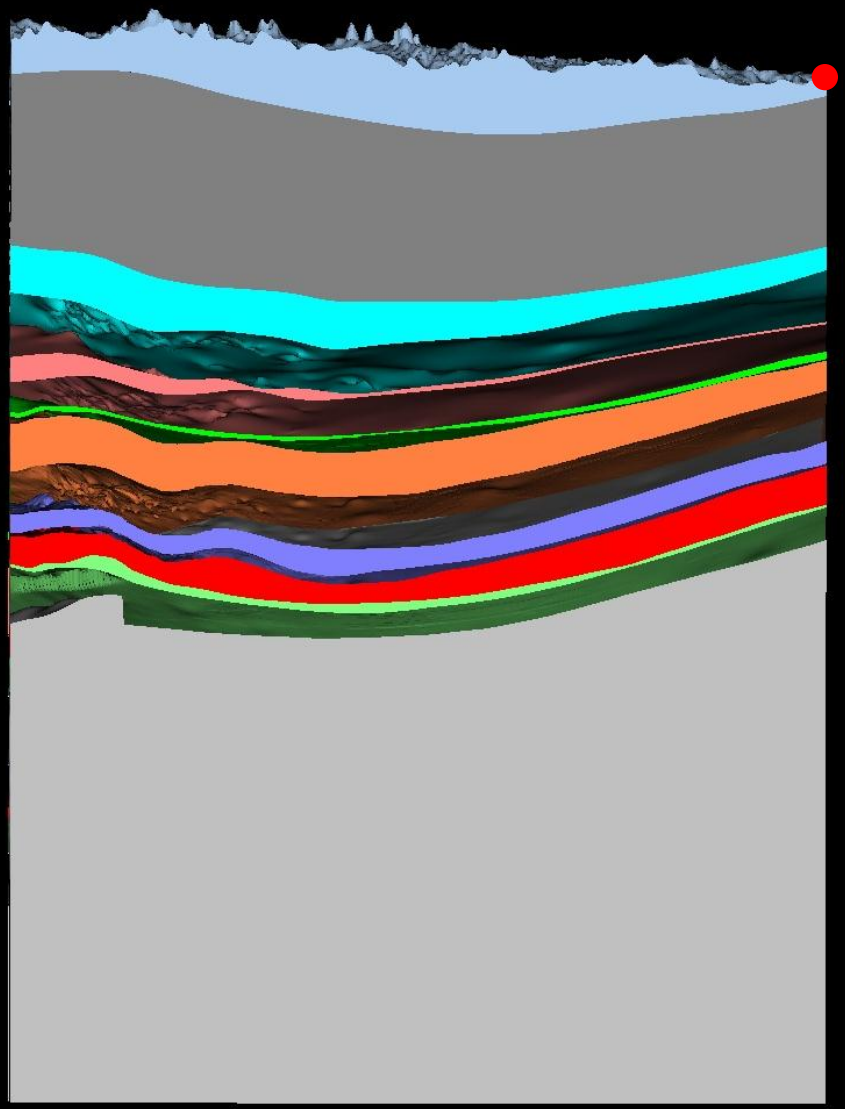

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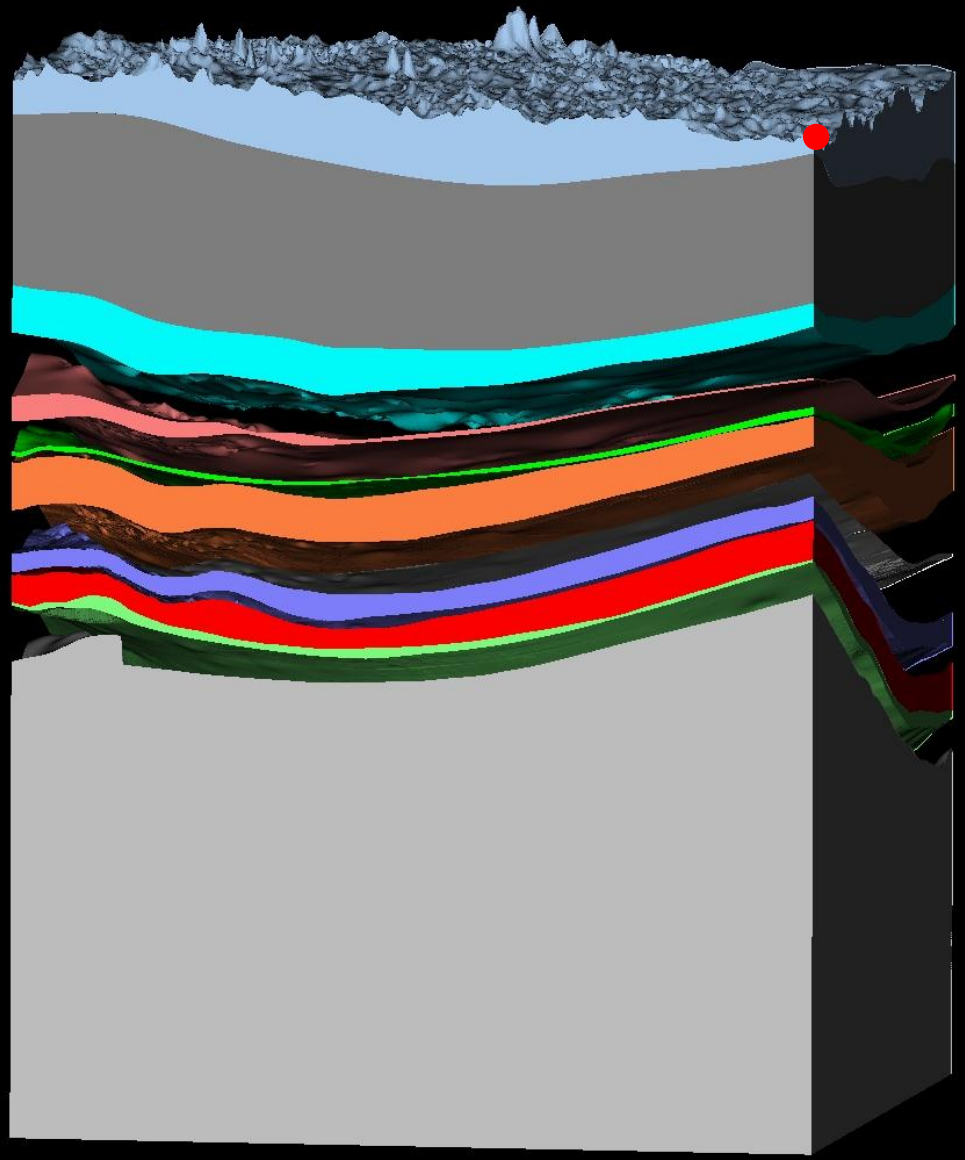

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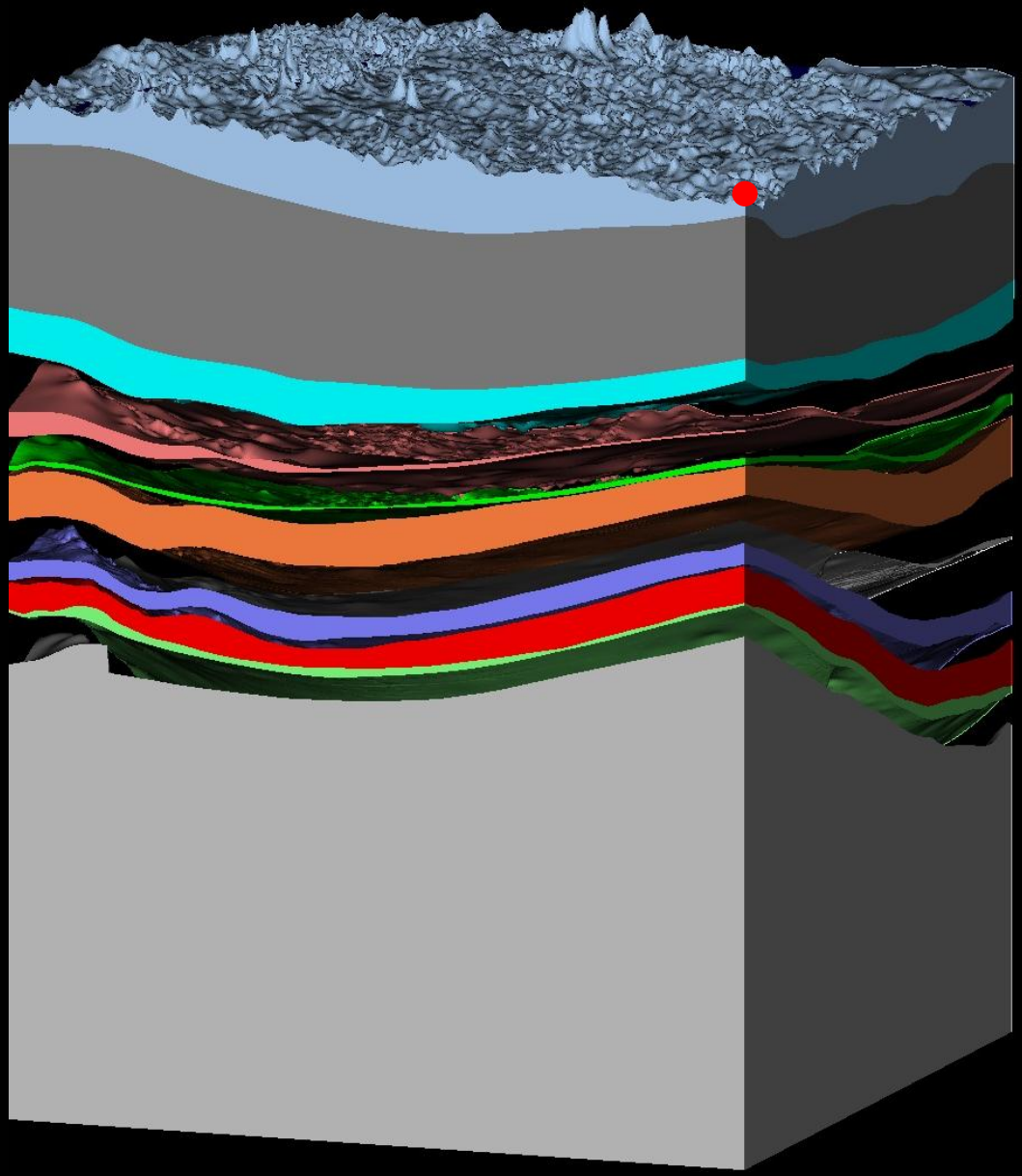

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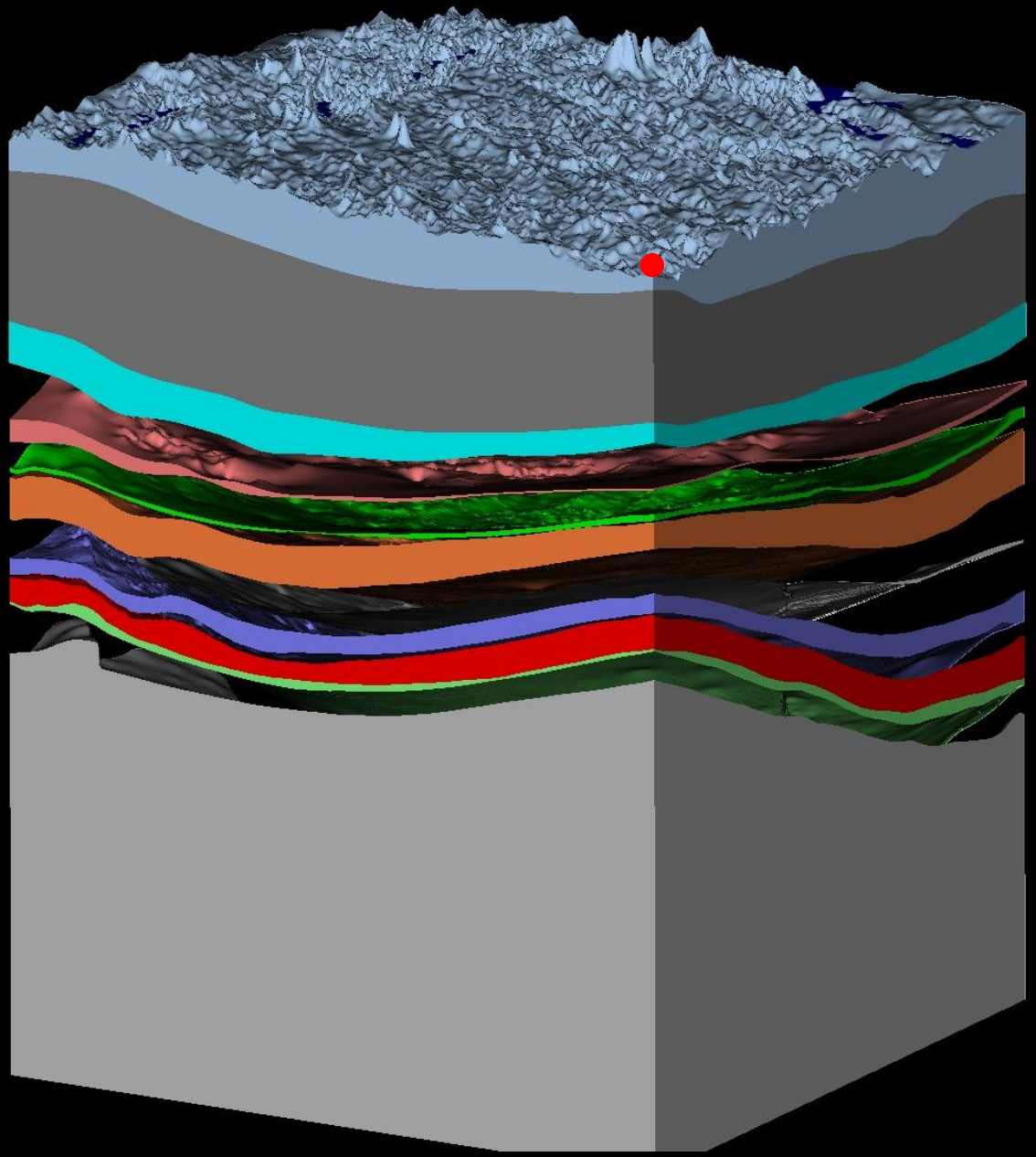

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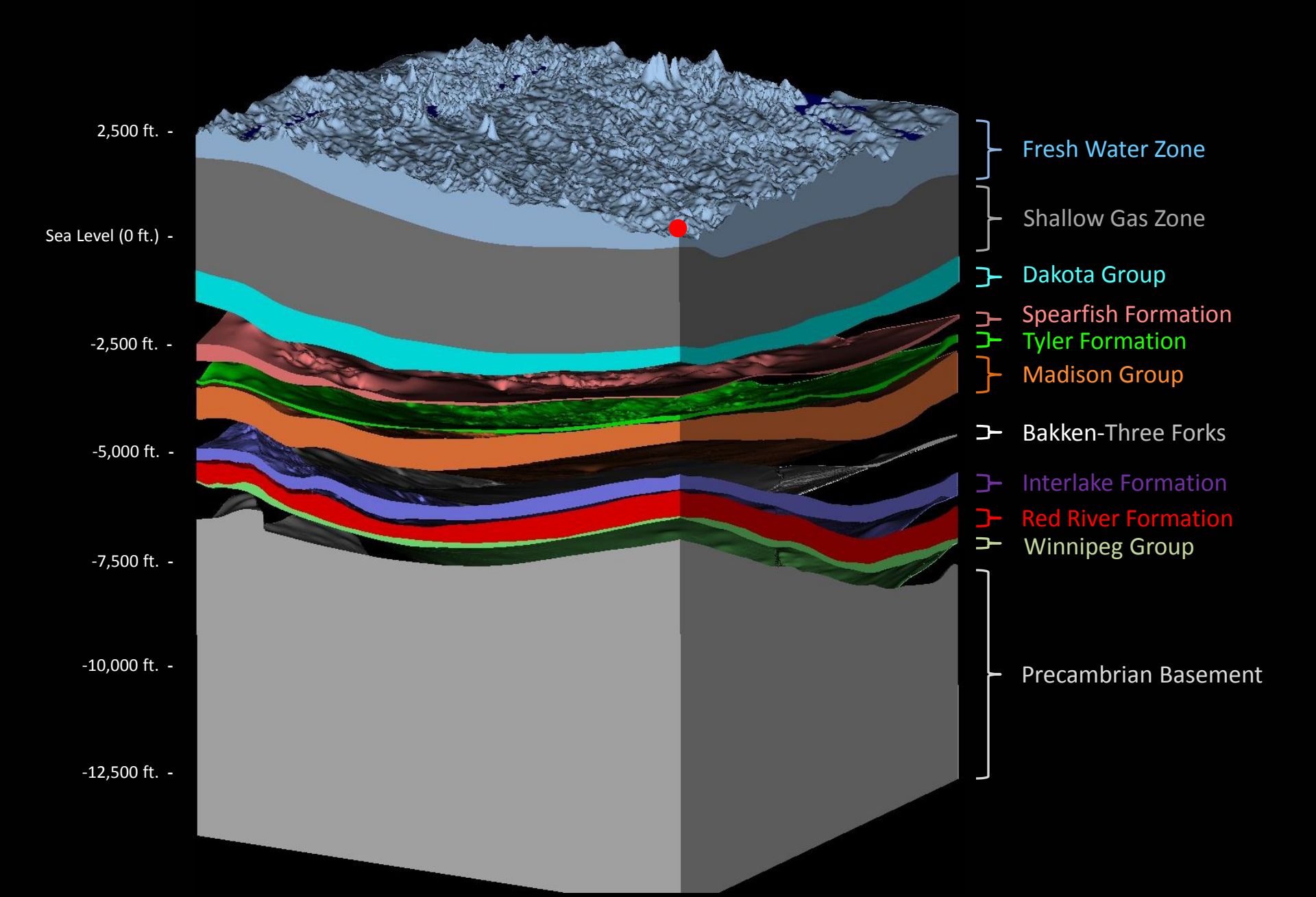

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*Numerous other formations are present beneath North Dakota's surface, but are not included in the above model.

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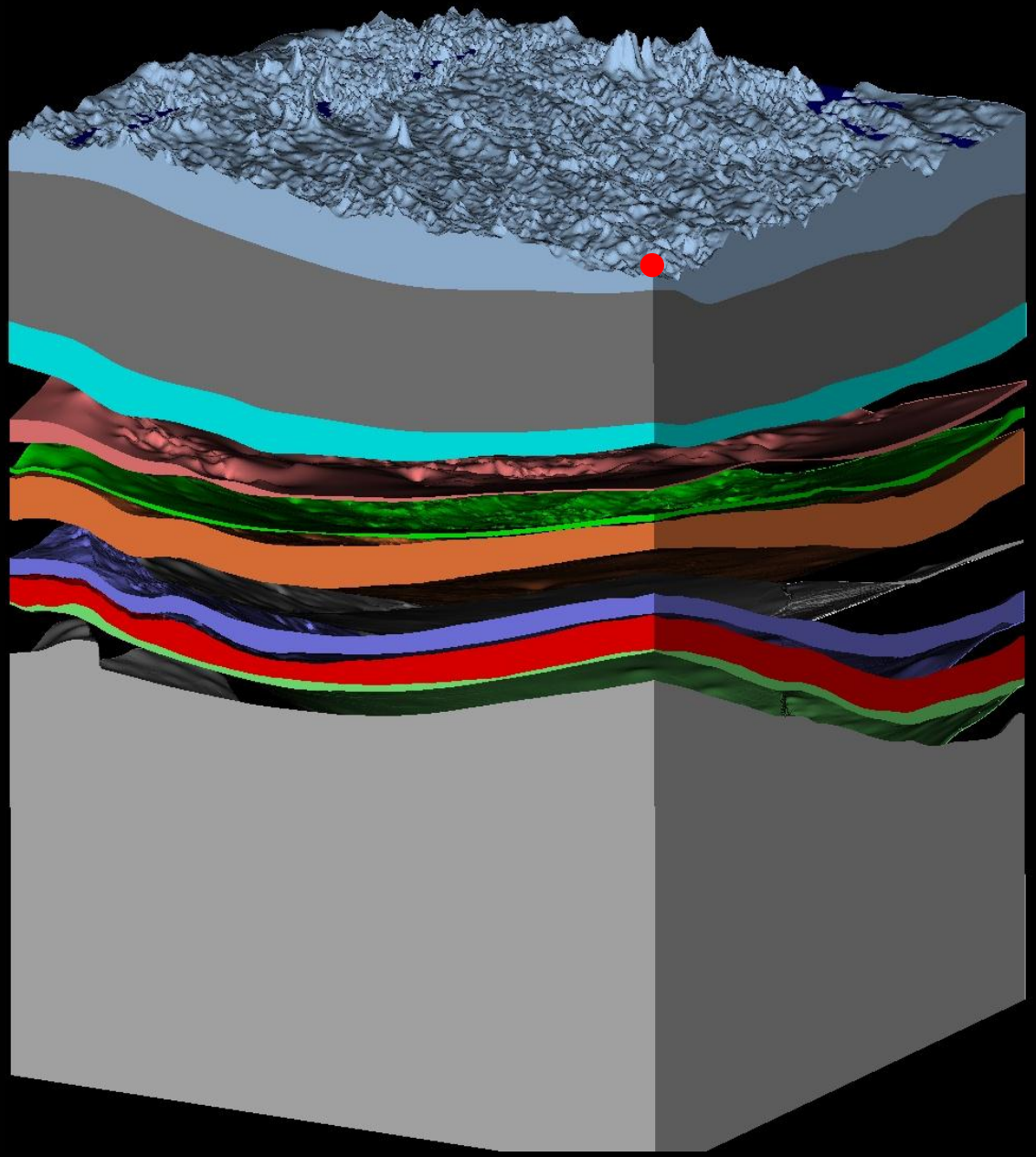

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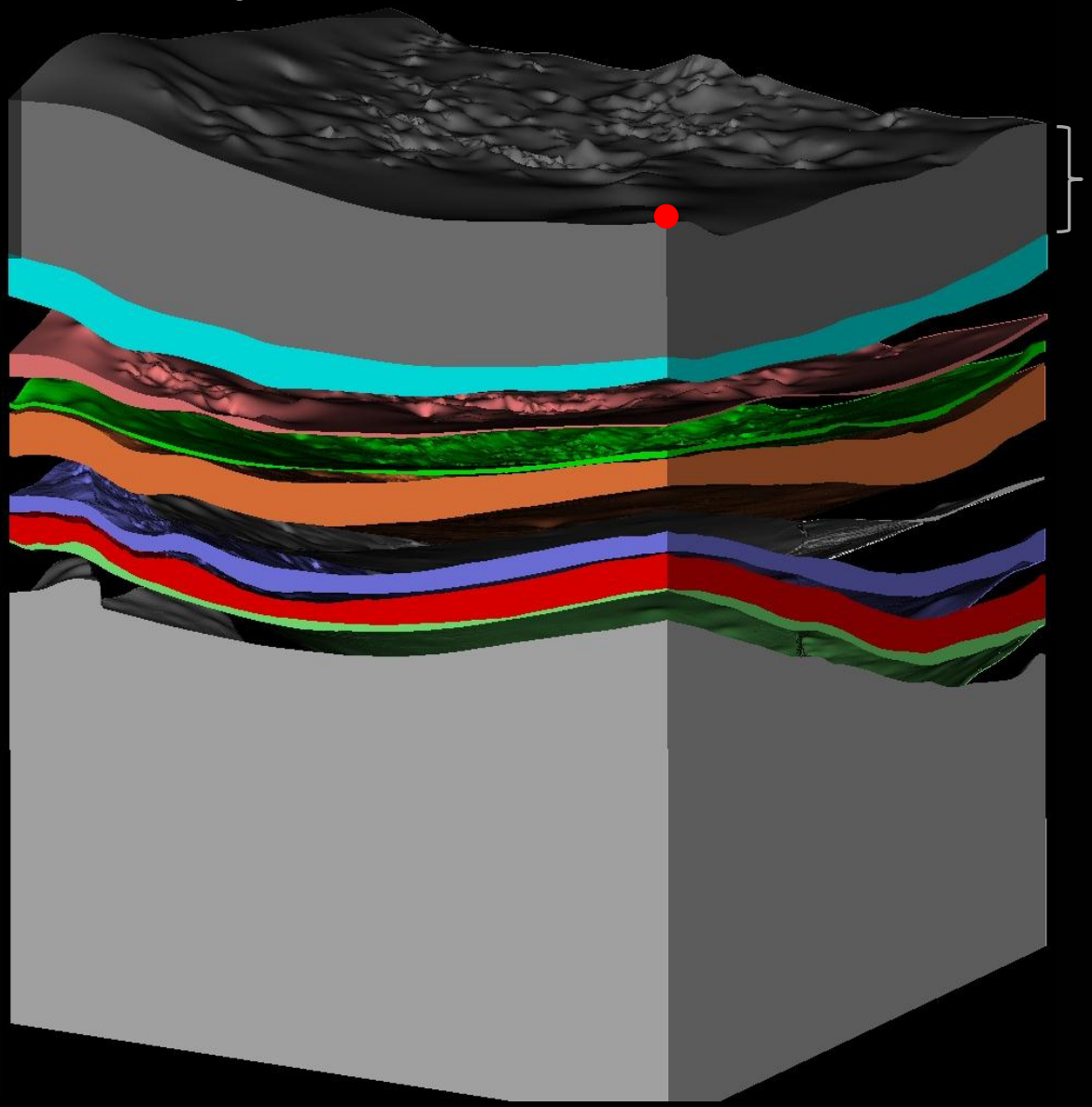
Shallow Gas Prospects

-Pierre Fm.
-Niobrara Fm.
-Carlile Fm.
-Greenhorn Fm.



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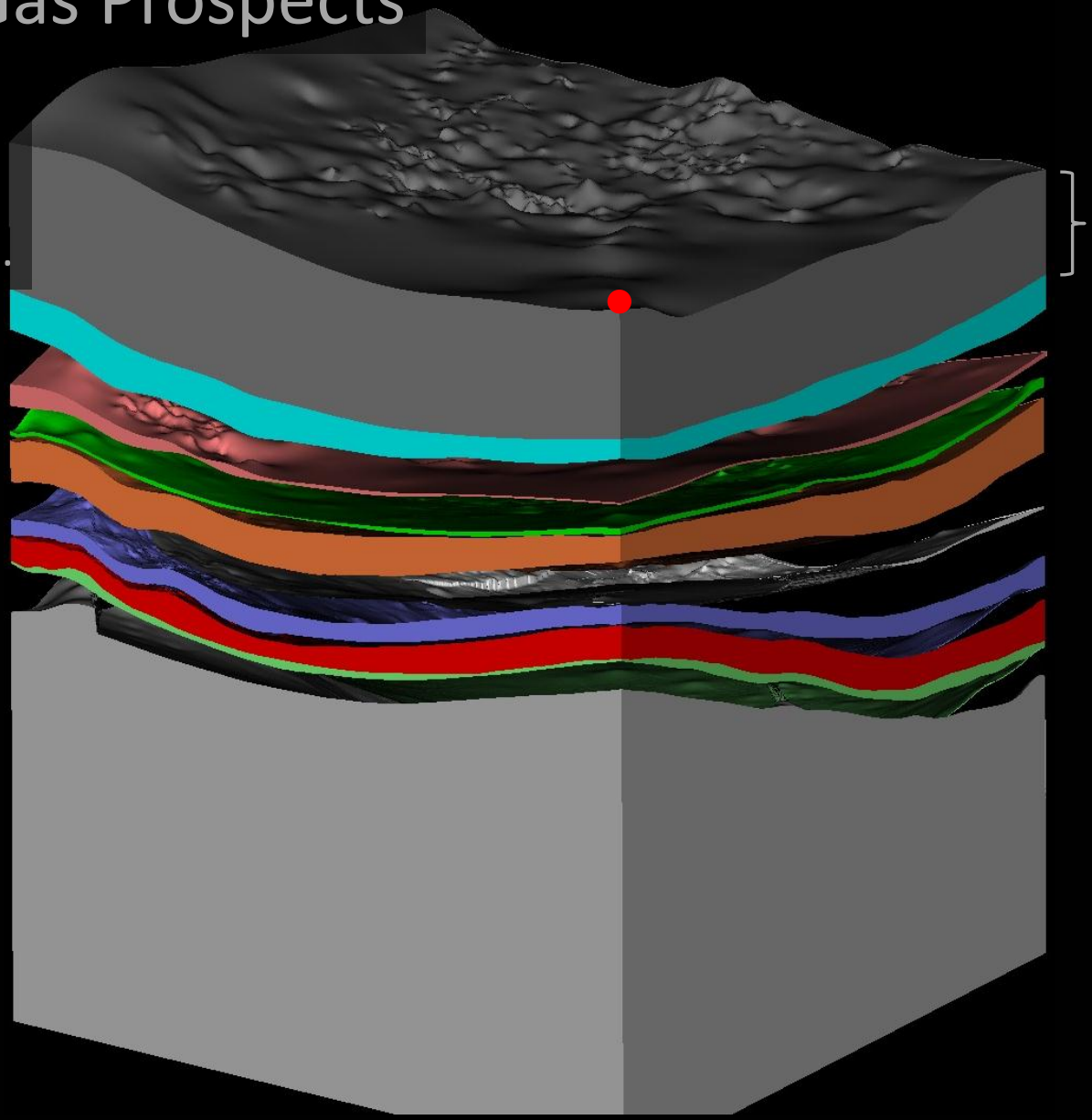

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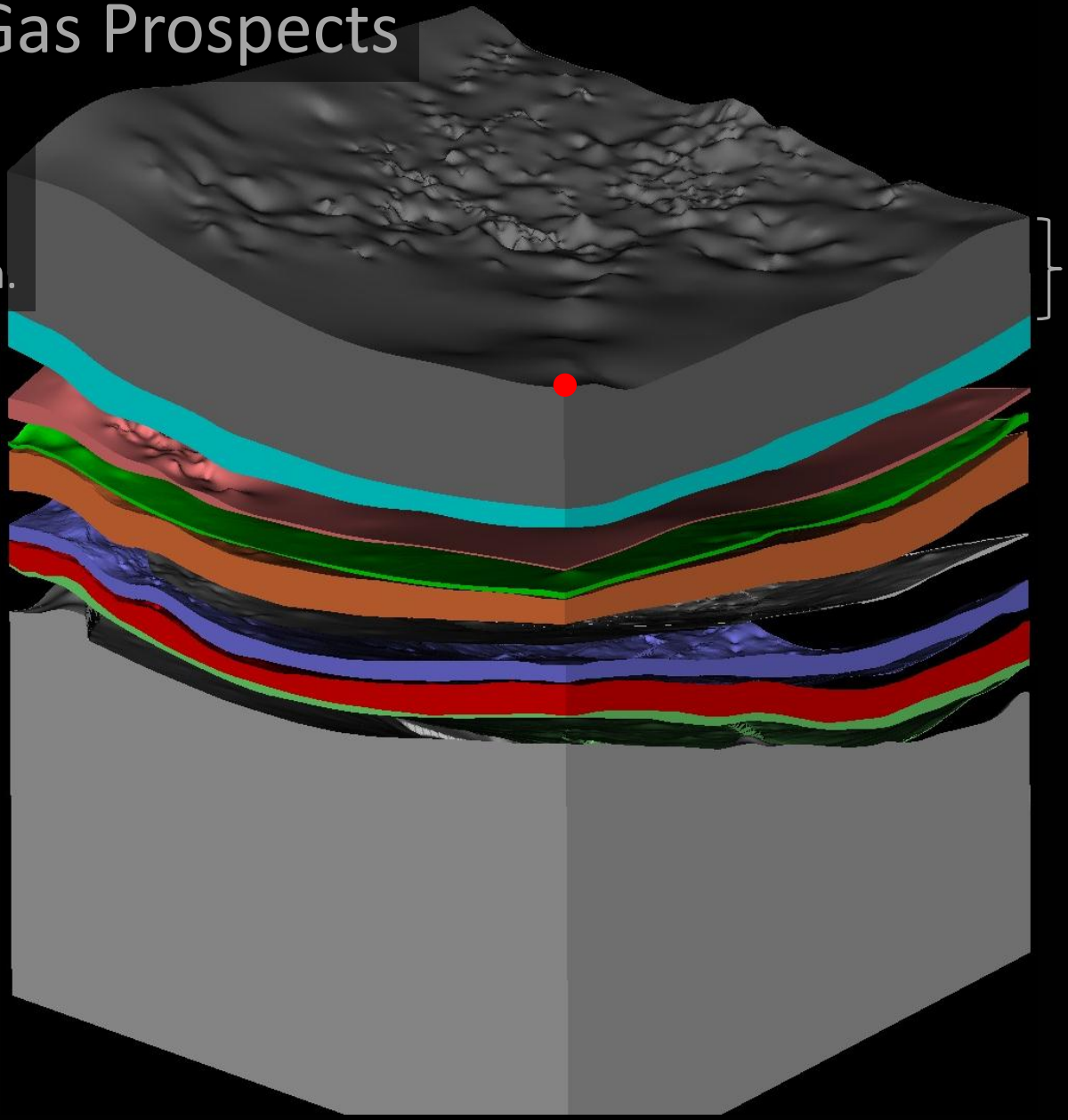

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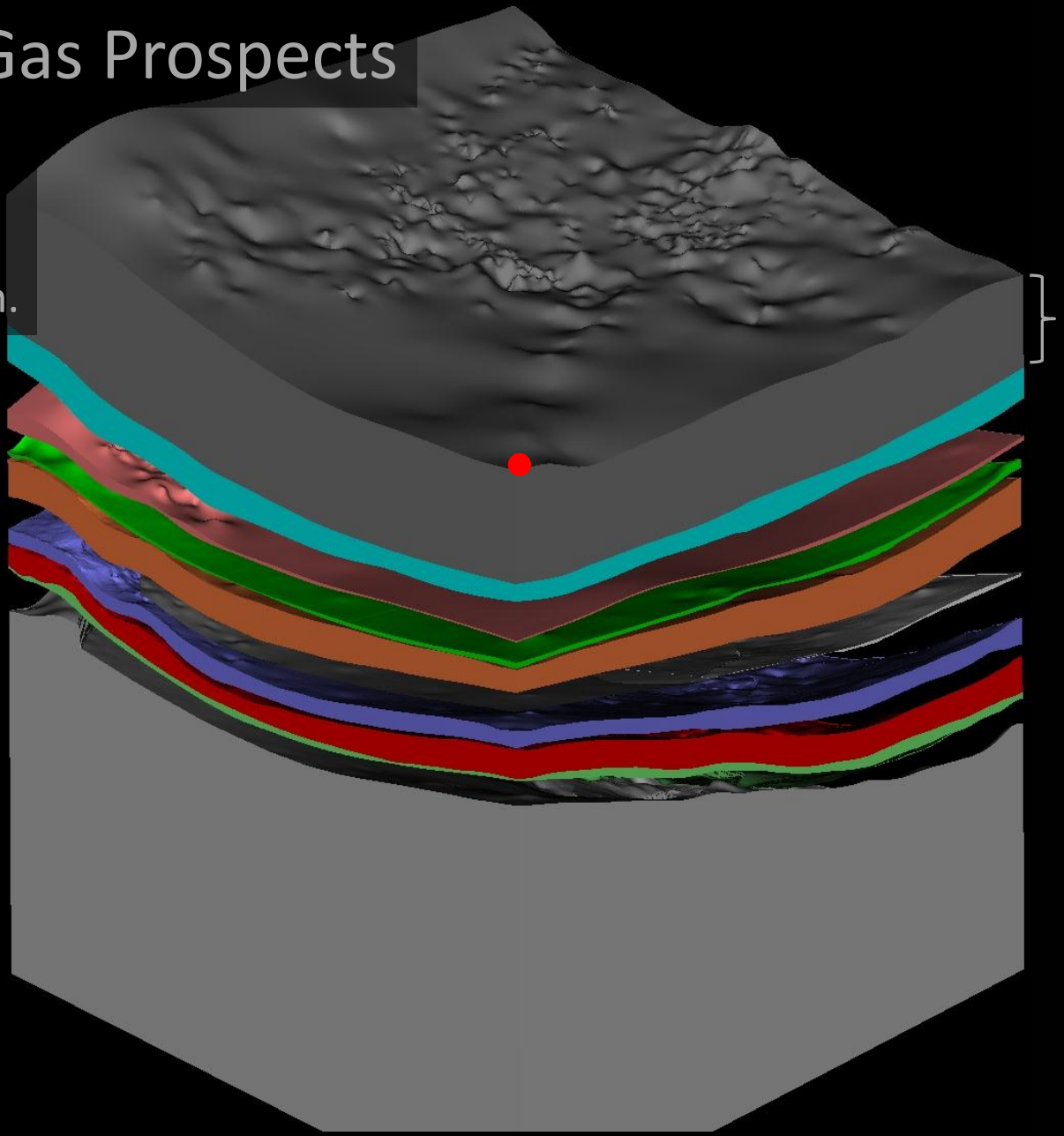

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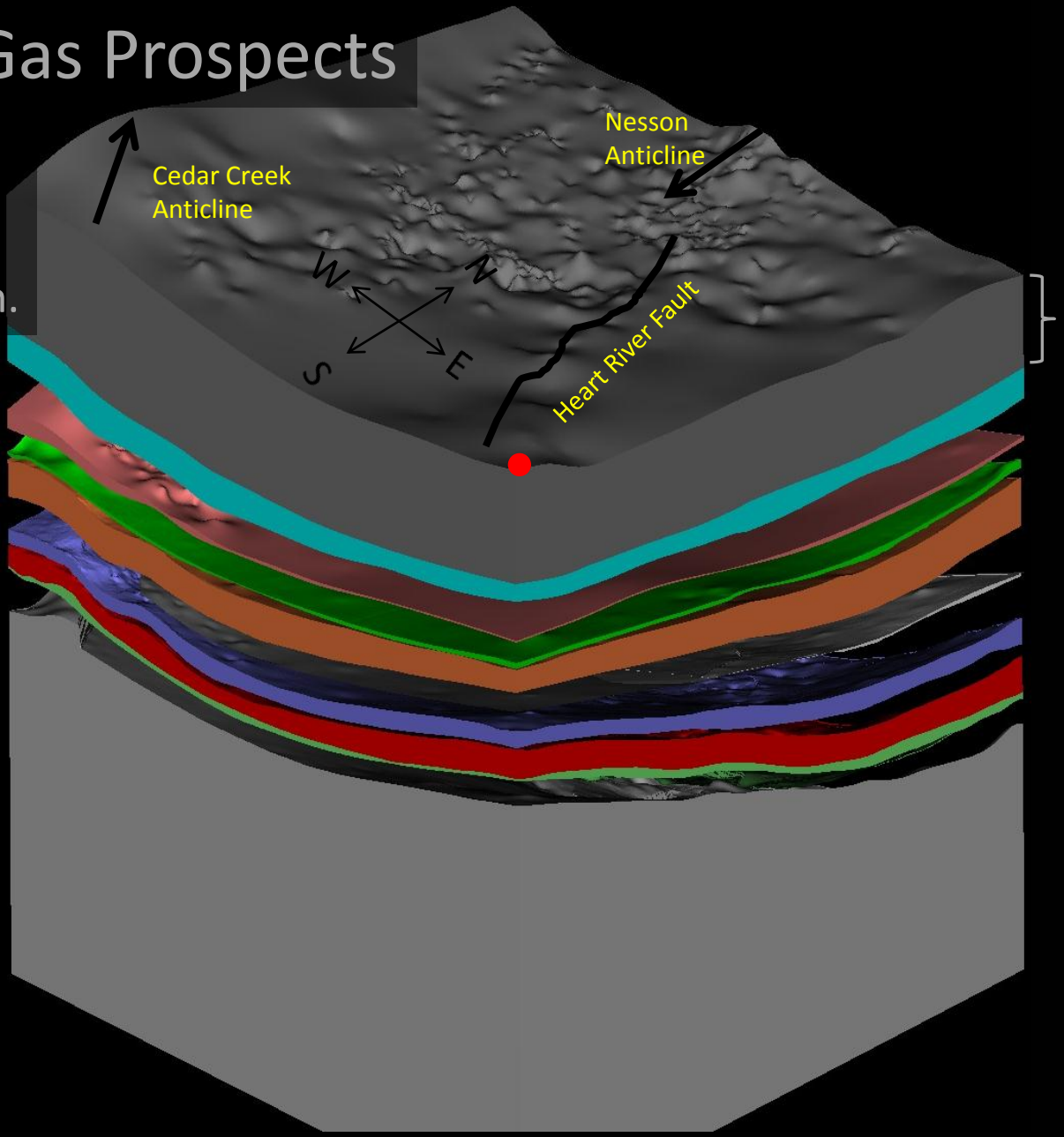

Pierre Fm.
Grey silty shale

Niobrara Fm.
Greyish-brown chalky shale

Carlile Fm.
Grey shale

Greenhorn Fm.
Greyish-green silty shale

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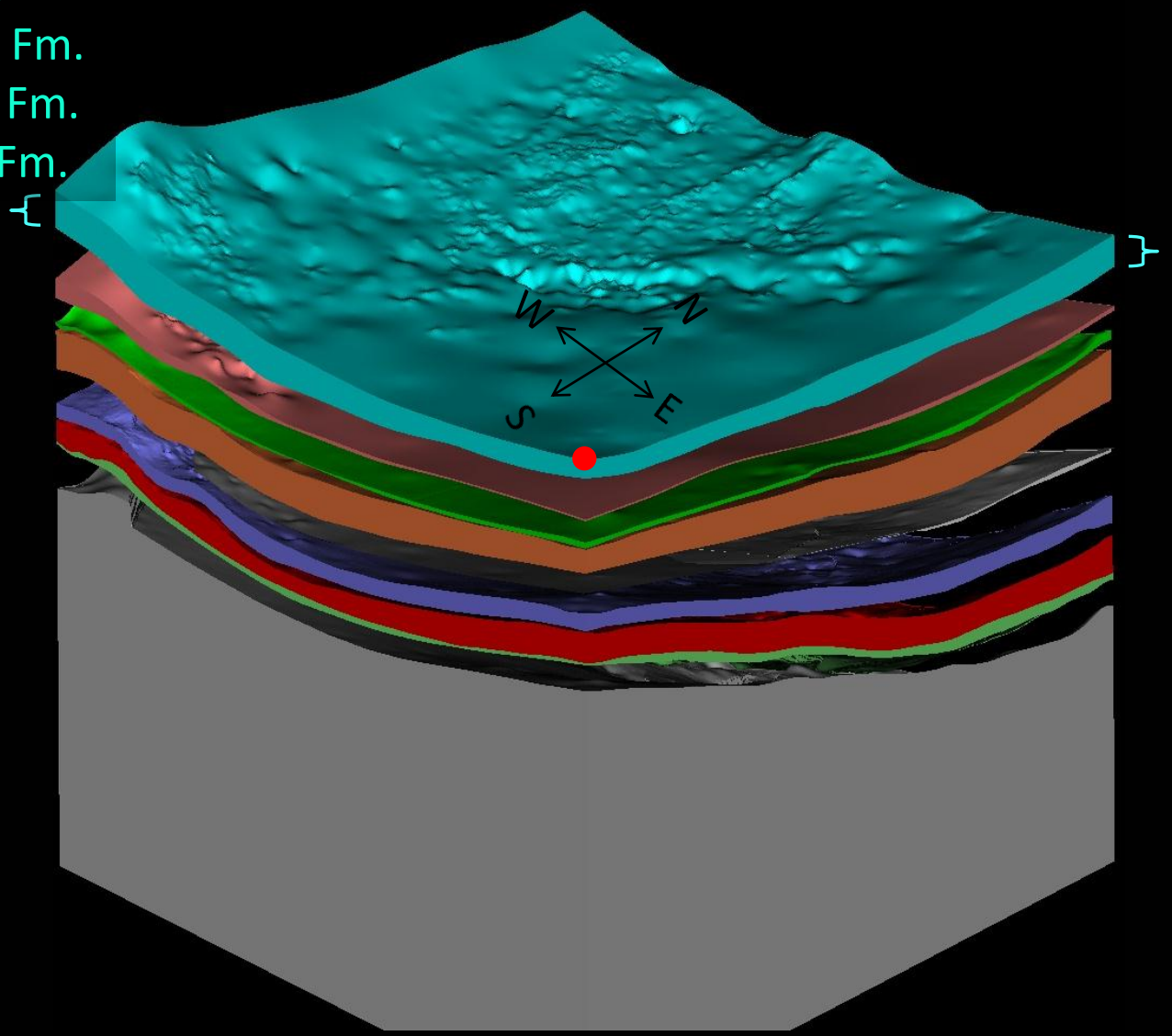
Dakota Group

-Mowry Fm.
-New Castle Fm.
-Skull Creek Fm.
-Inyan Kara Fm.



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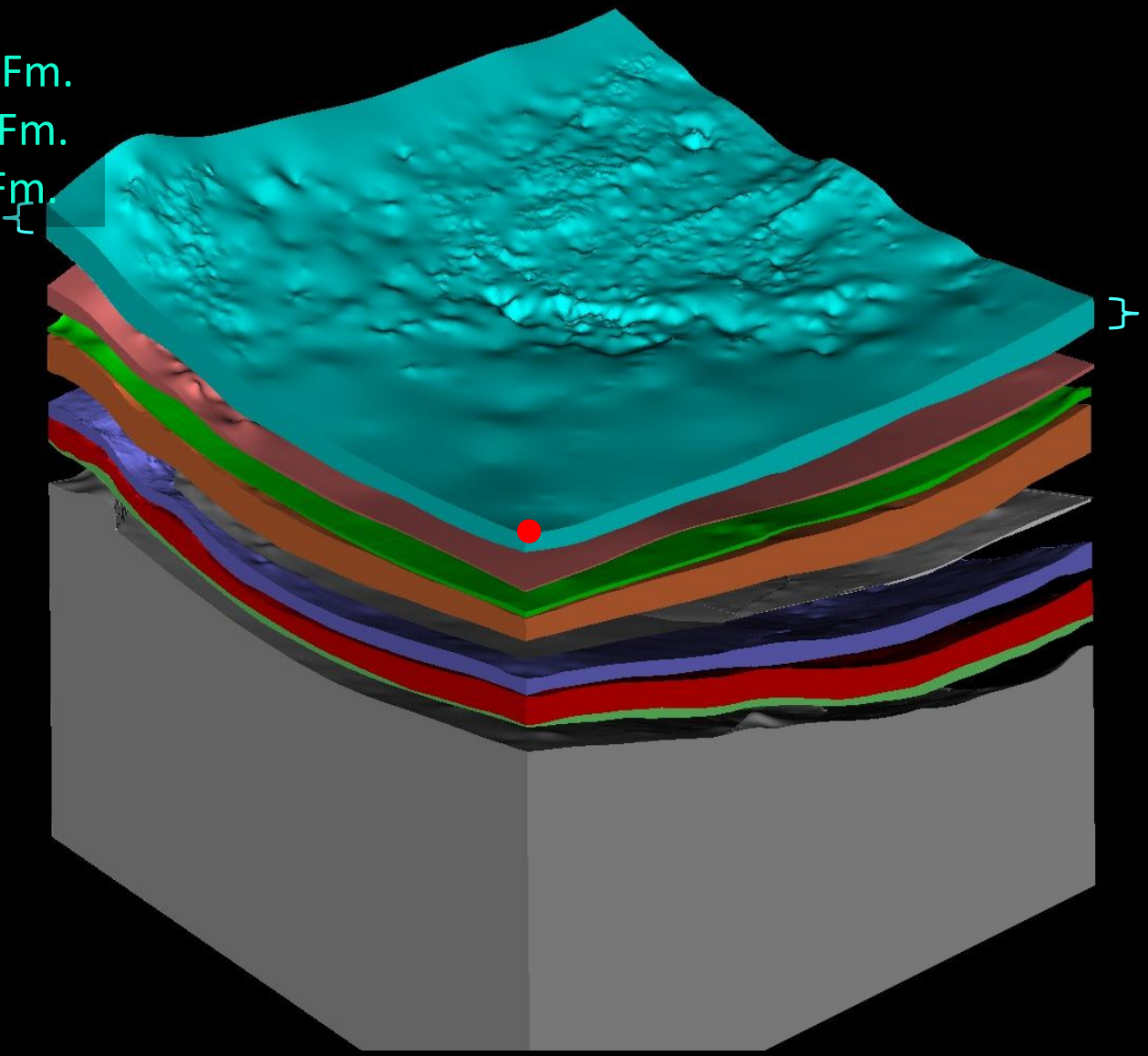

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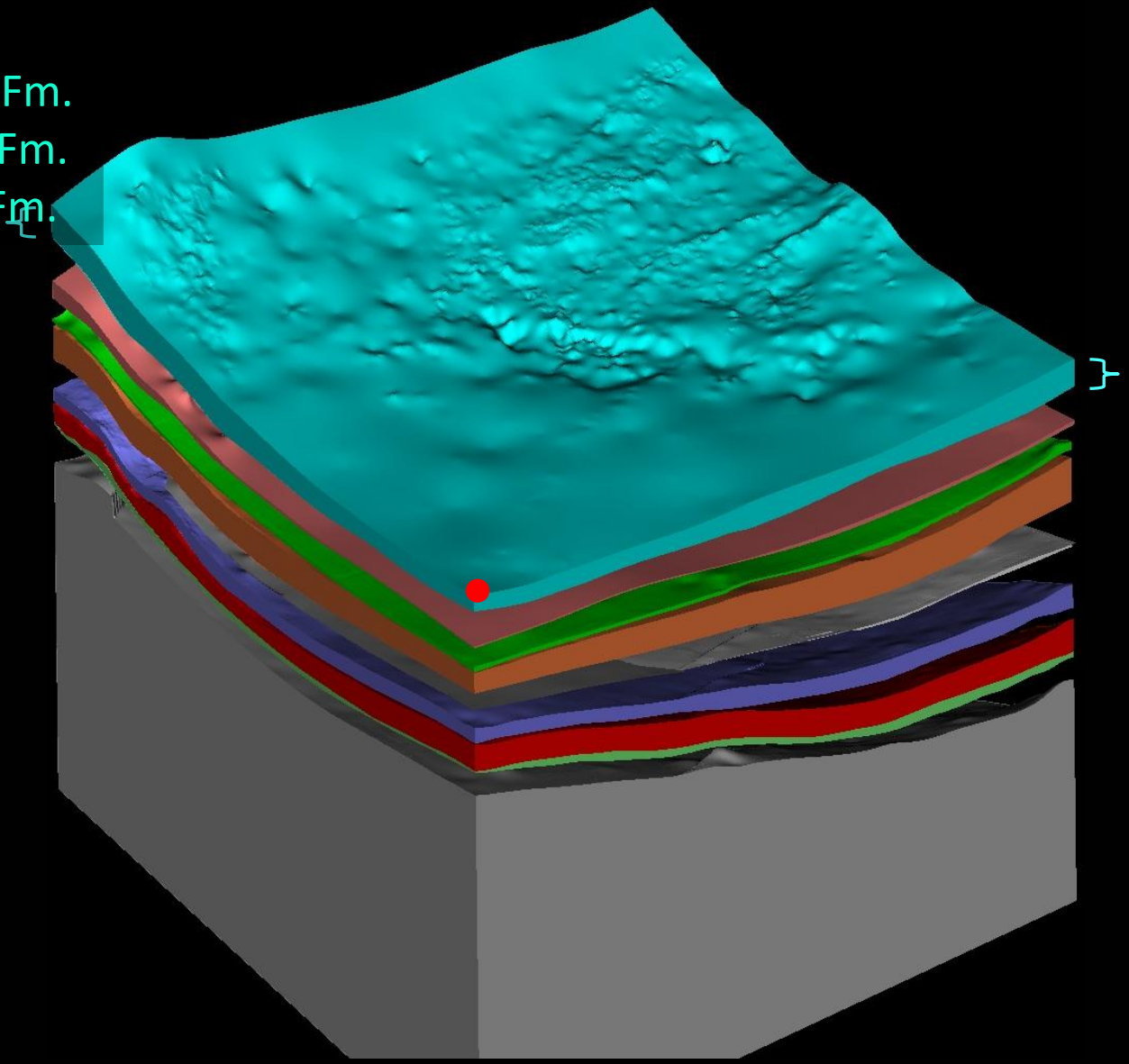

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Dakota Group

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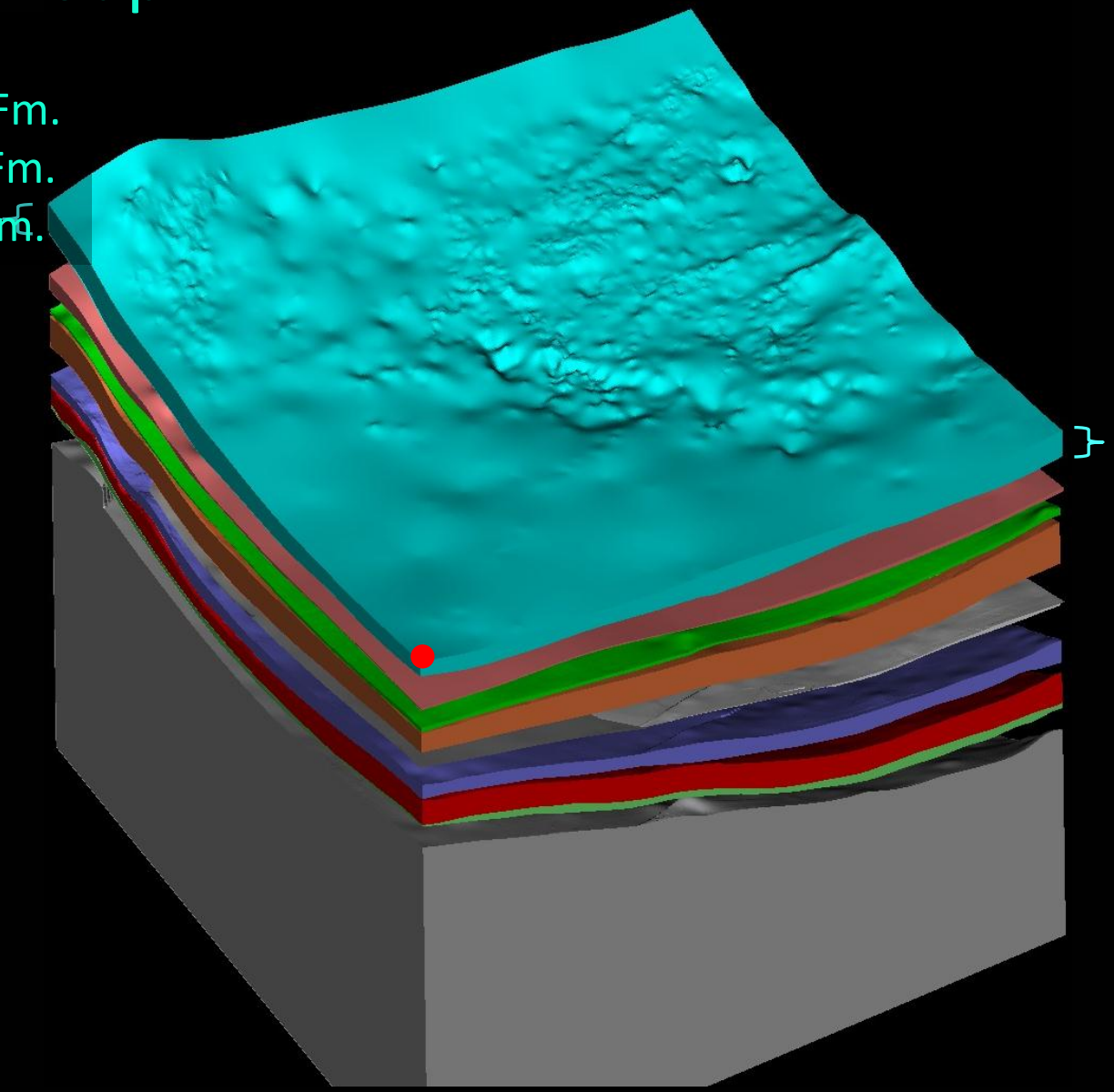

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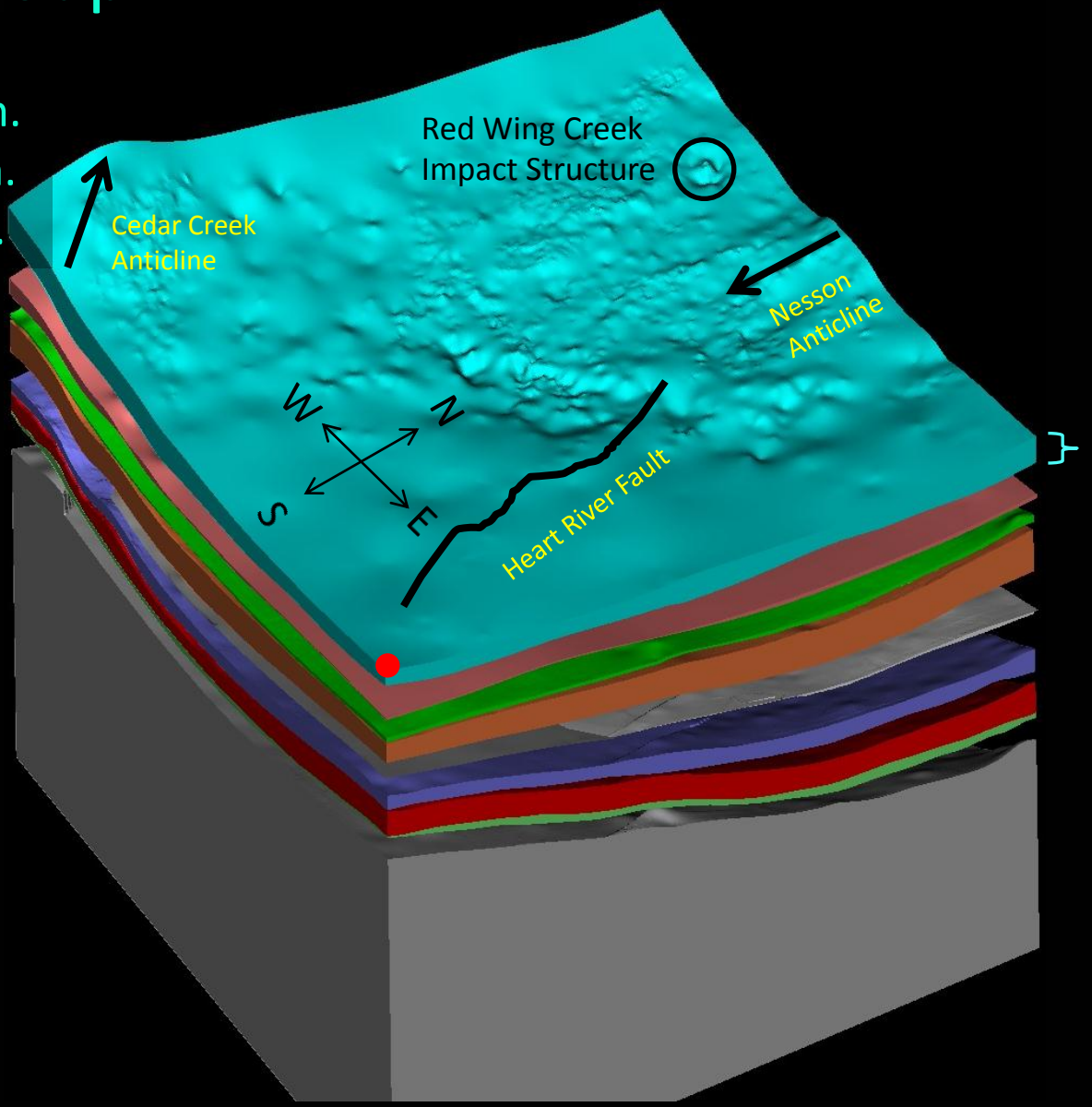

Inyan Kara Fm.
Core Example

Silty to sandy shale

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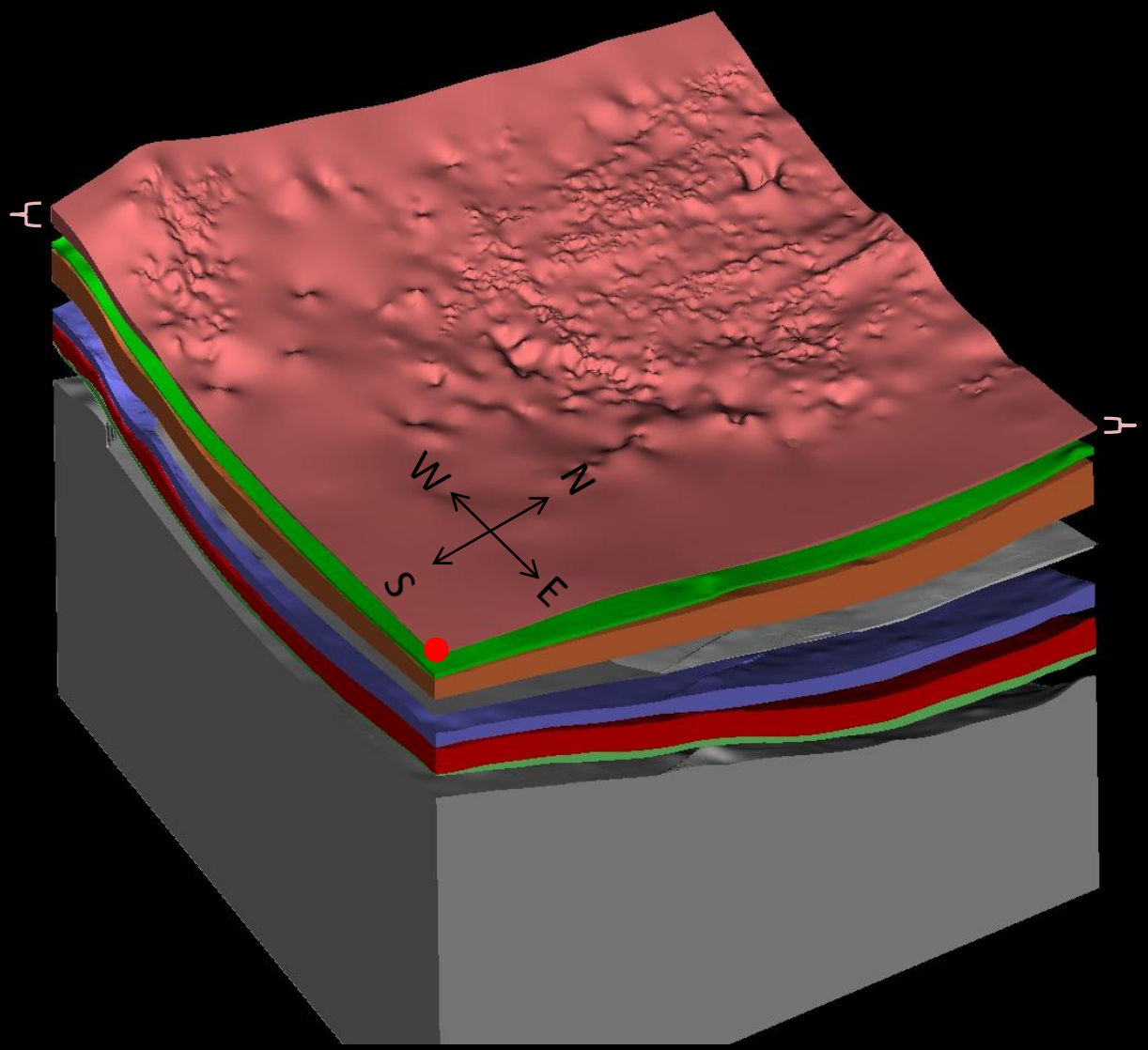
Spearfish Formation



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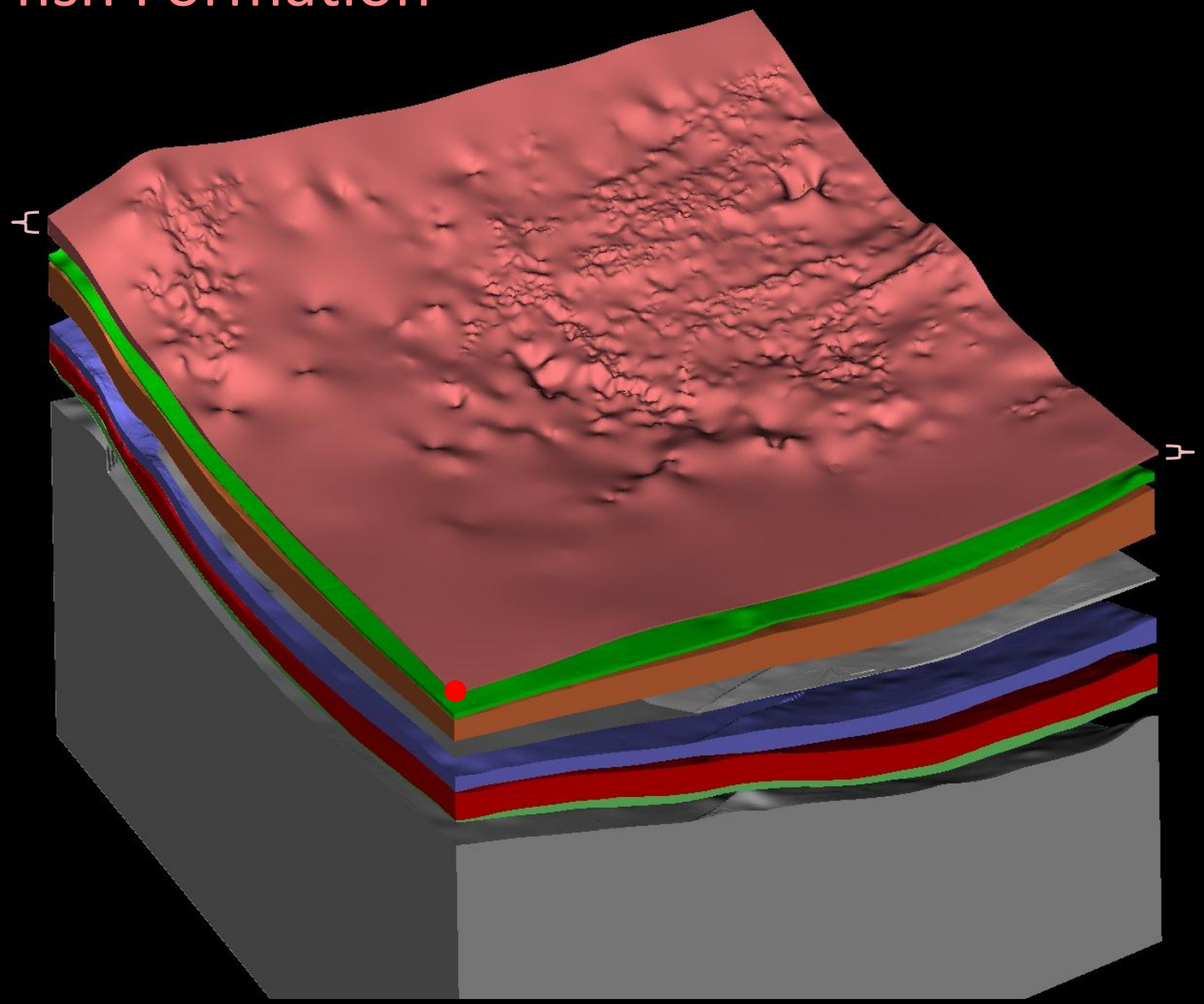
Spearfish Formation



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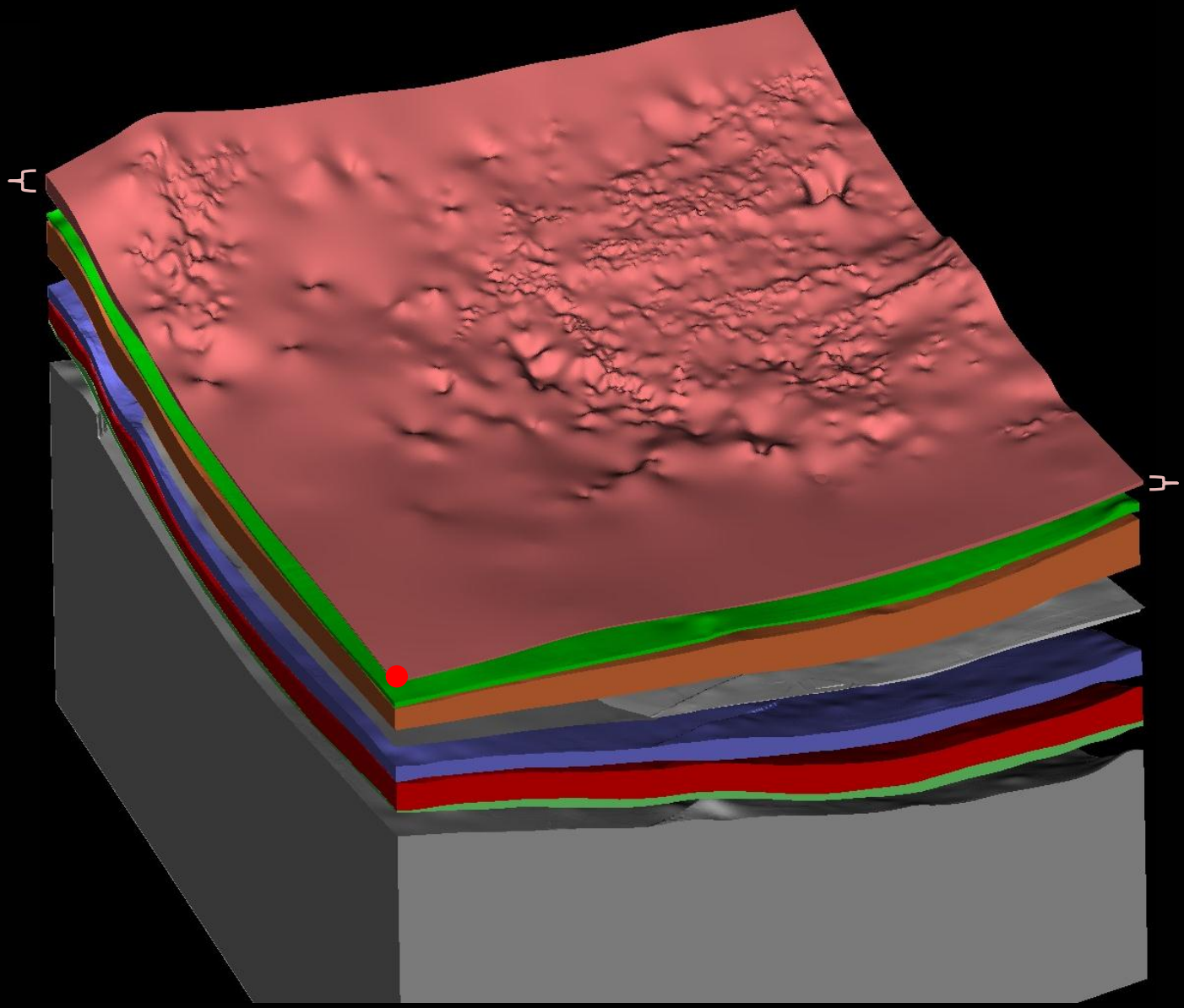

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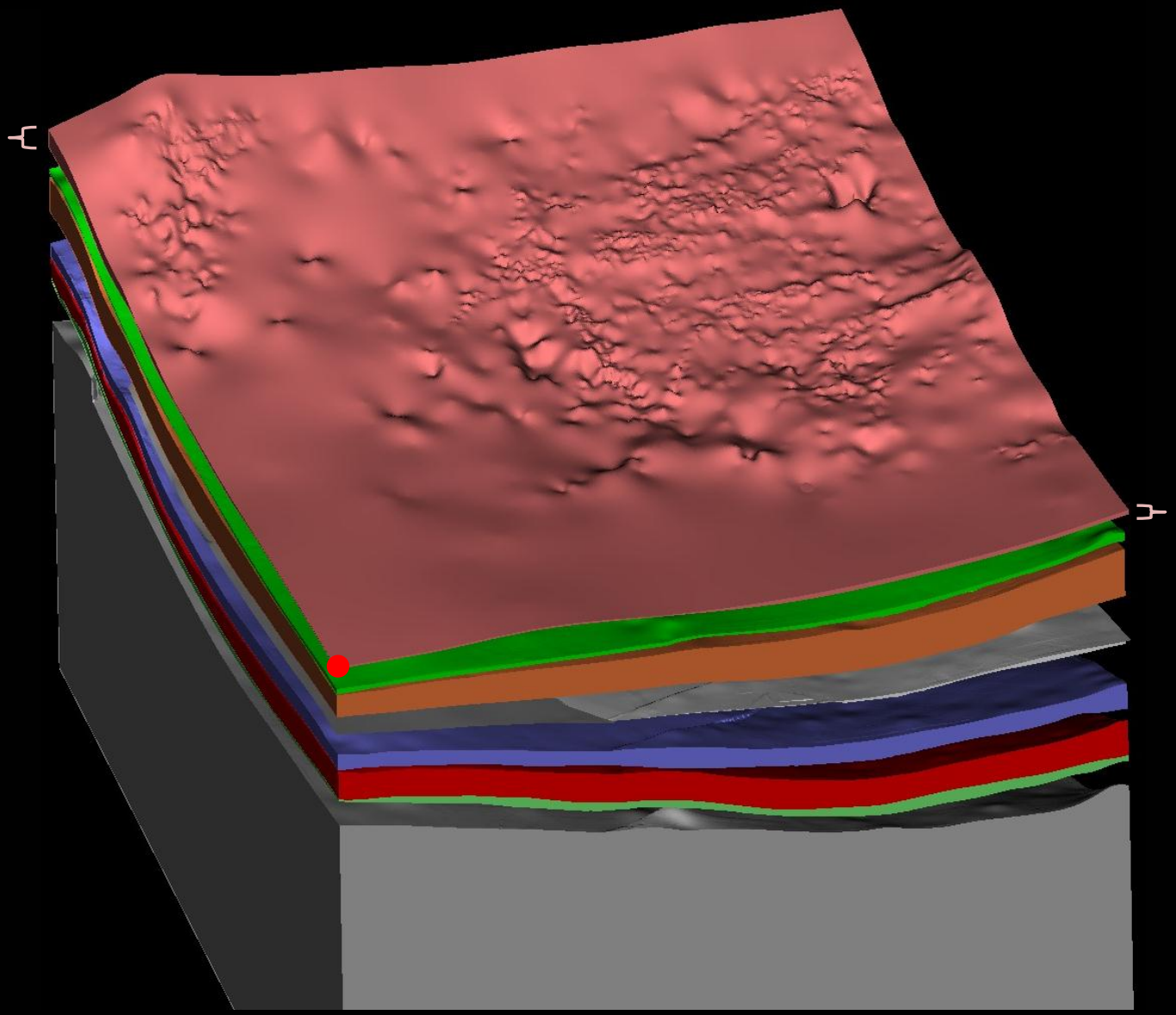

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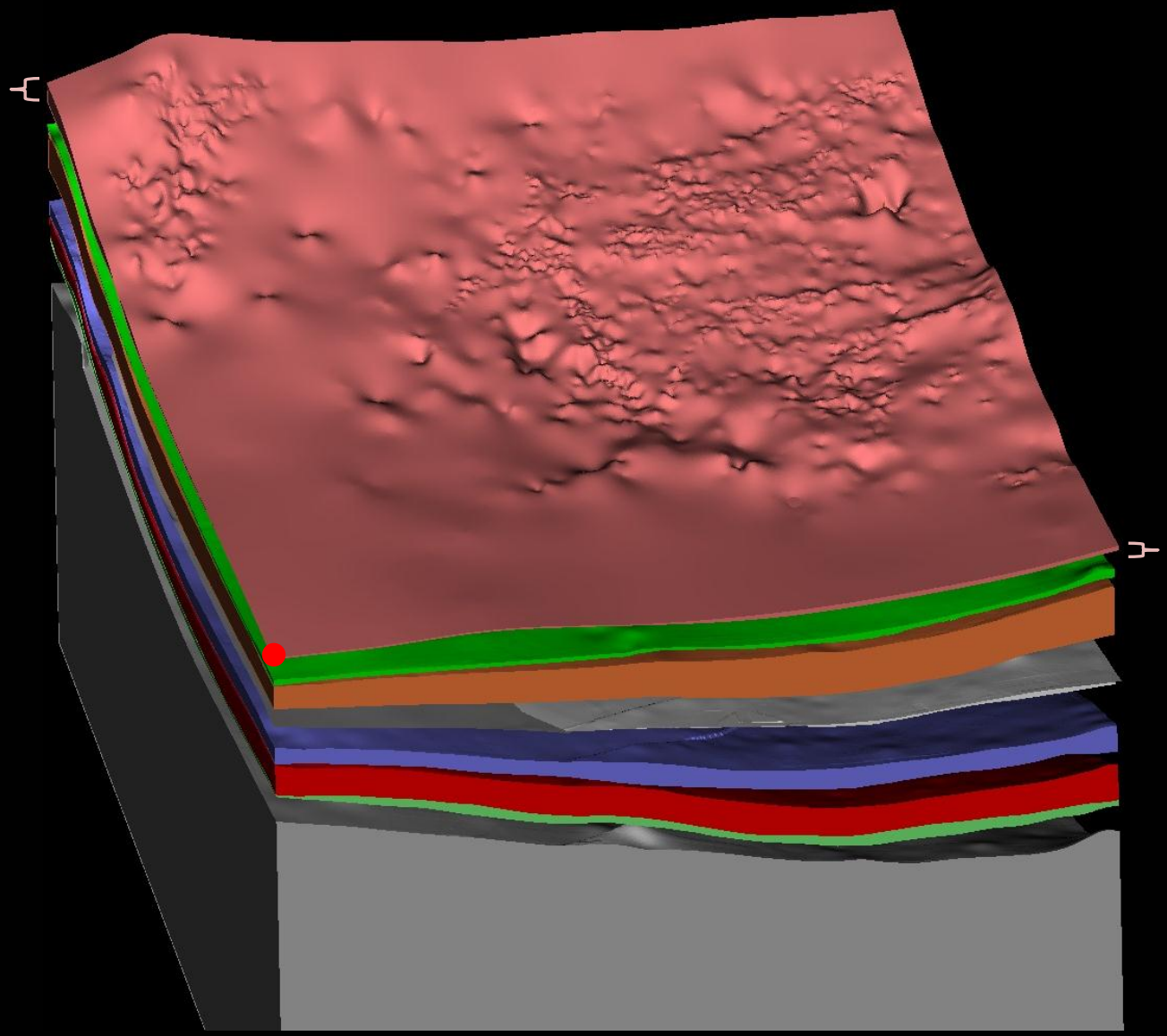

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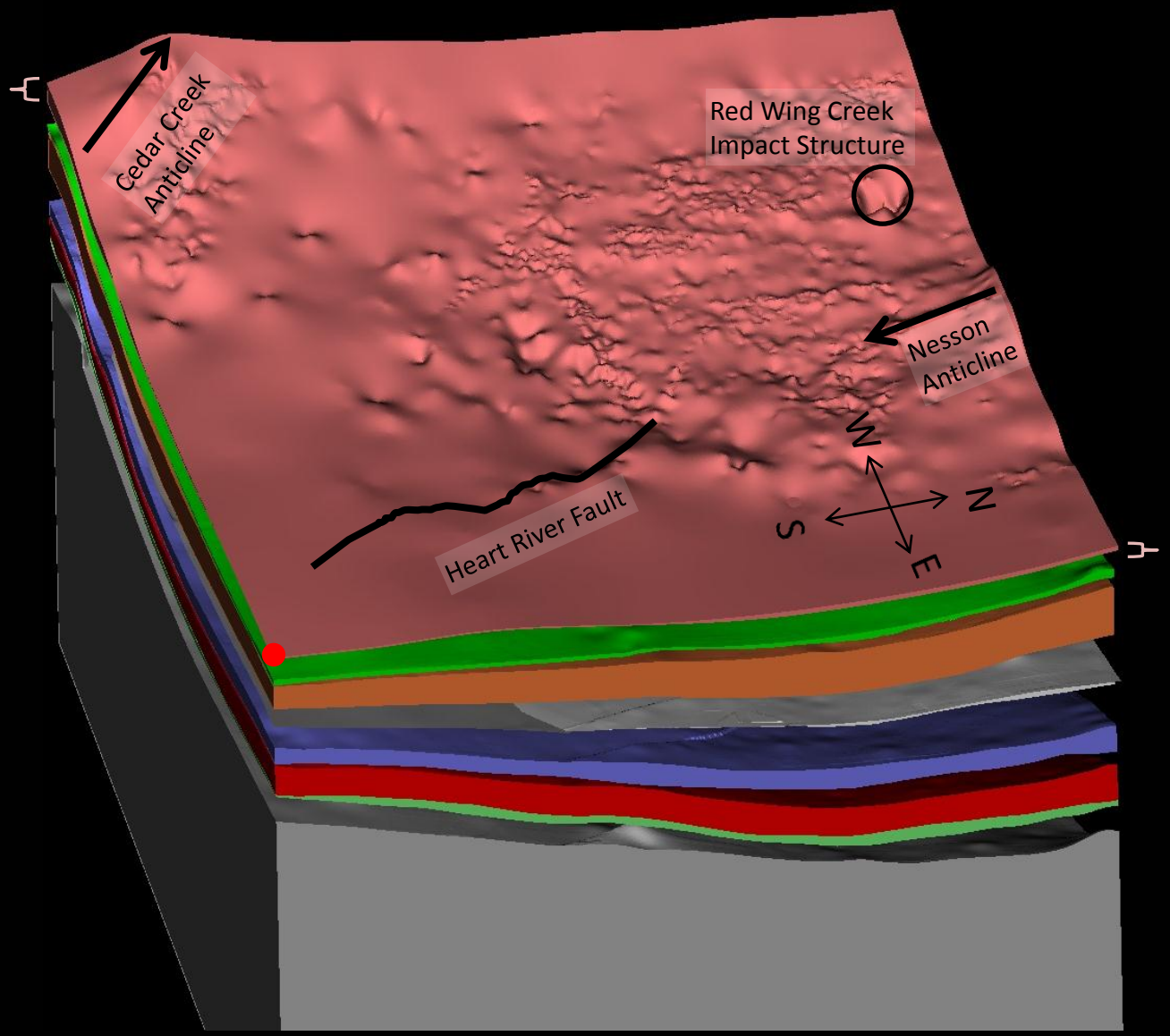
Spearfish Formation



Spearfish Fm.
Core Examples

Red-brown dolomitic siltstone

Red-brown anhydritic sandstone

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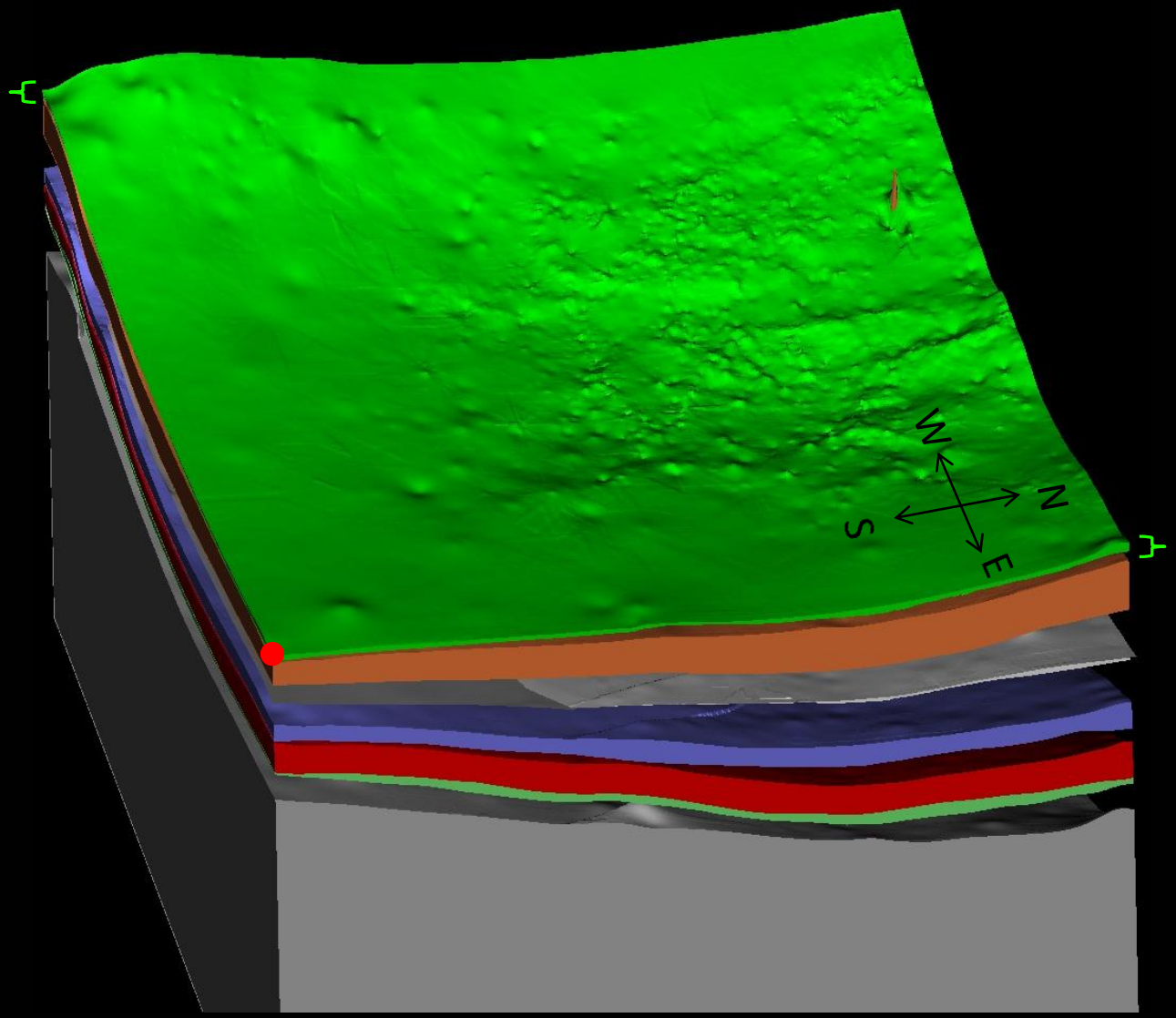
Tyler Formation



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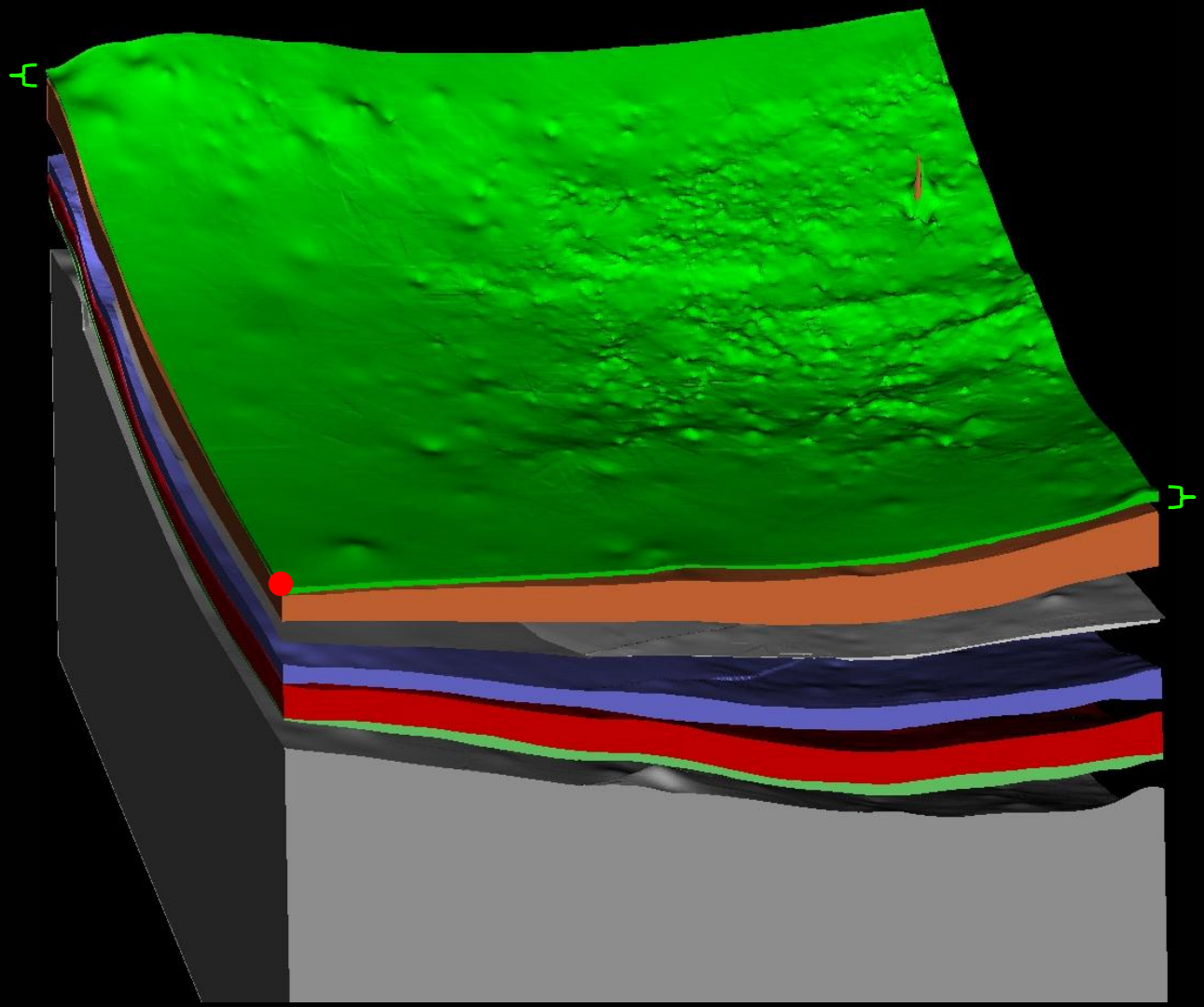
Tyler Formation



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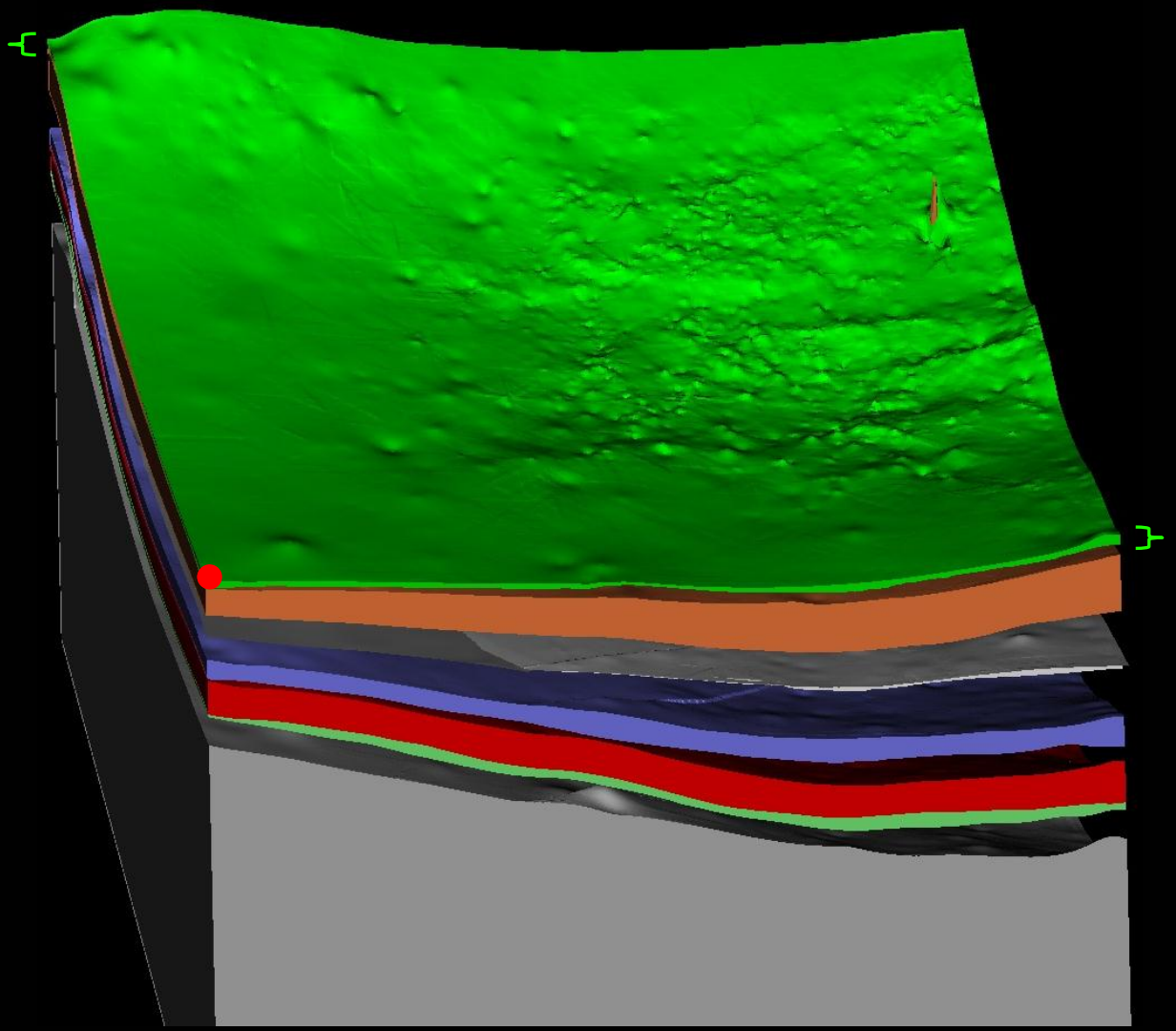

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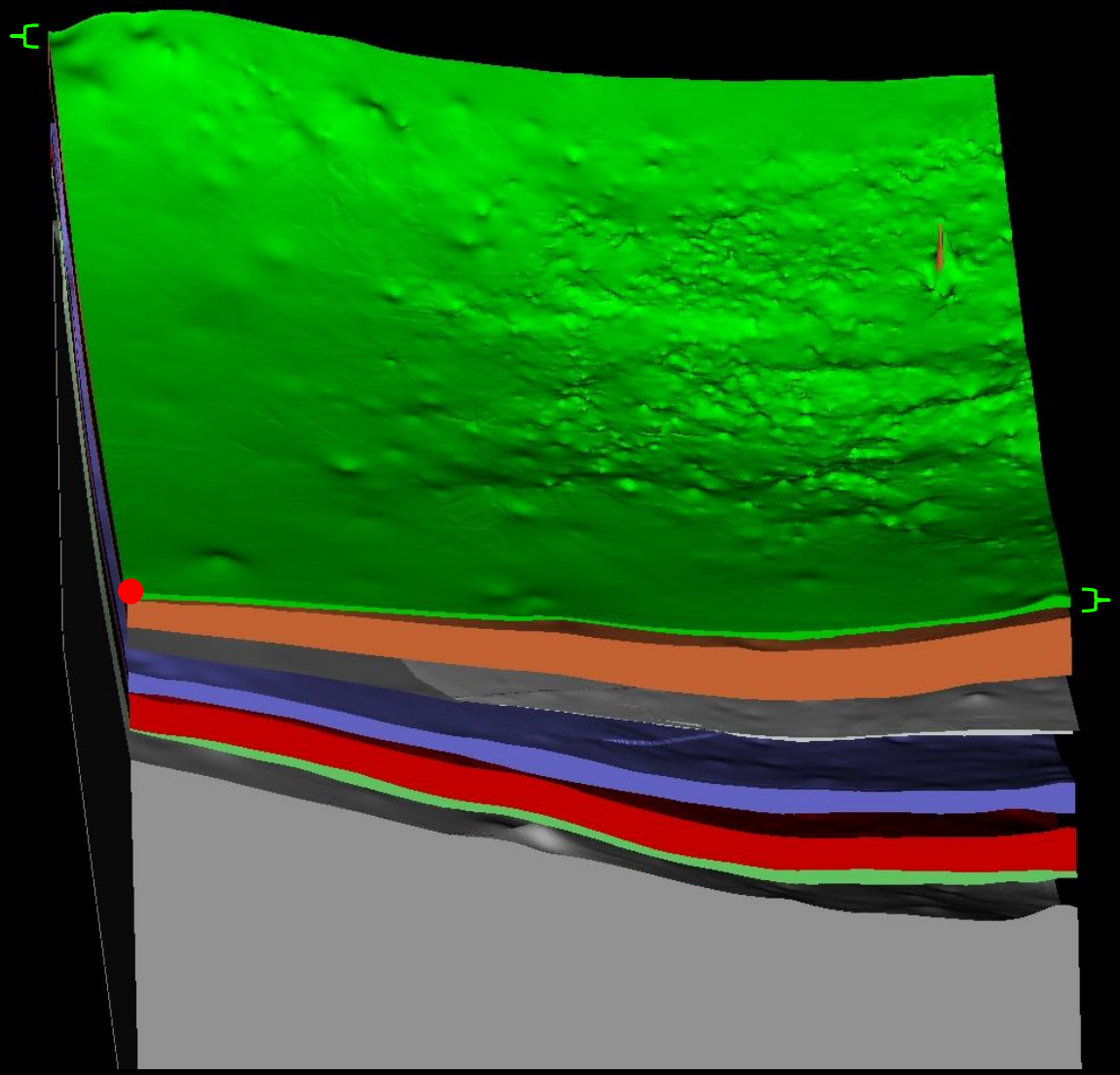

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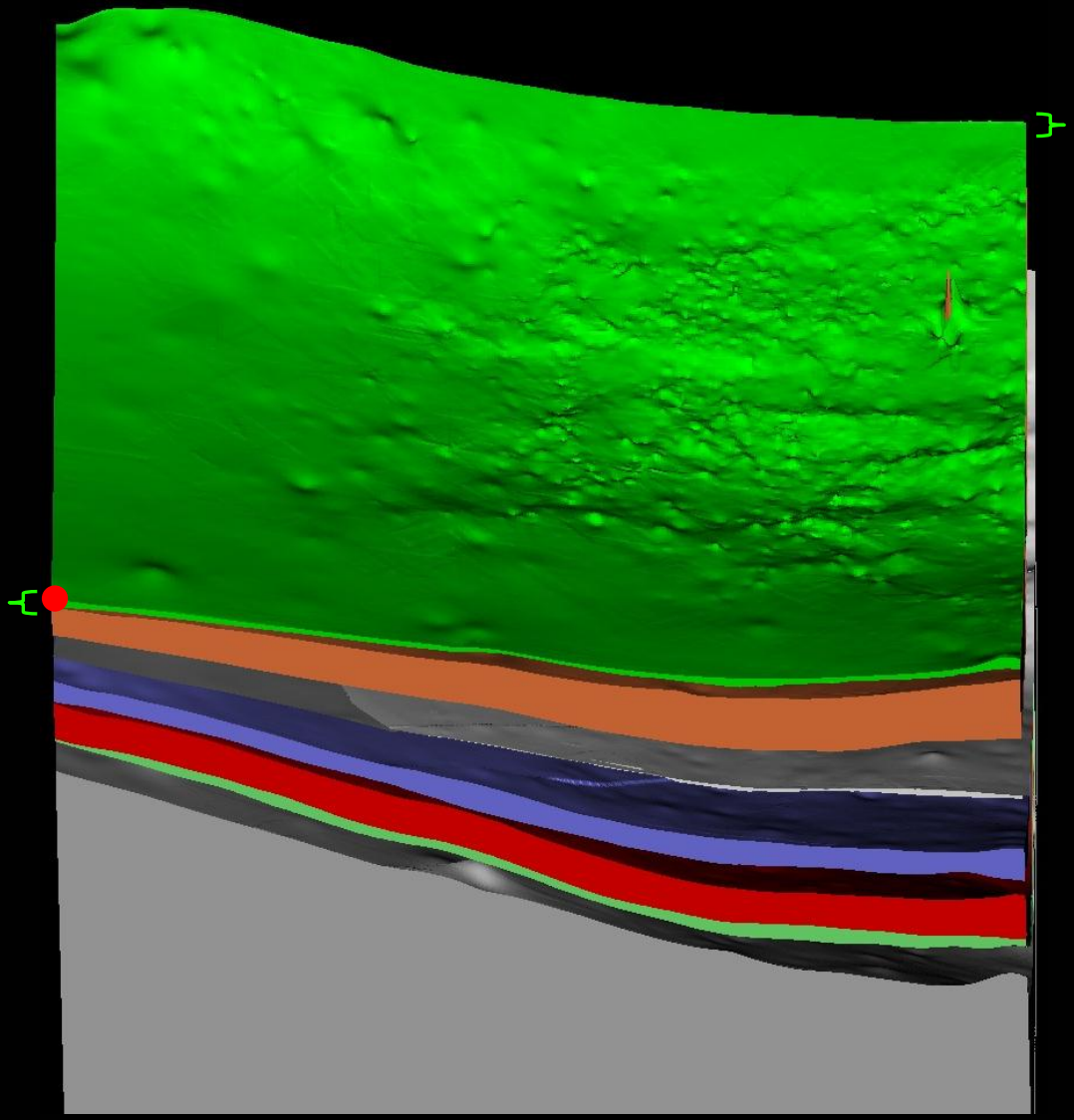

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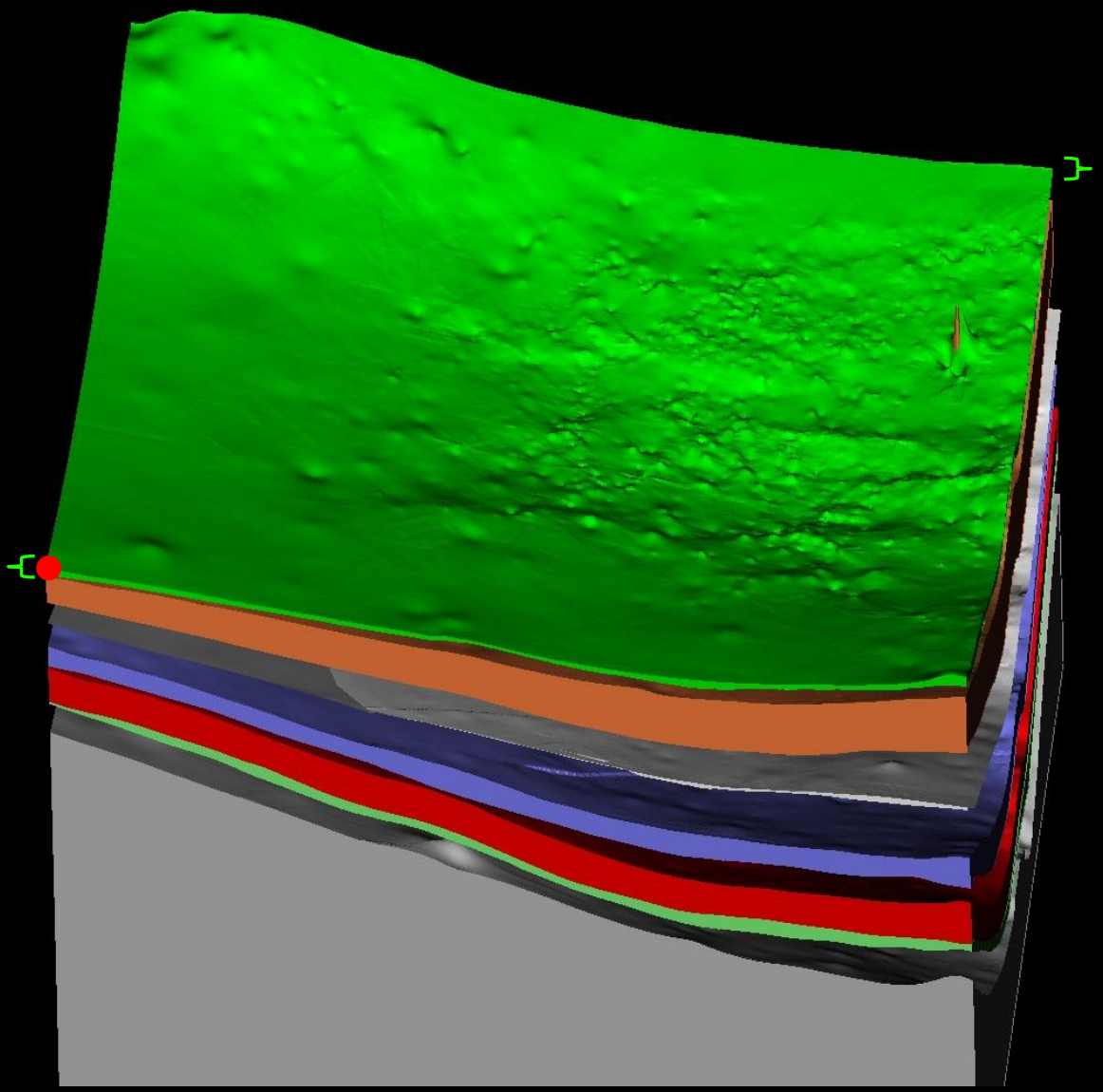

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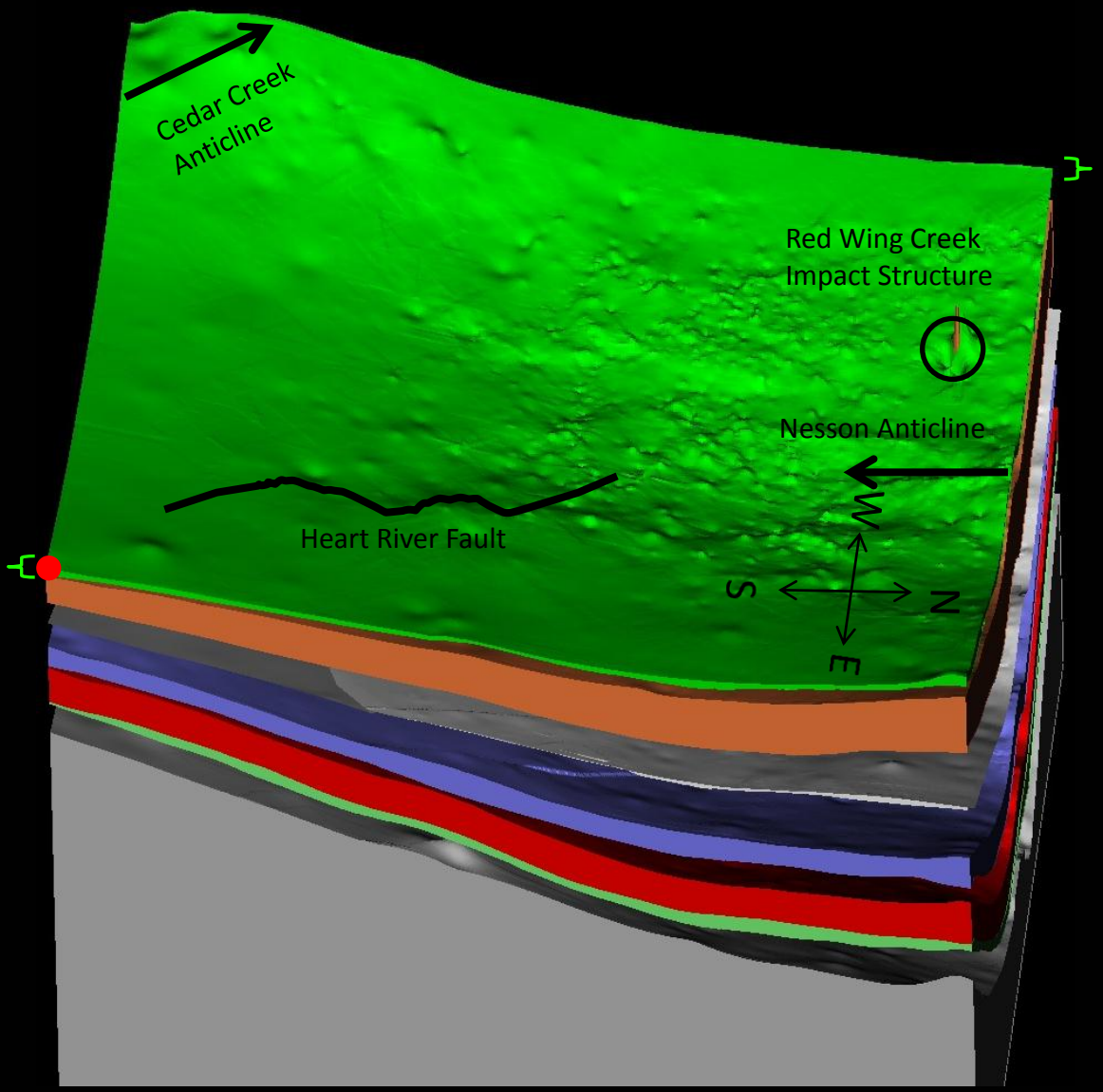
Tyler Formation



Partial Tyler Fm.
Core Sequence

Red mudstone

Black shale

Organic-rich limestone

Thin coal

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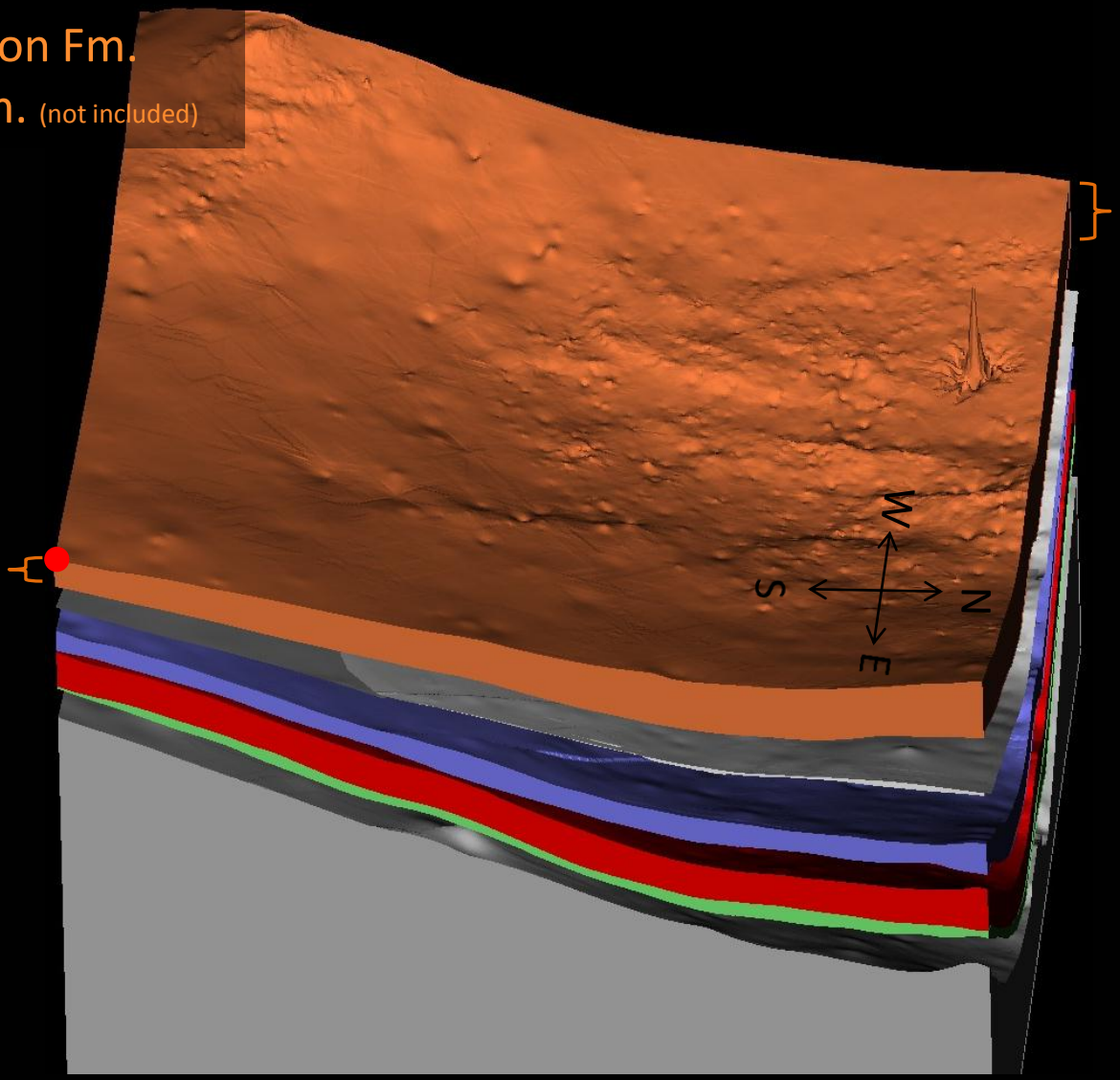
Madison Group

-Charles Fm.
-Mission Canyon Fm.
-Lodgepole Fm. (not included)



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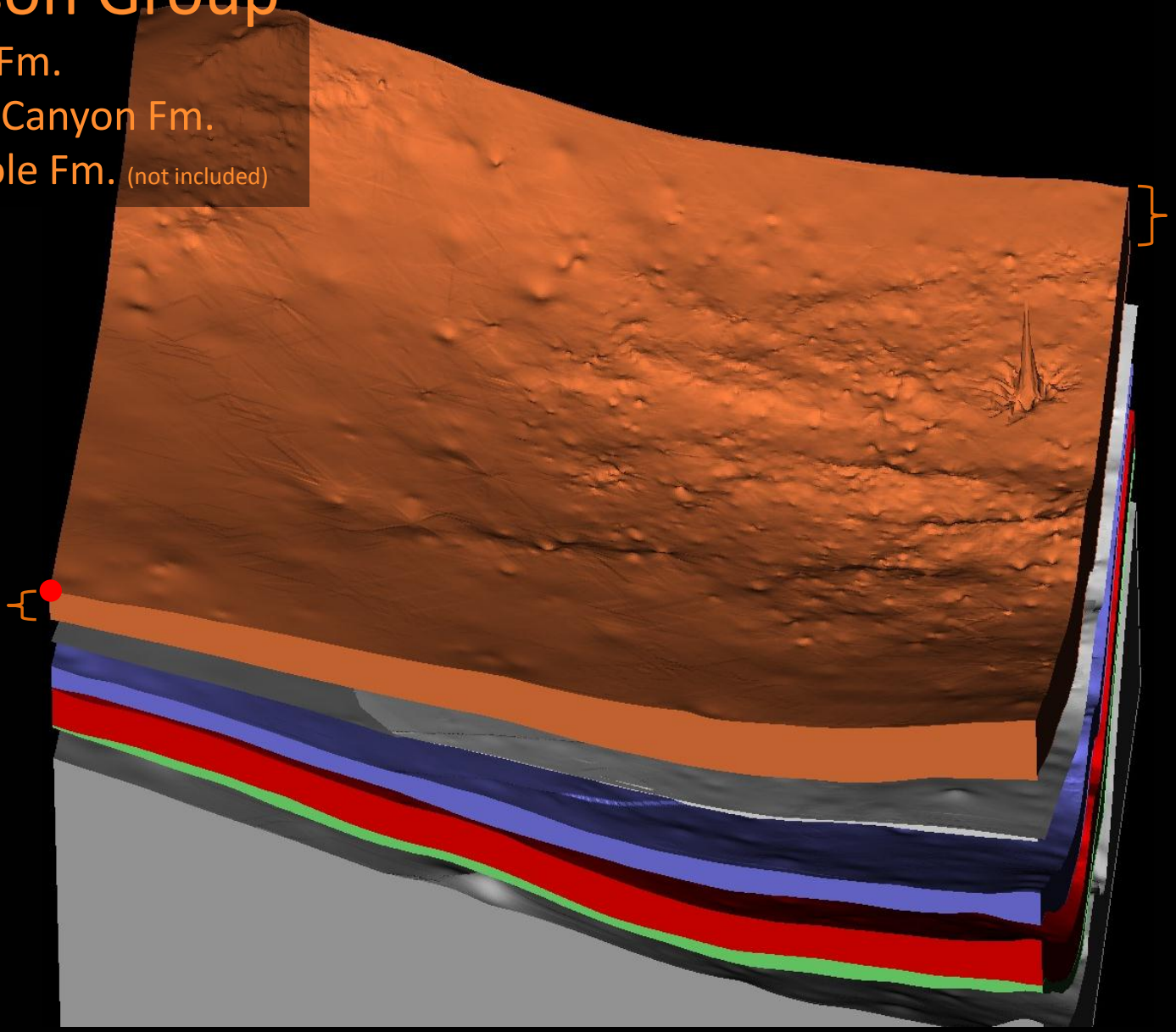

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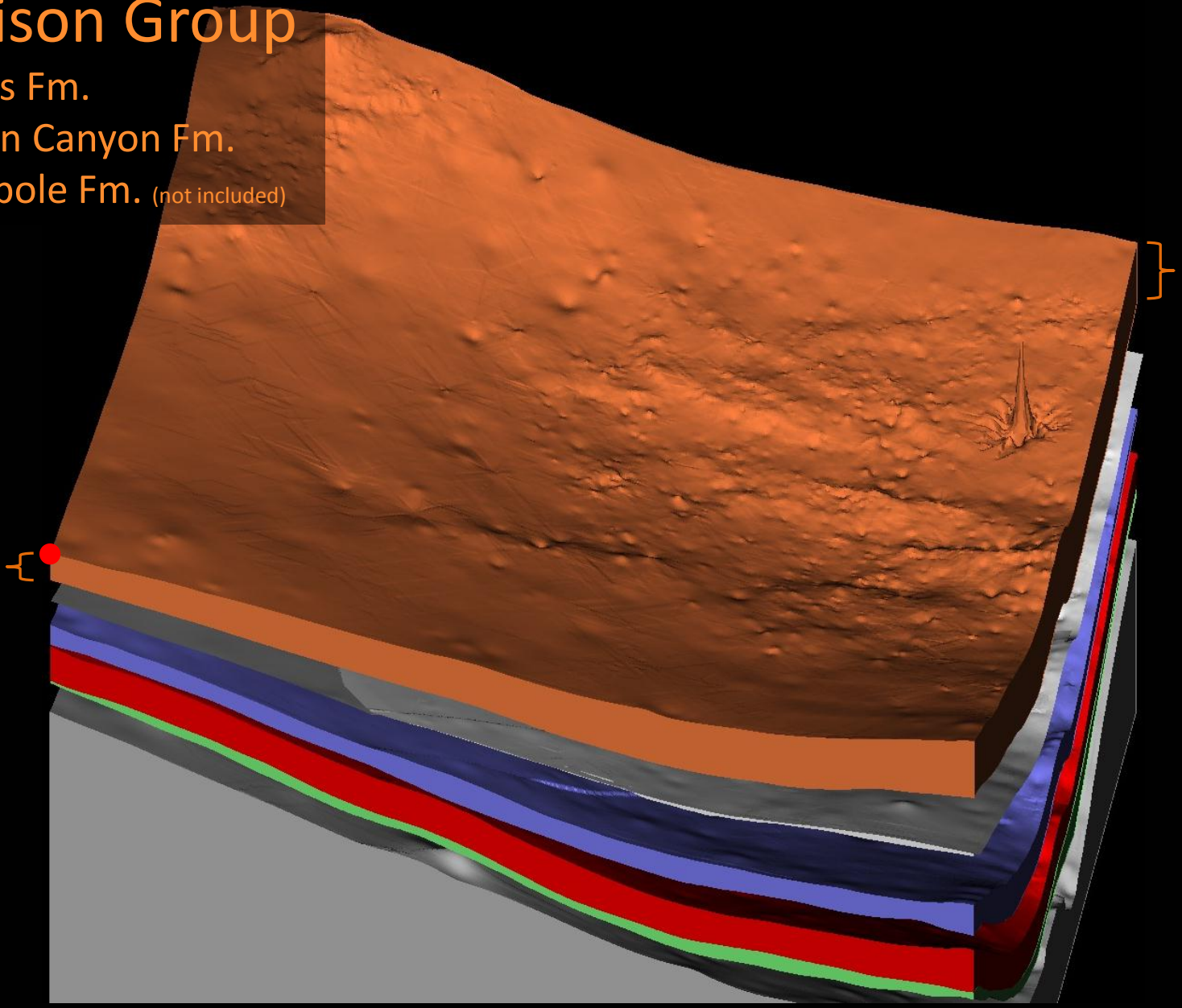

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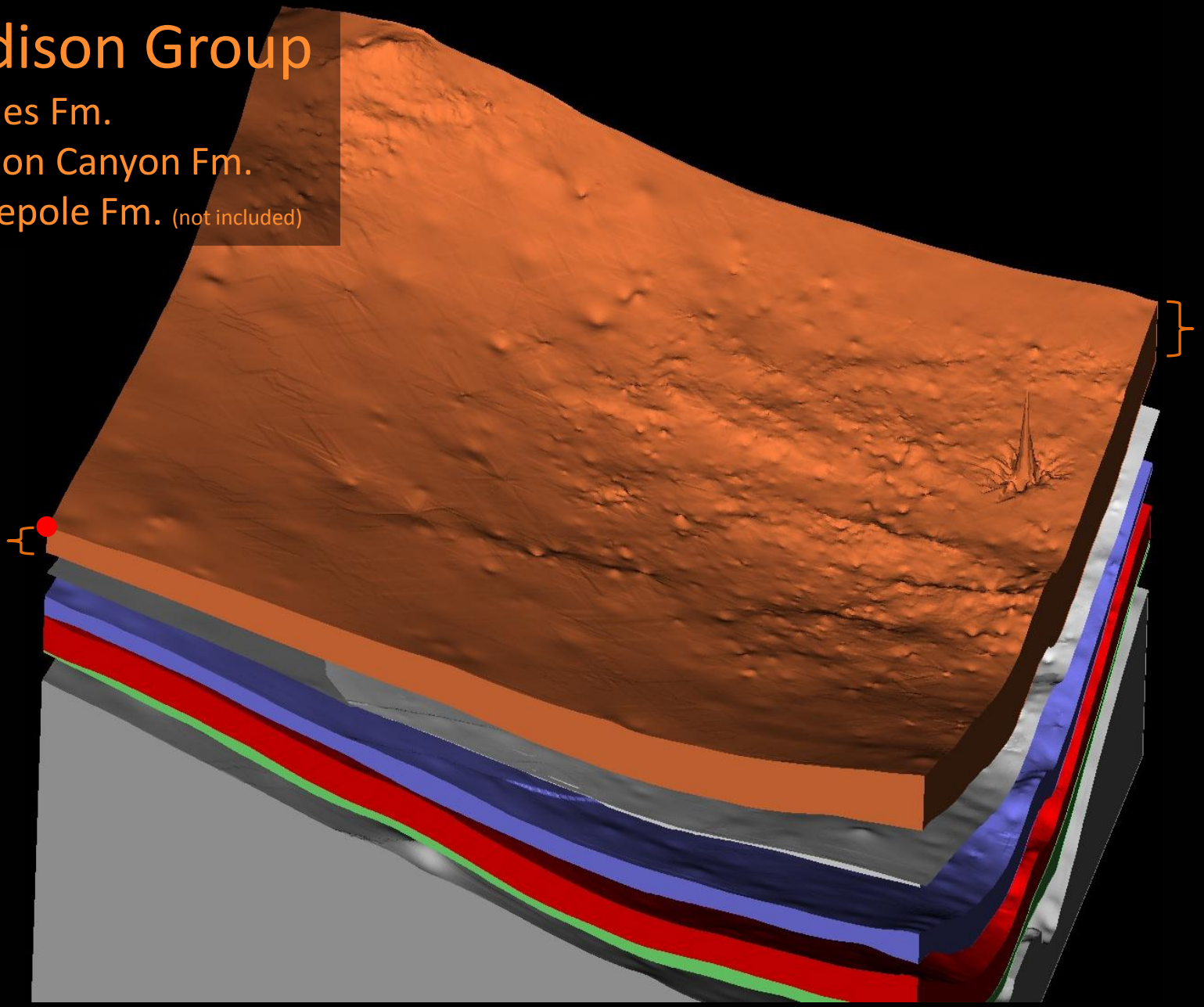
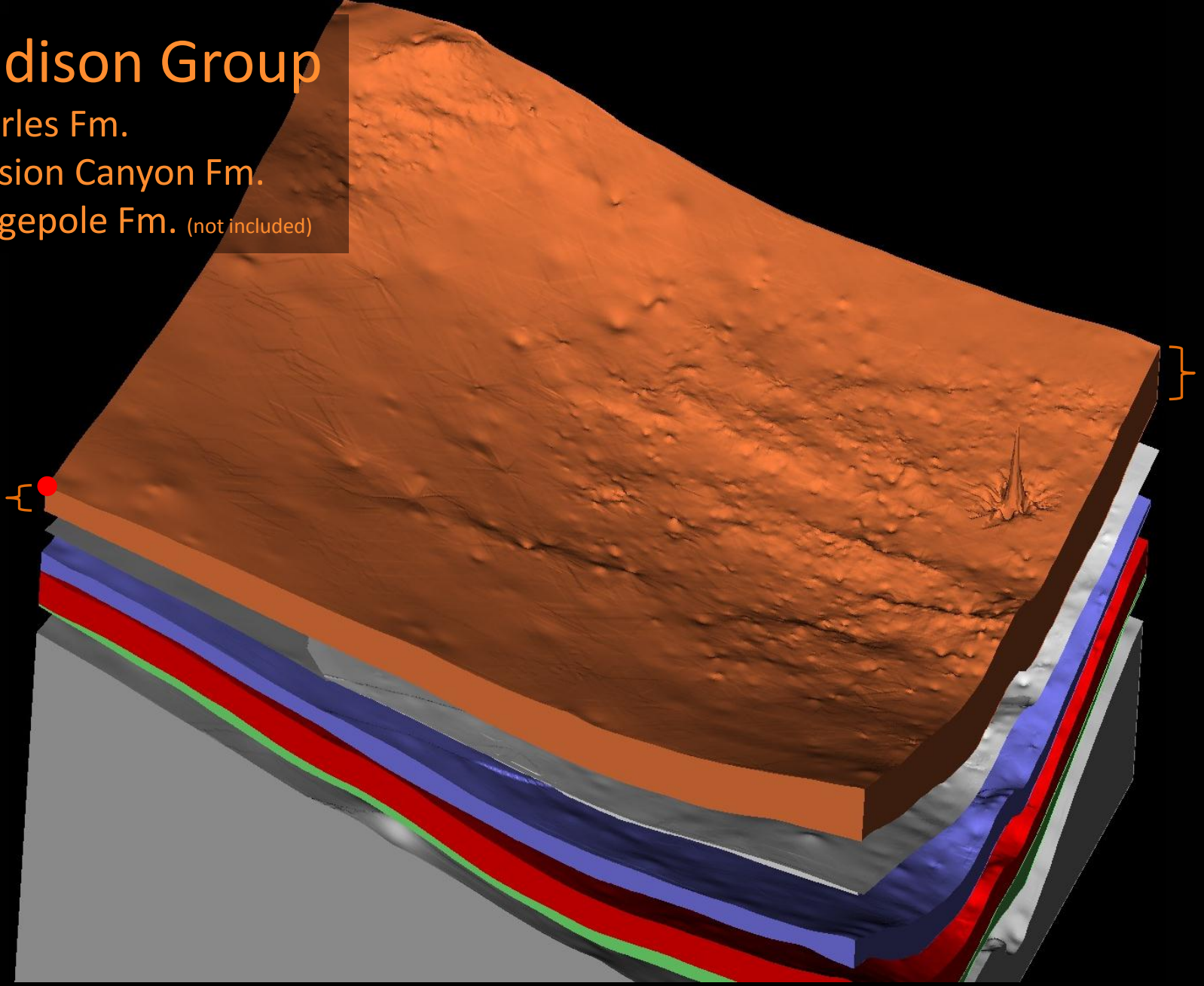


North Dakota
Geological Survey

GI-141

Madison Group

-Charles Fm.
-Mission Canyon Fm.
-Lodgepole Fm. (not included)



North Dakota
Geological Survey

GI-141

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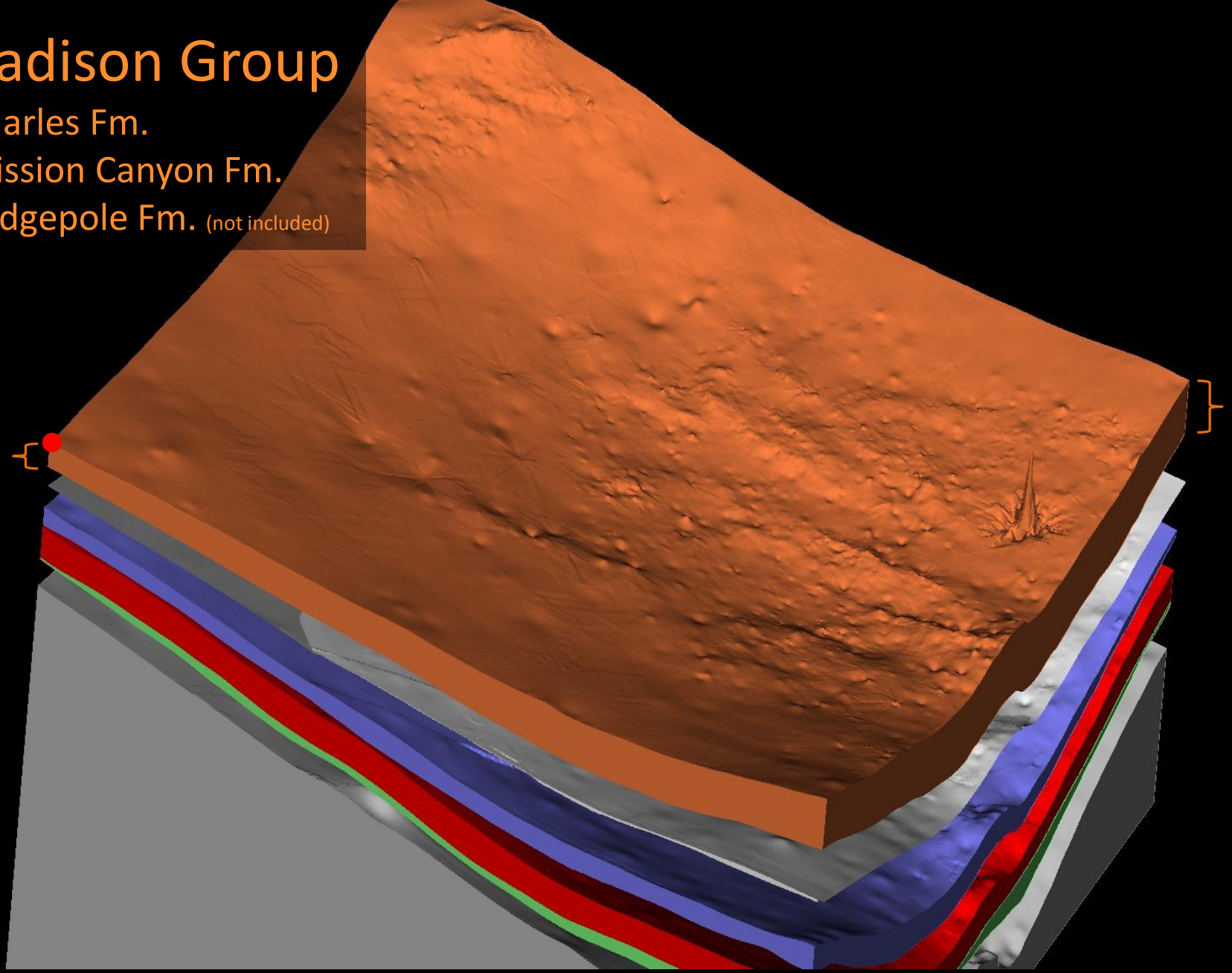

North Dakota
Geological Survey

GI-141

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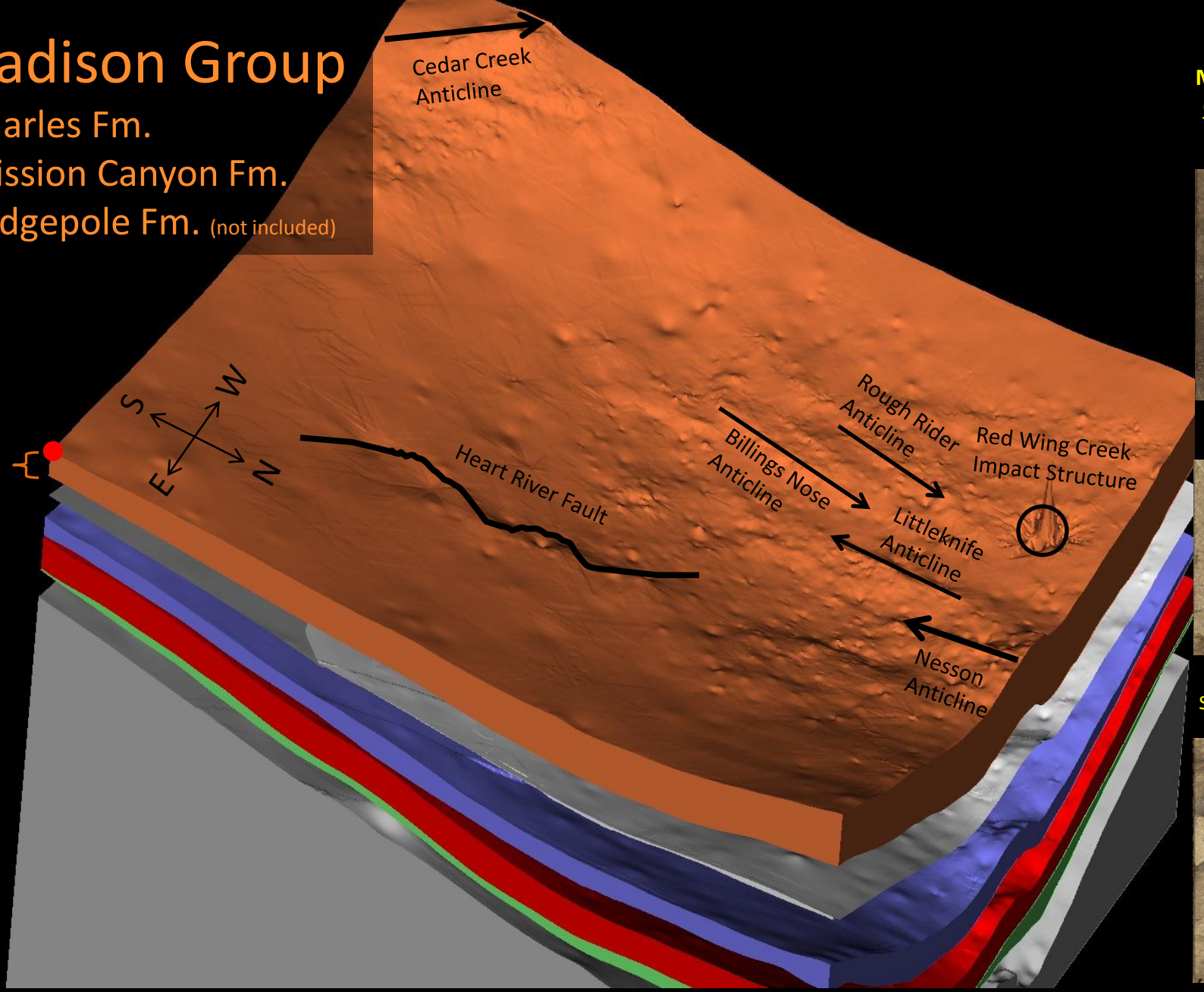


Mission Canyon
Core Examples

Dolomite

Limestone

Slightly anhydritic limestone

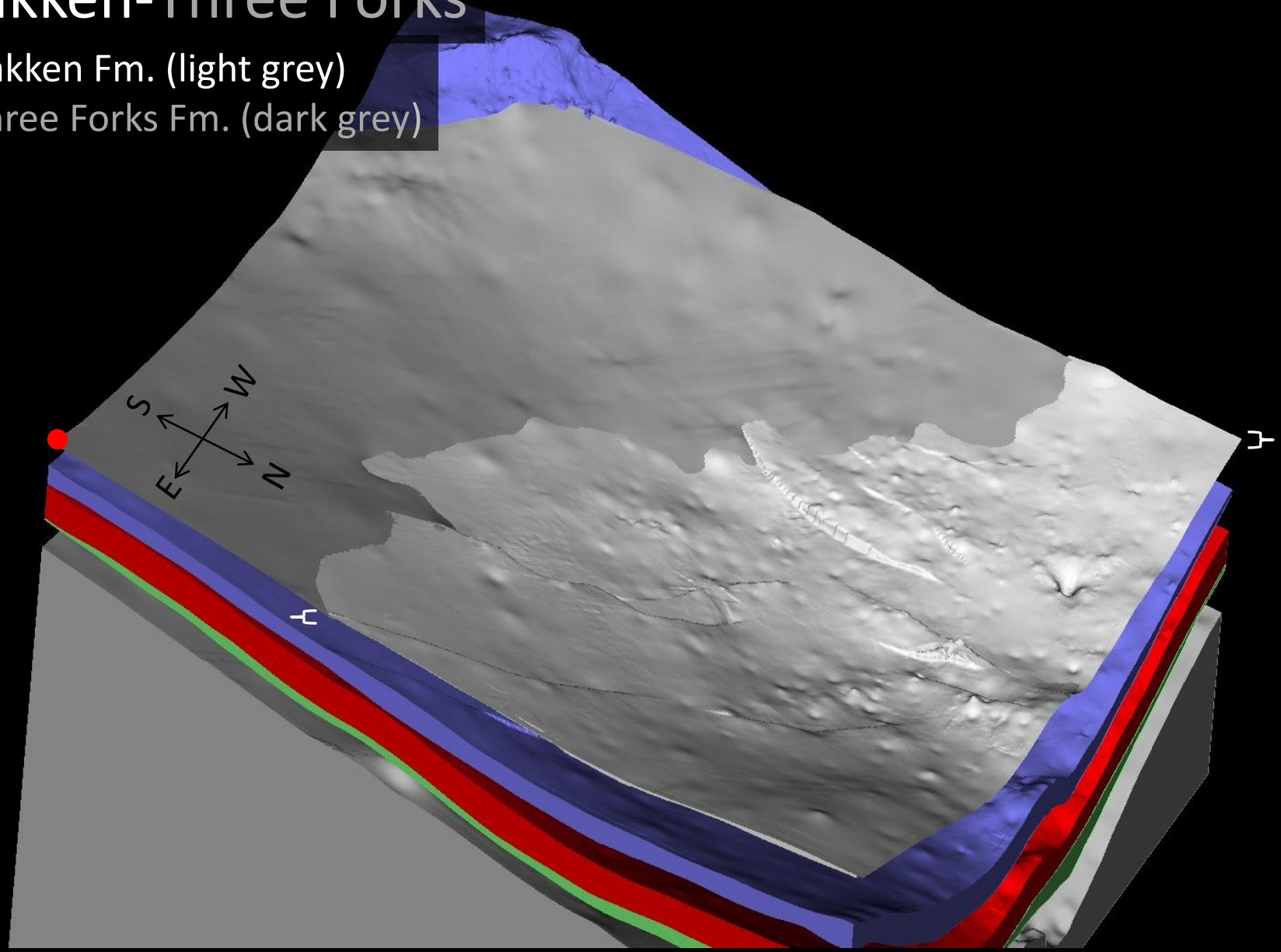
North Dakota Geological Survey

GI-141

Bakken-Three Forks

-Bakken Fm. (light grey)

-Three Forks Fm. (dark grey)



North Dakota Geological Survey

GI-141

Bakken-Three Forks

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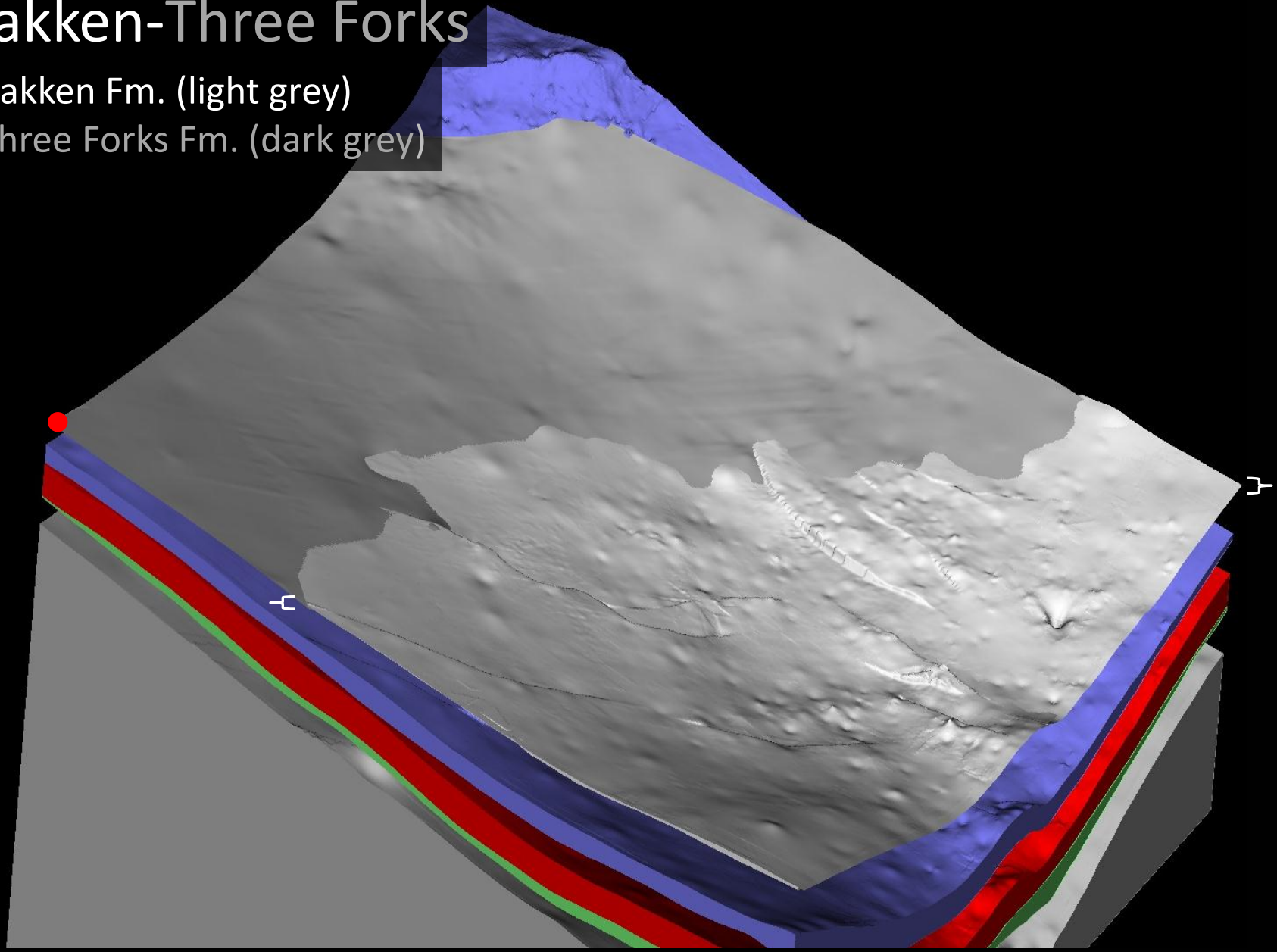

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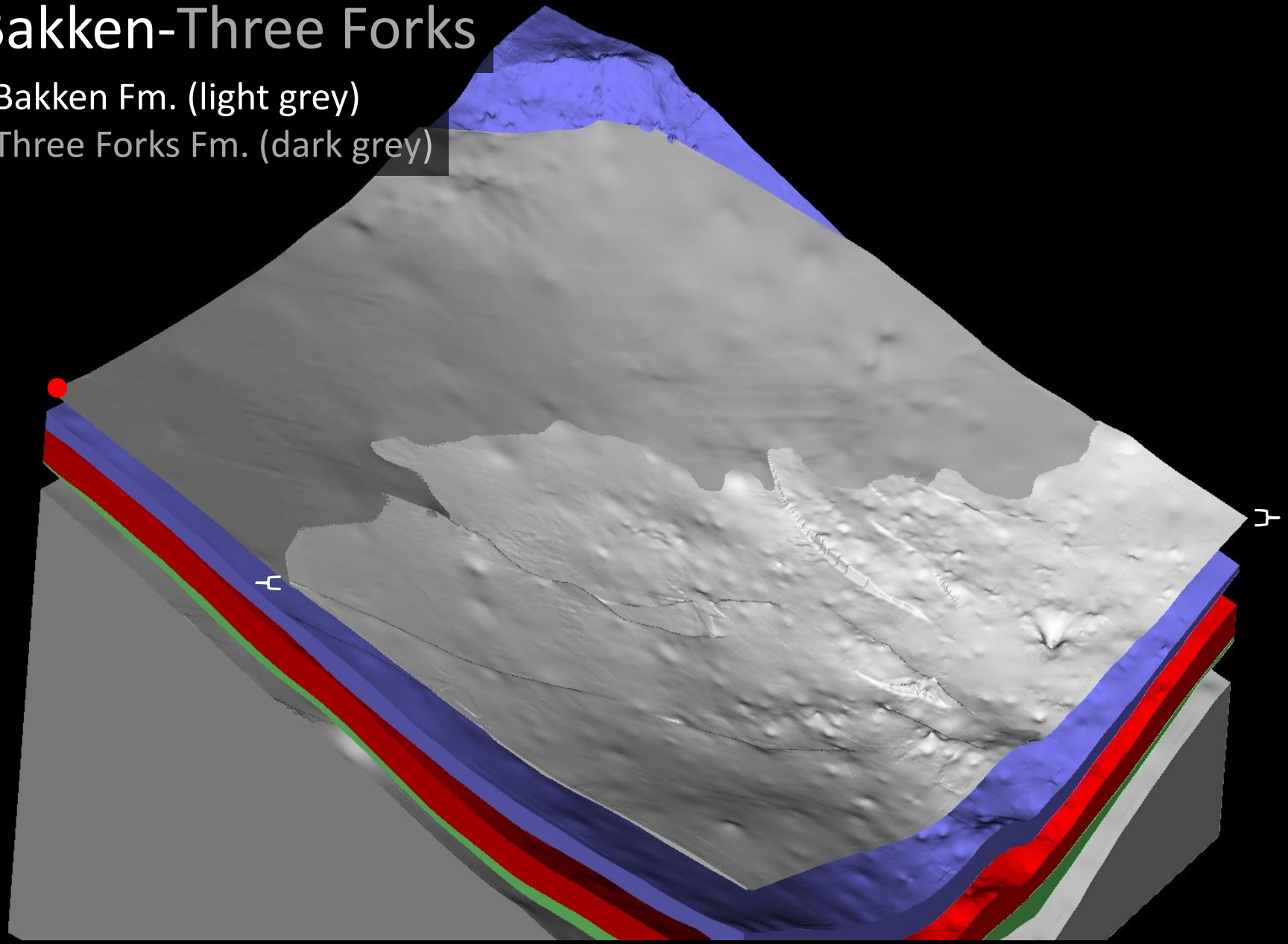

North Dakota Geological Survey

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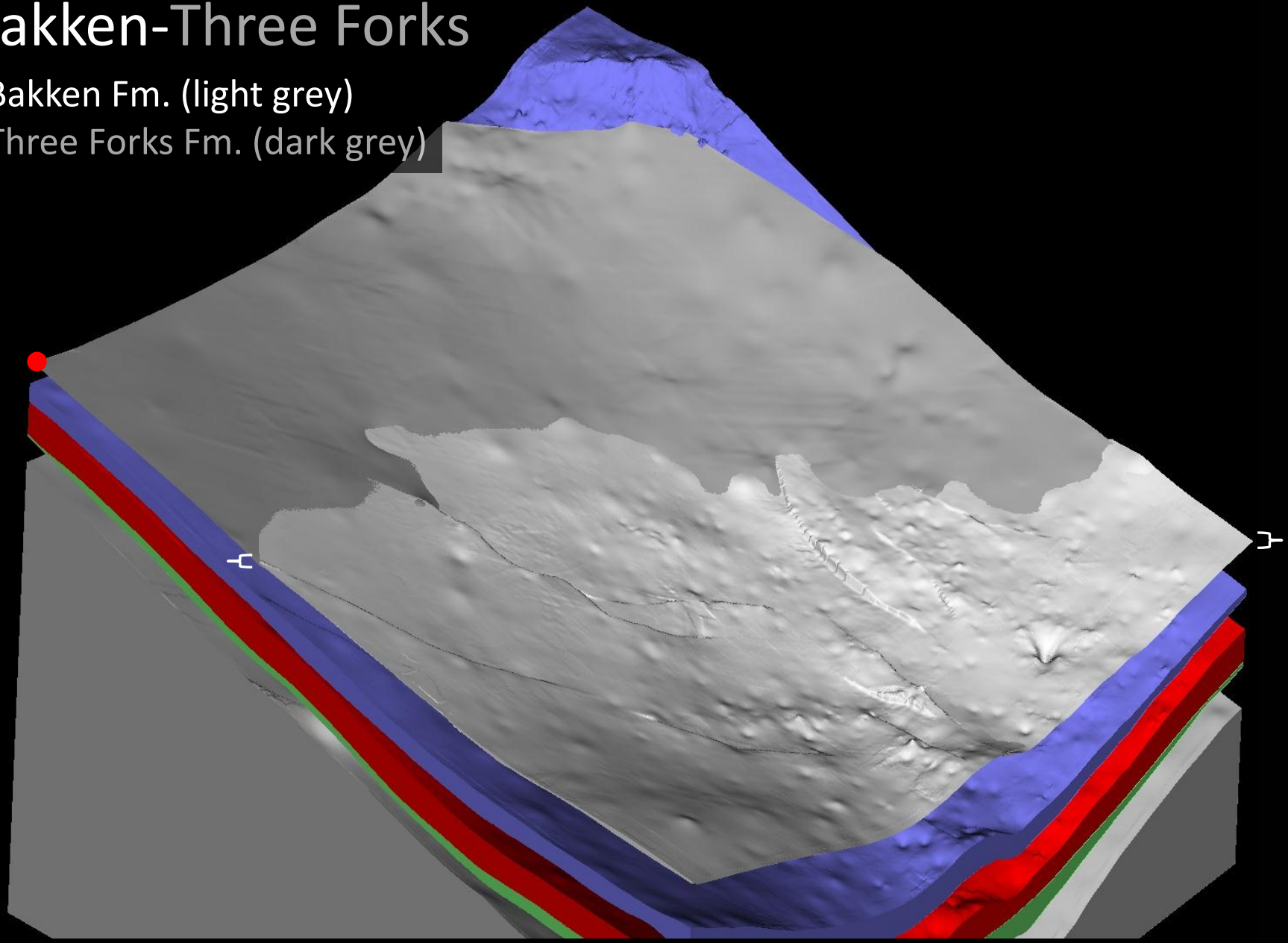

North Dakota Geological Survey

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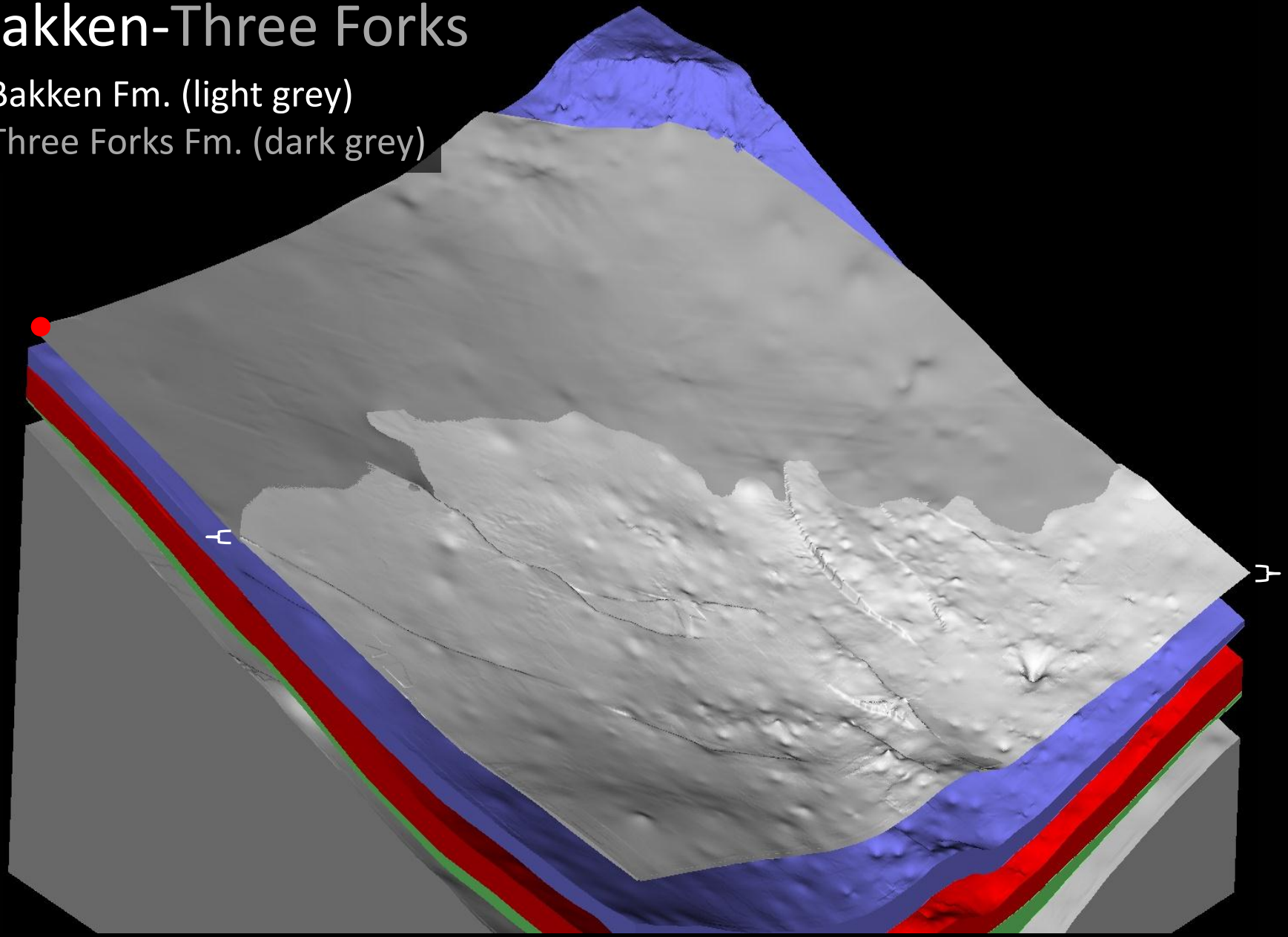

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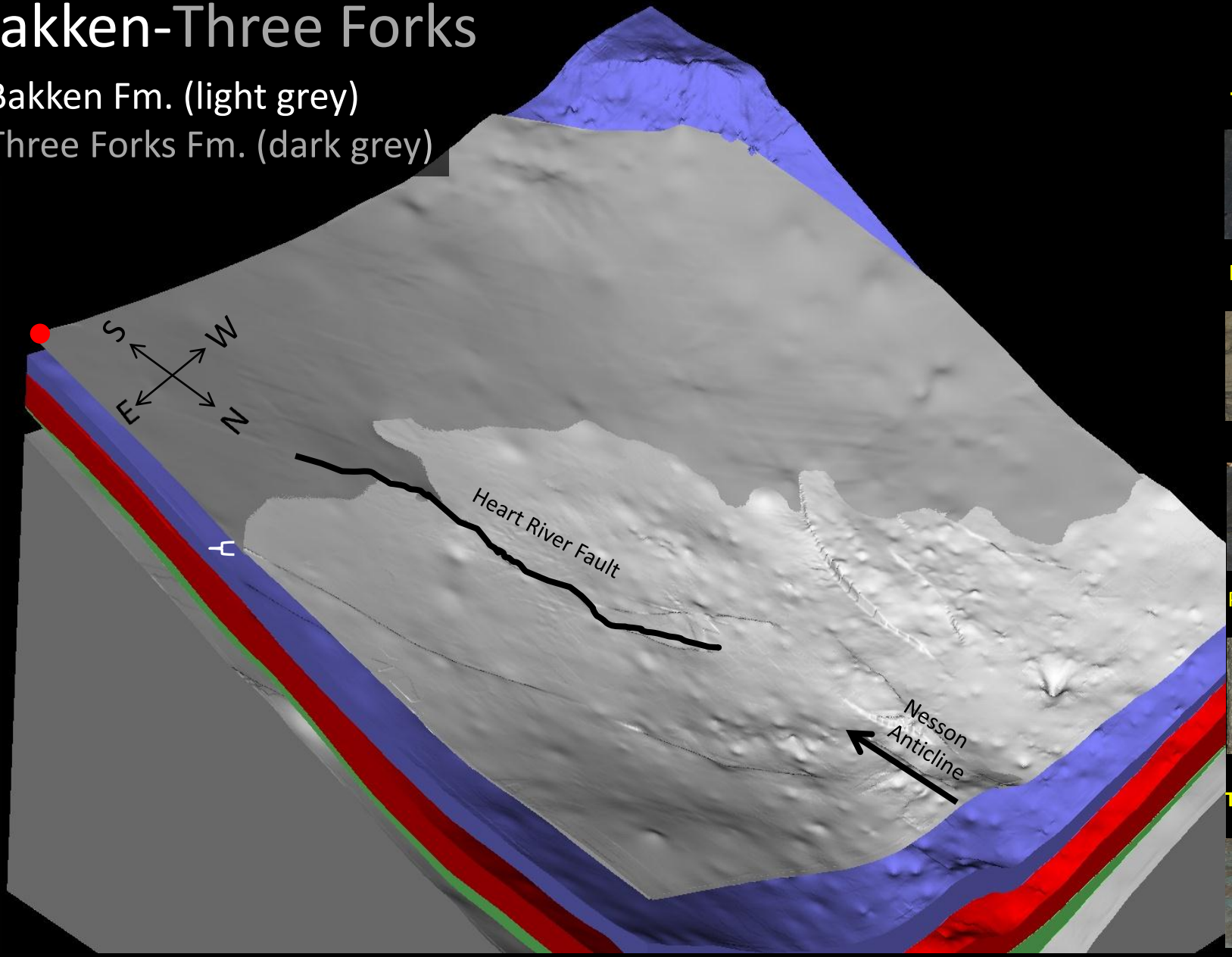


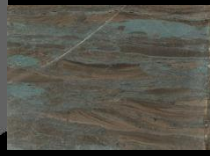
Bakken Fm.
Upper Shale

Middle Bakken
Sandy carbonate

Lower Shale

Pronghorn Mbr.
Mudstone

Three Forks Fm.
Dolomite



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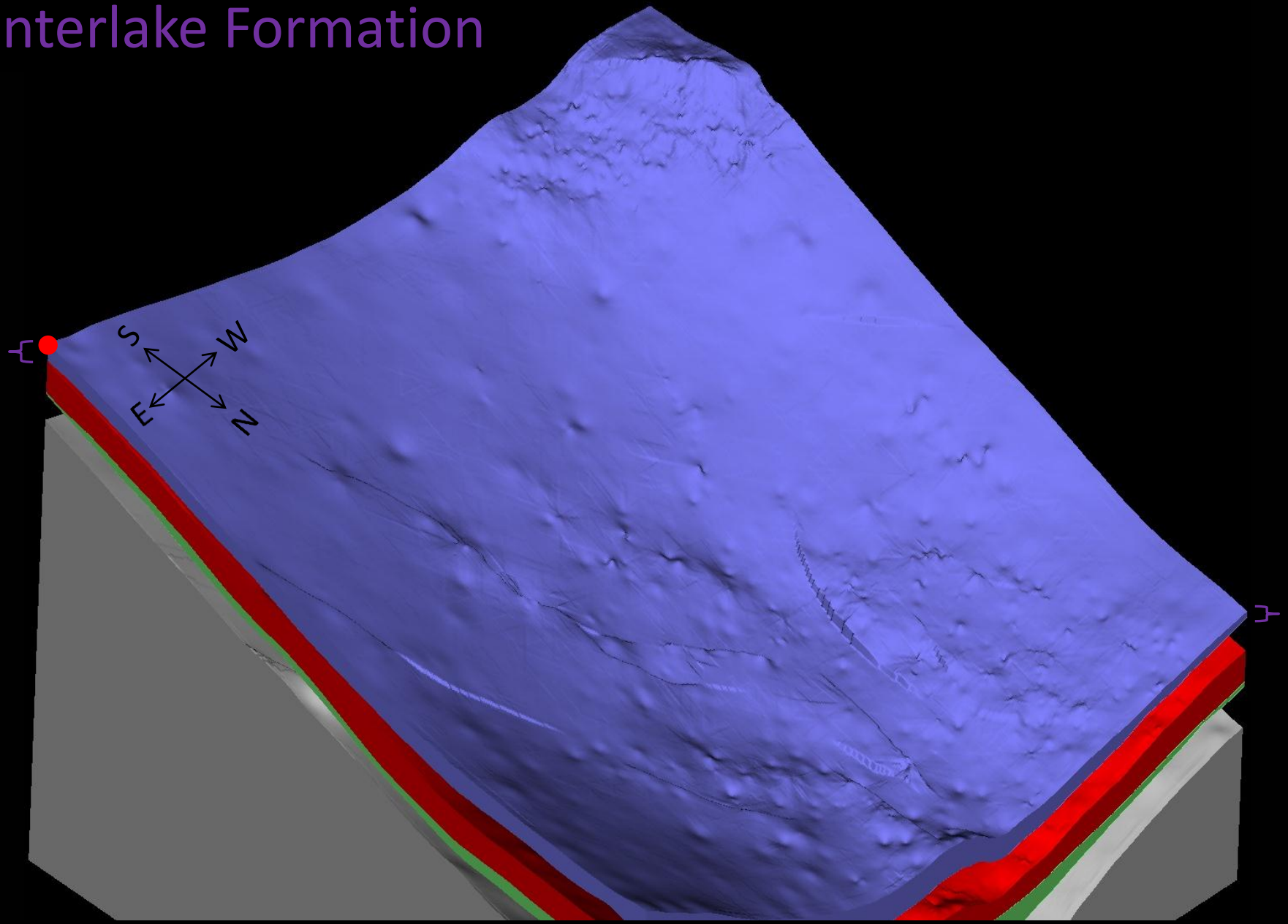
GI-141

Interlake Formation



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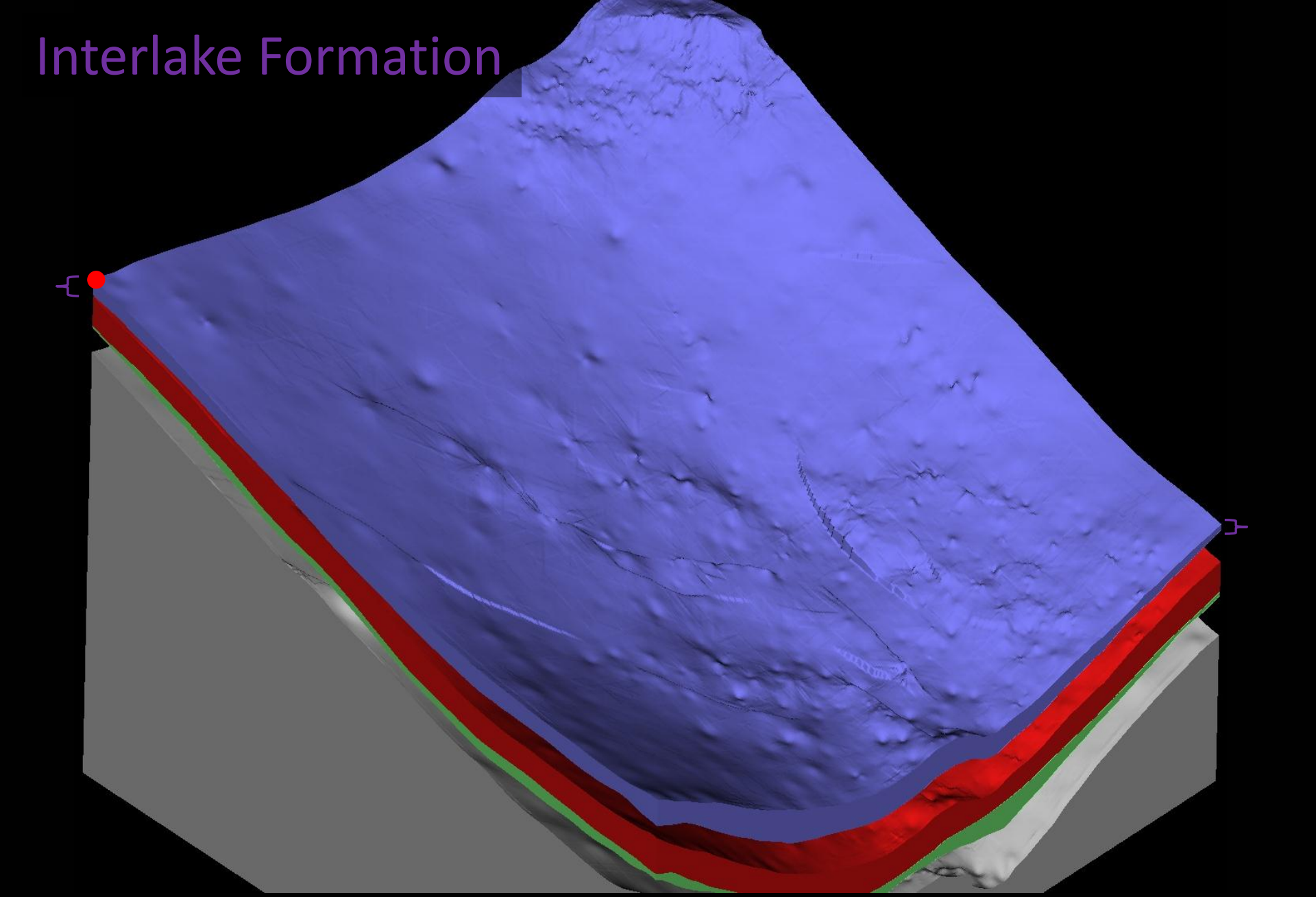
Geological Survey

GI-141

Interlake Formation



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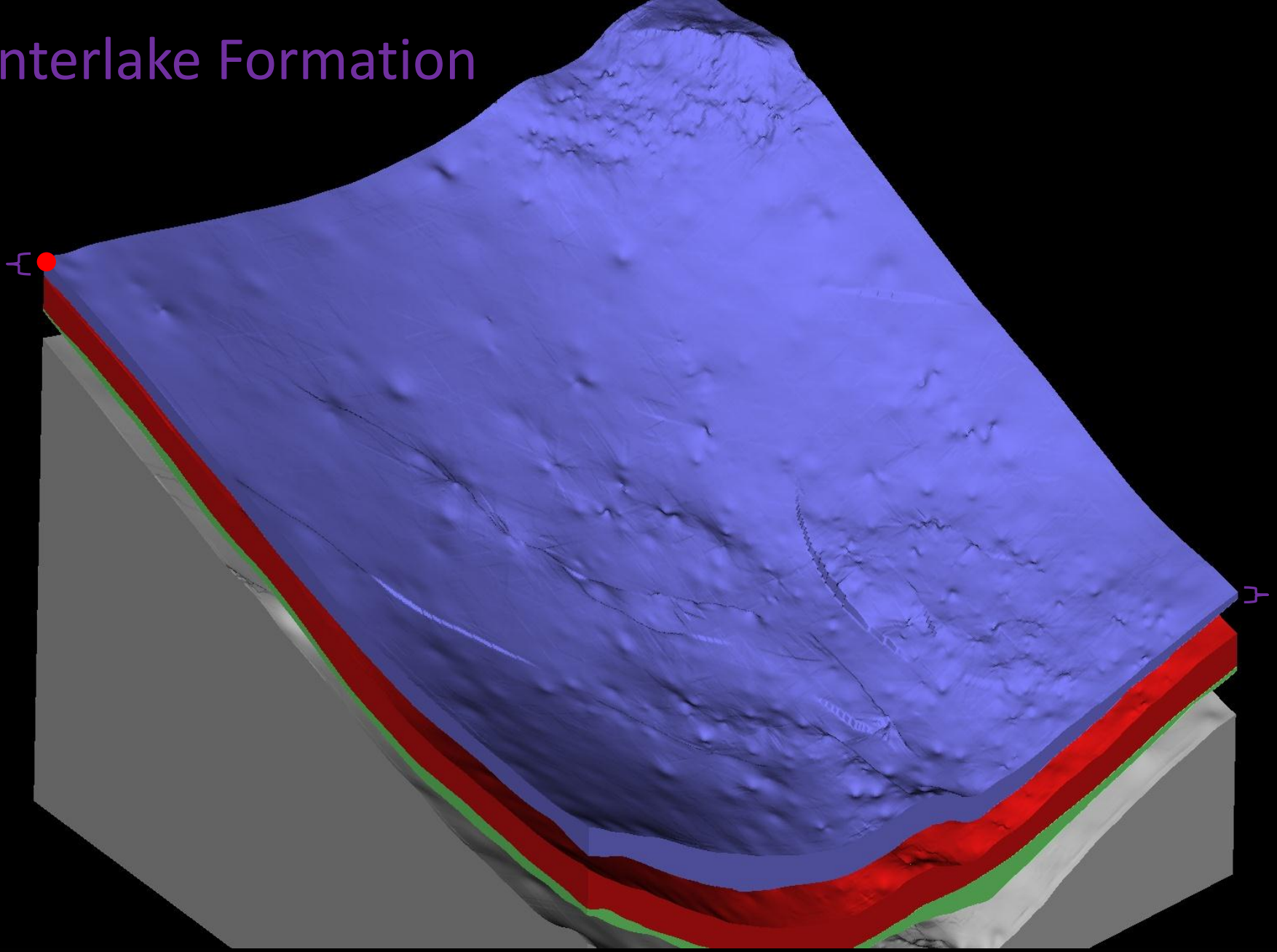
Interlake Formation



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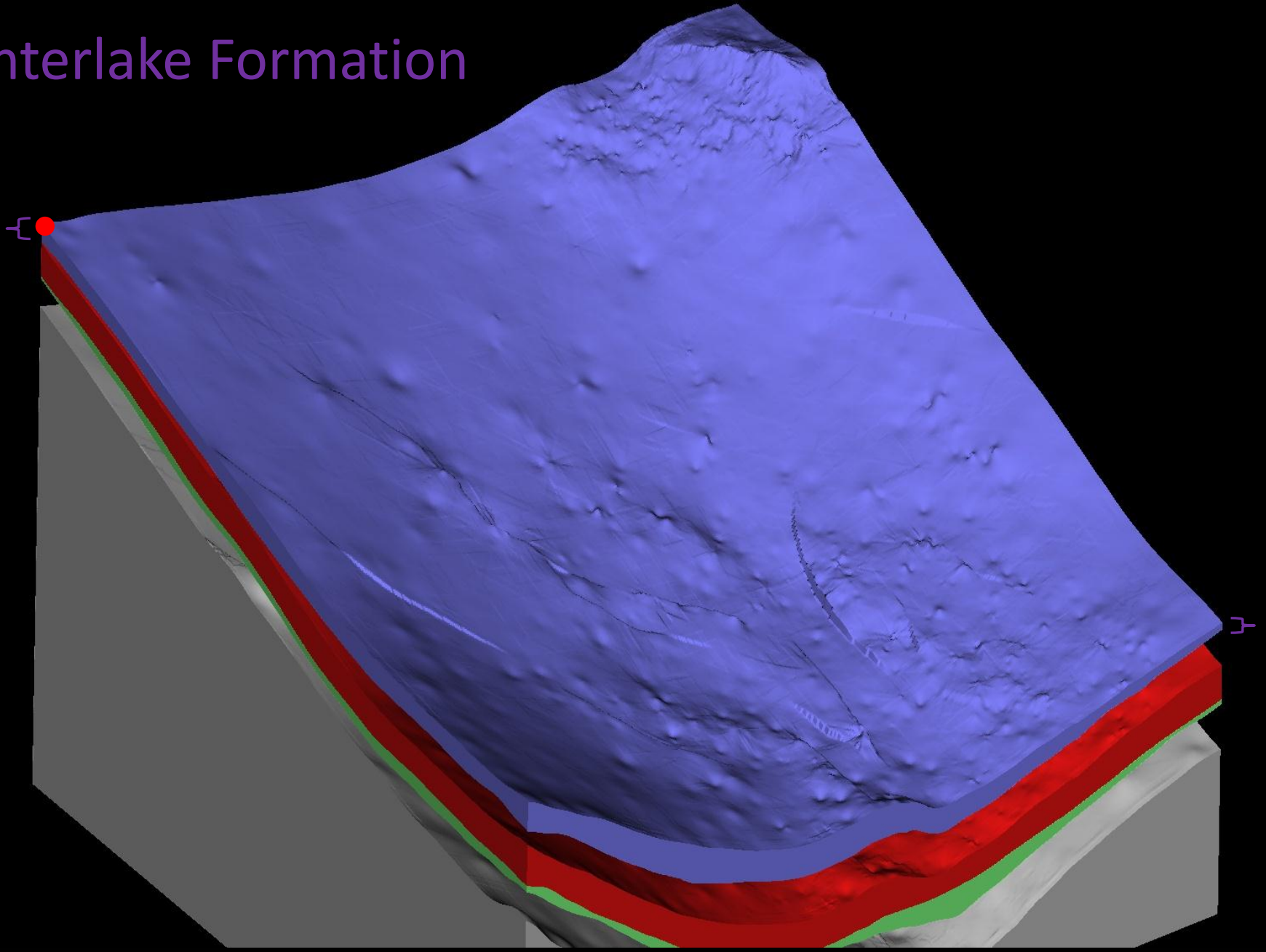

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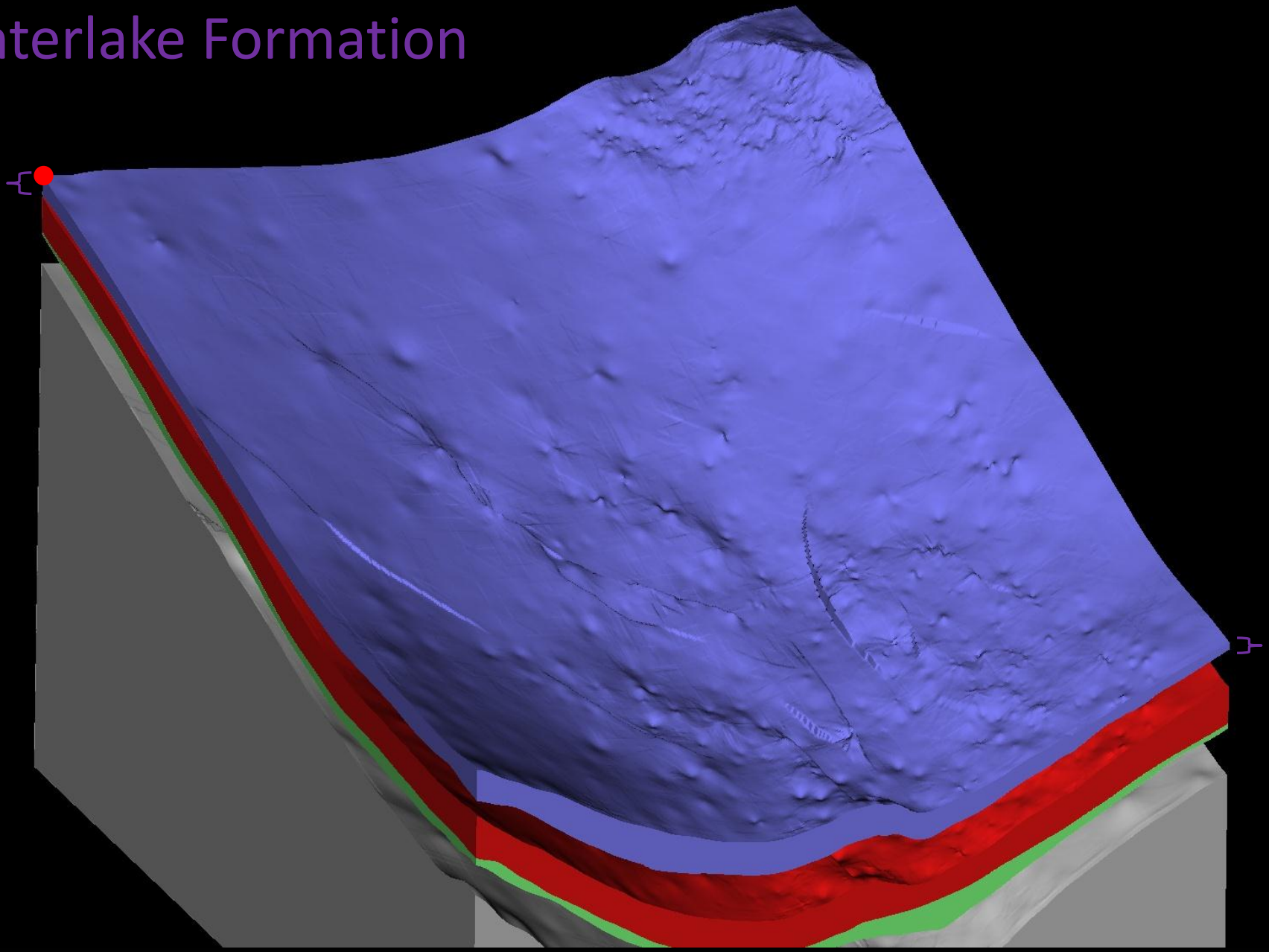

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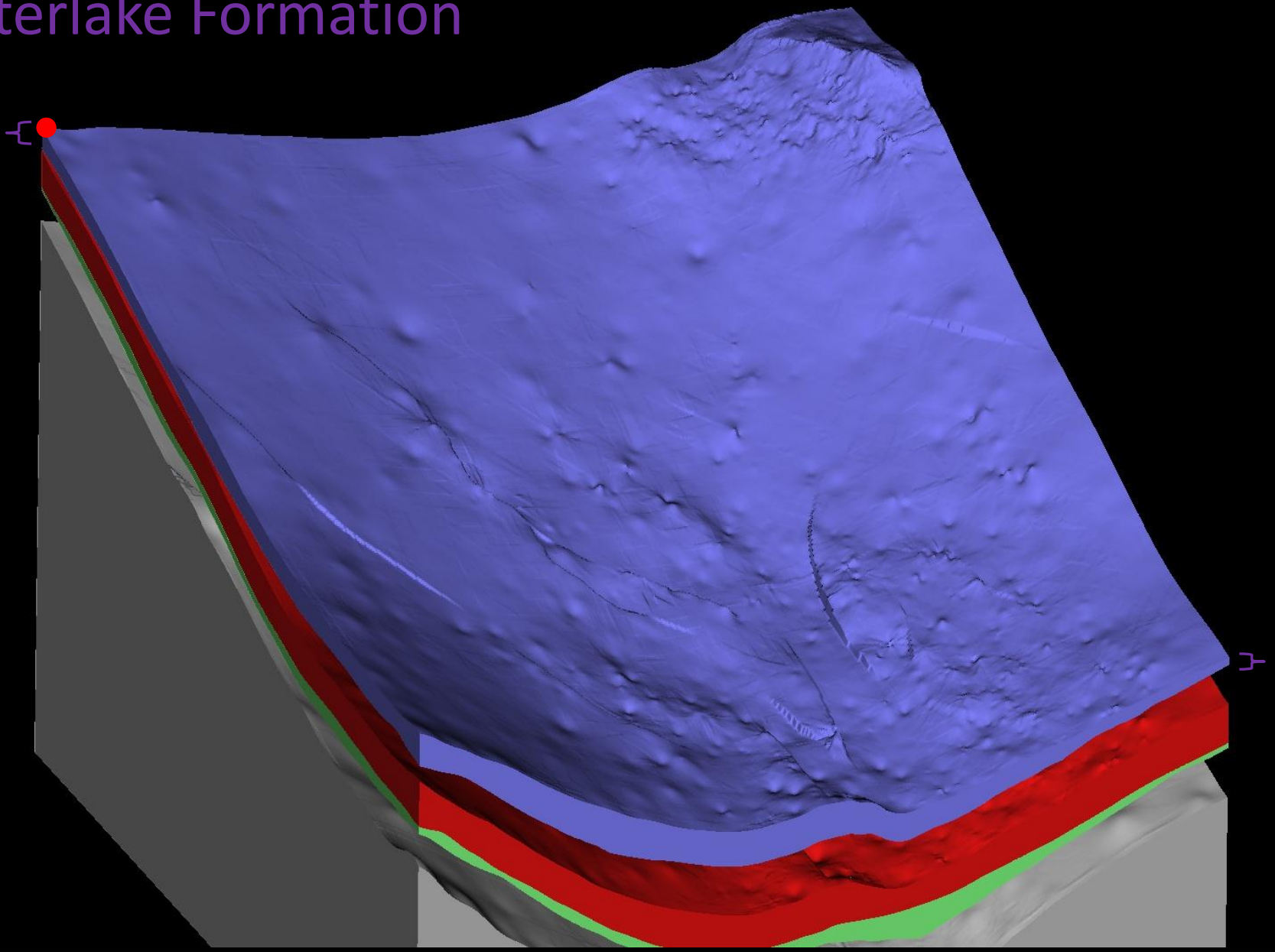

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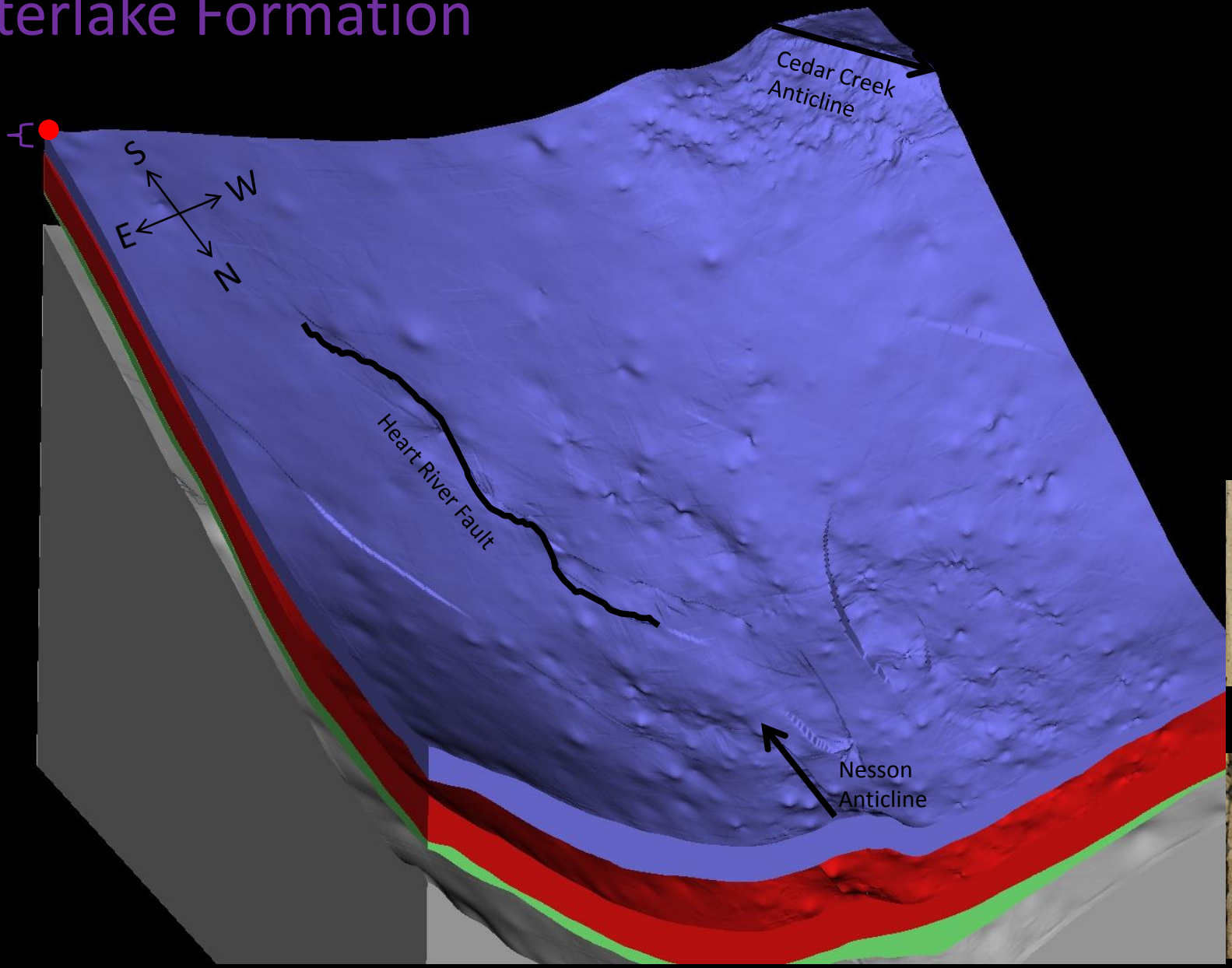

Interlake Fm.
Core Examples

Dolomitic limestone

Light grey Dolomite

North Dakota Geological Survey

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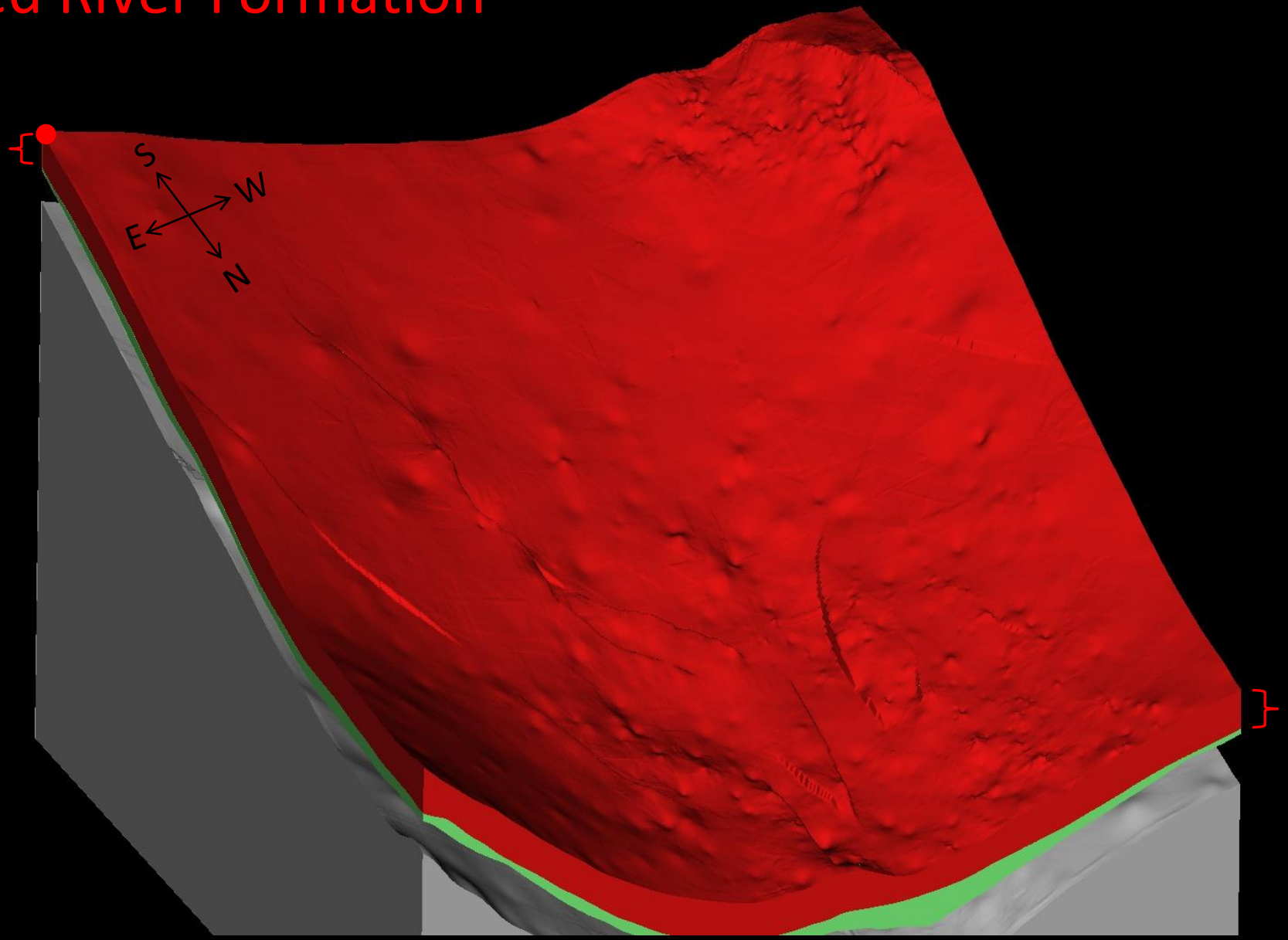
Red River Formation



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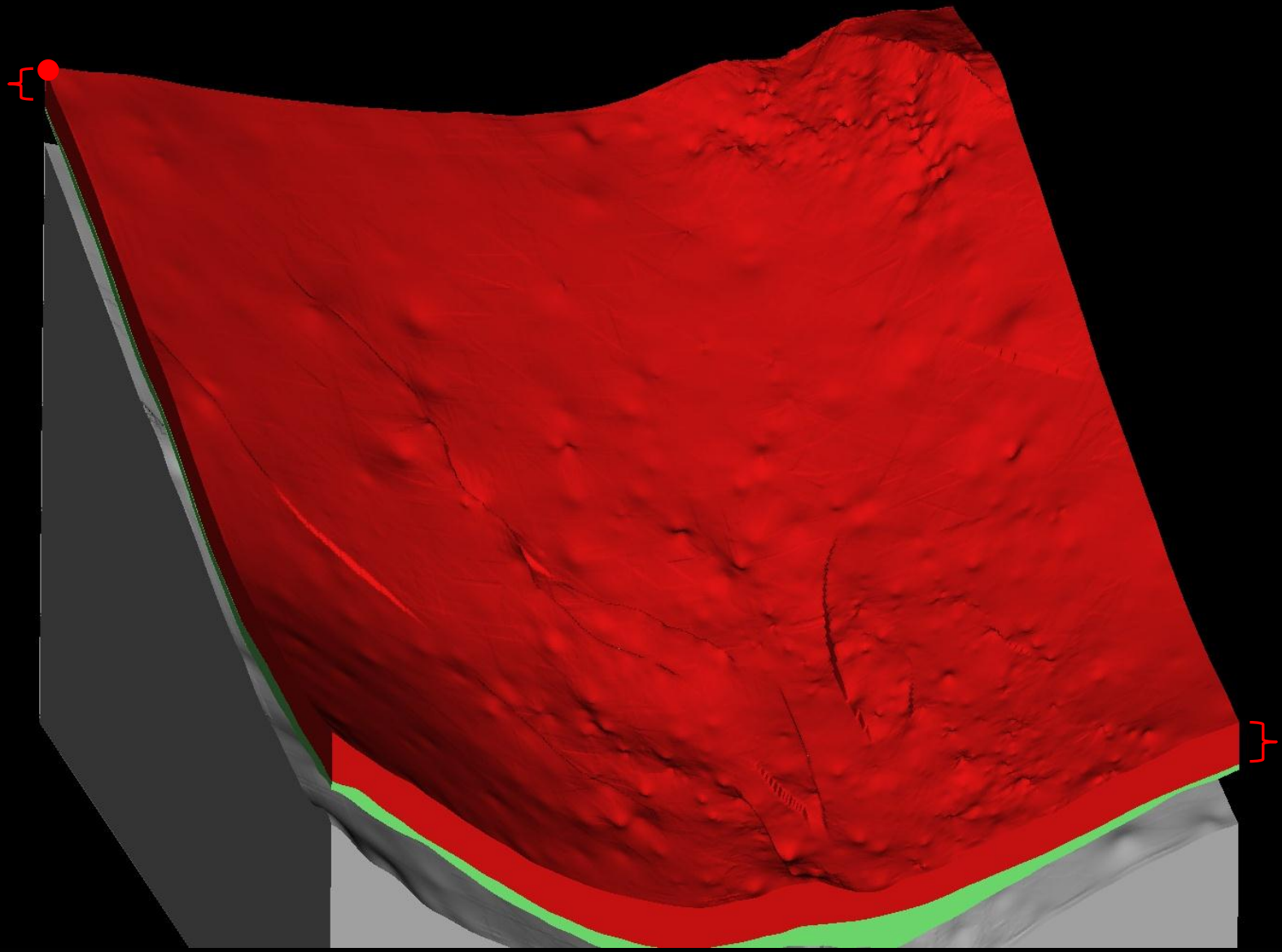
Red River Formation



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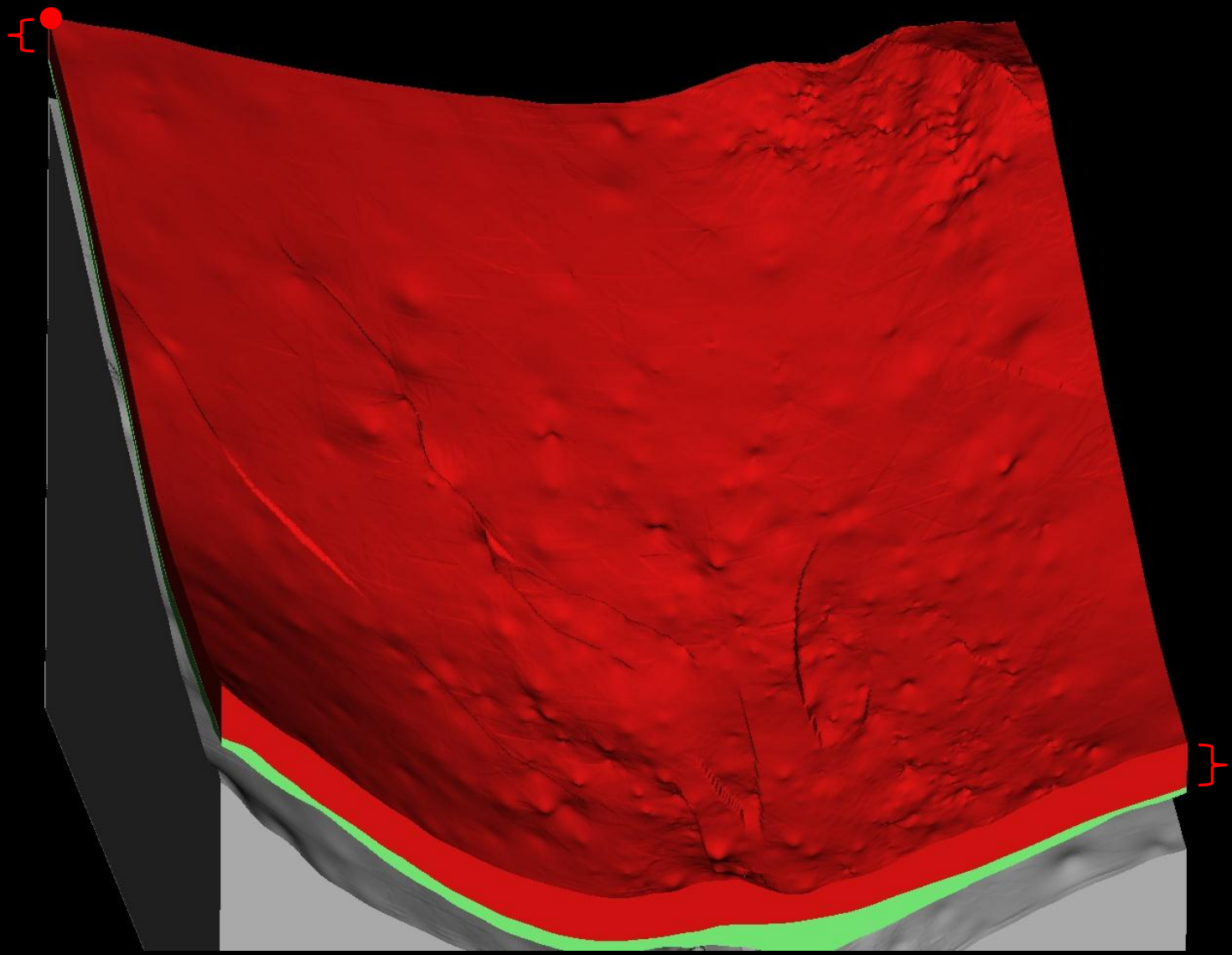
Red River Formation



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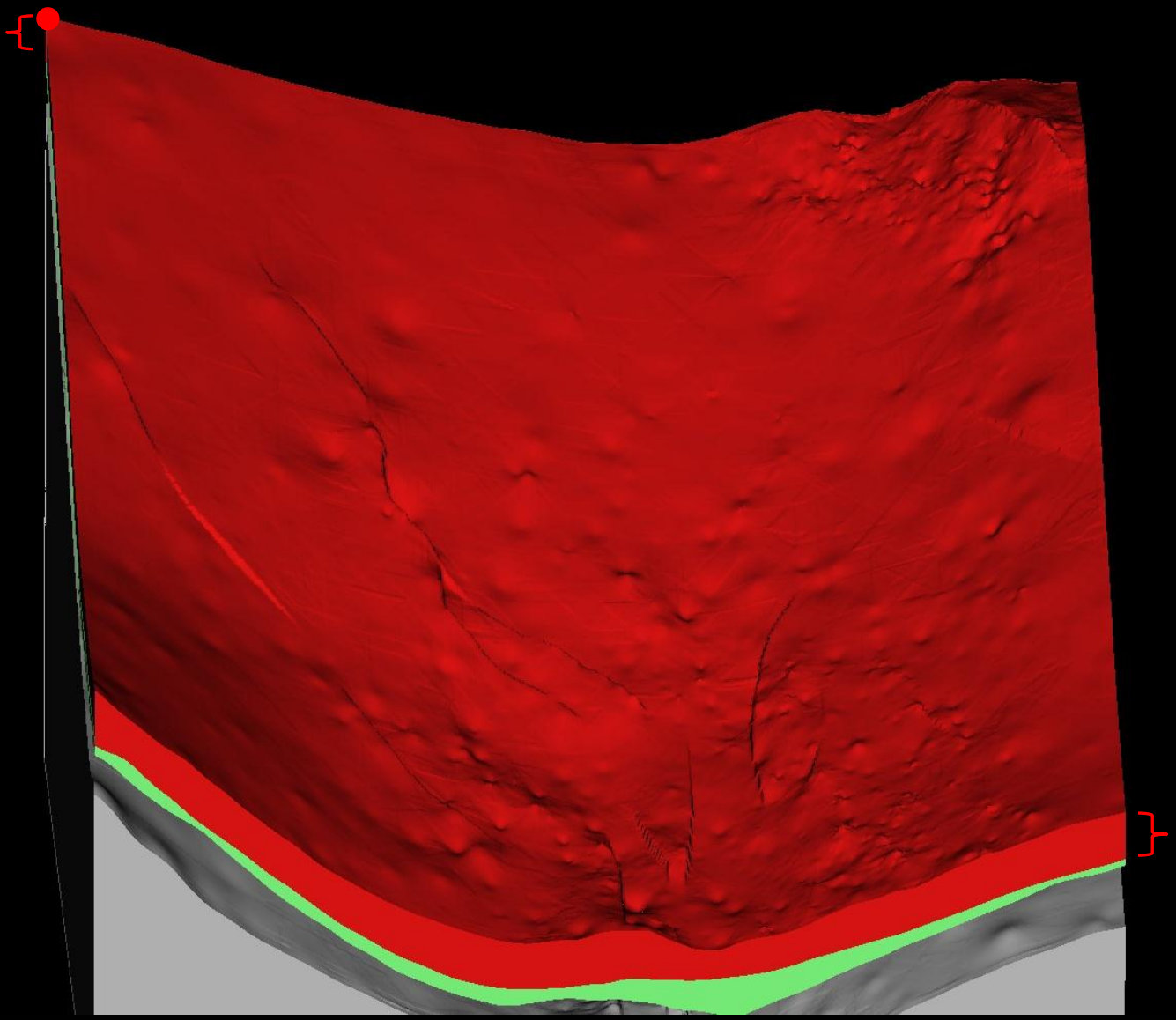
GI-141

Red River Formation



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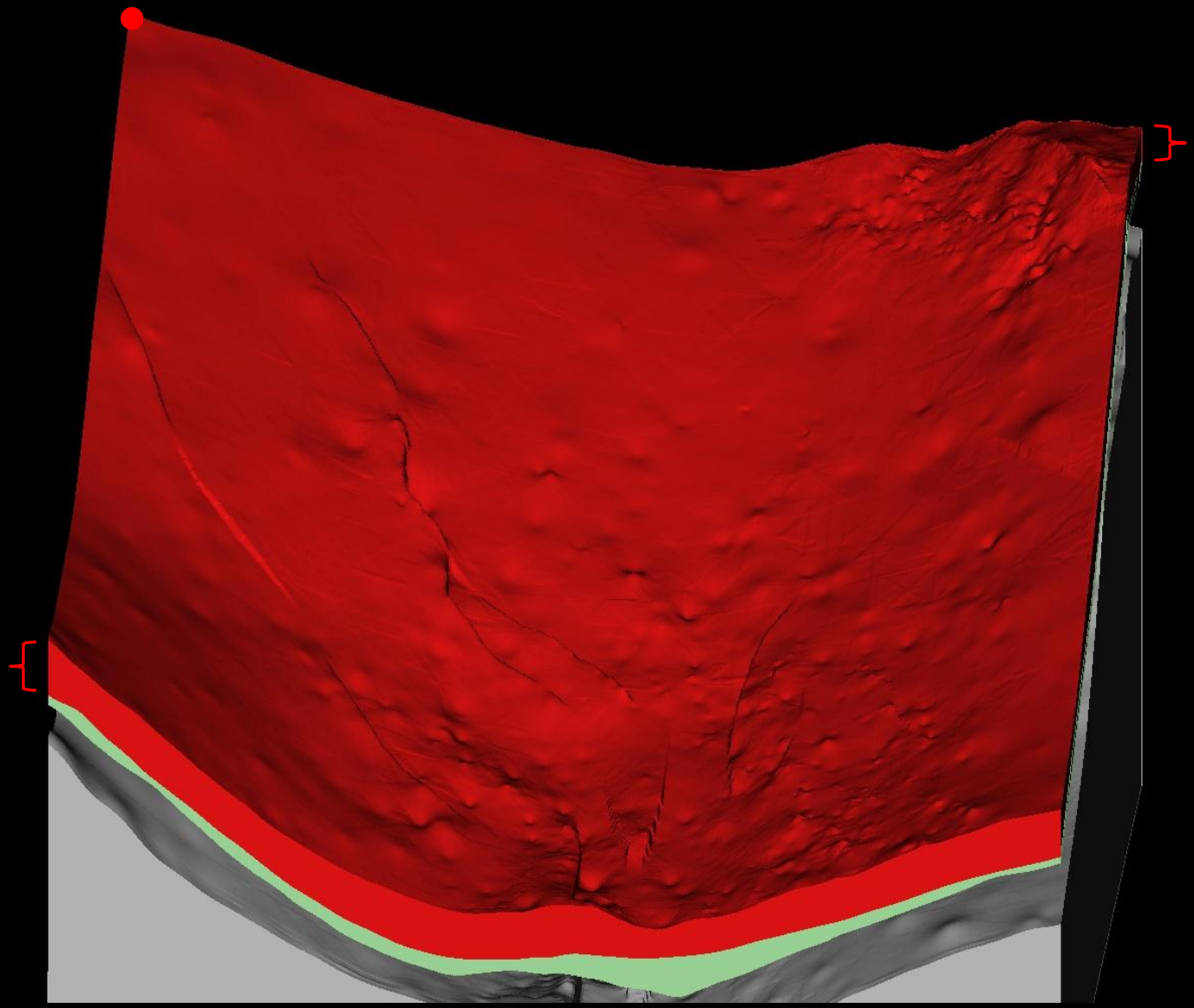

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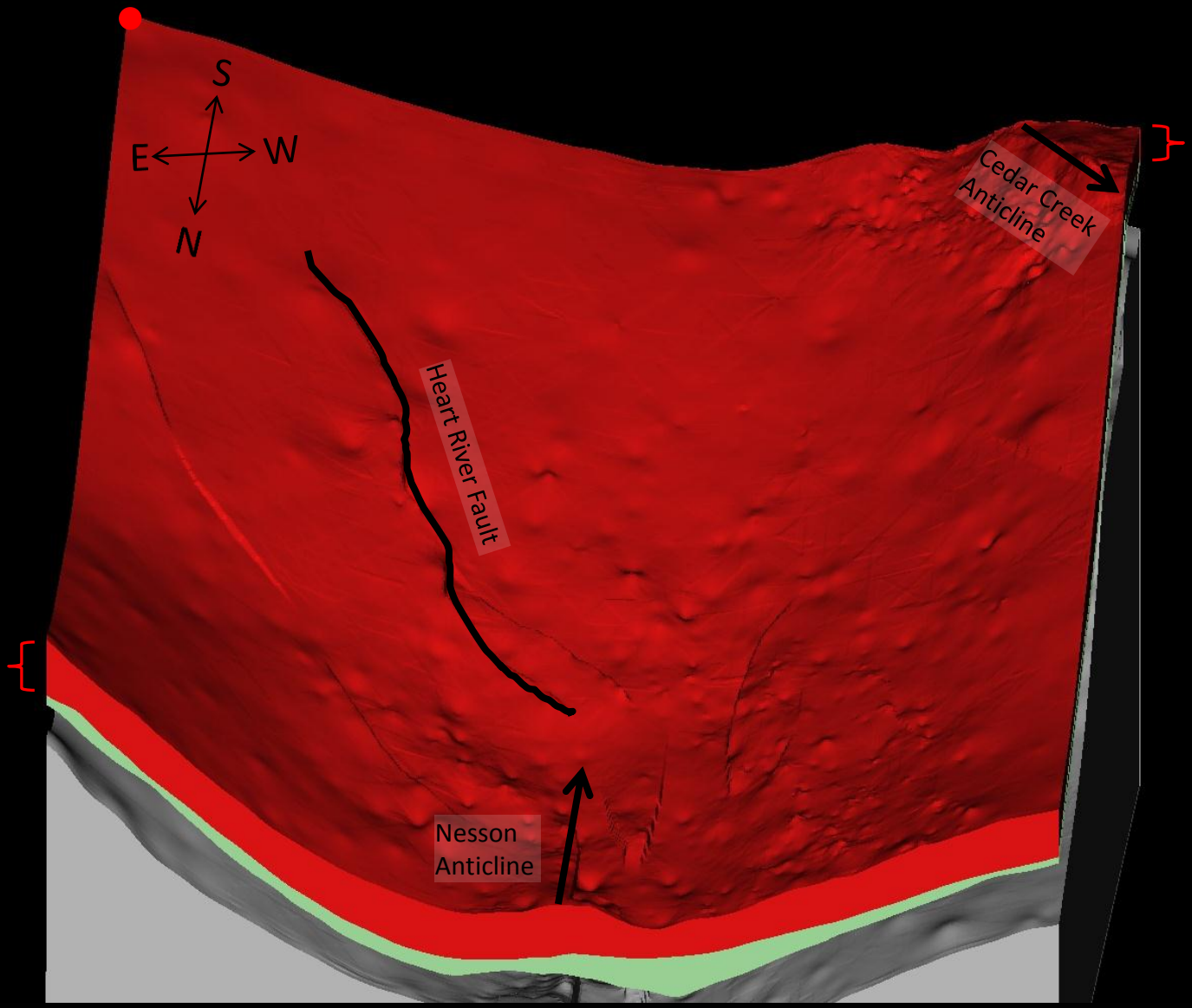
Red River Formation



Red River Fm.
Core Examples

Brownish-grey dolomite

Grayish-brown dolomite

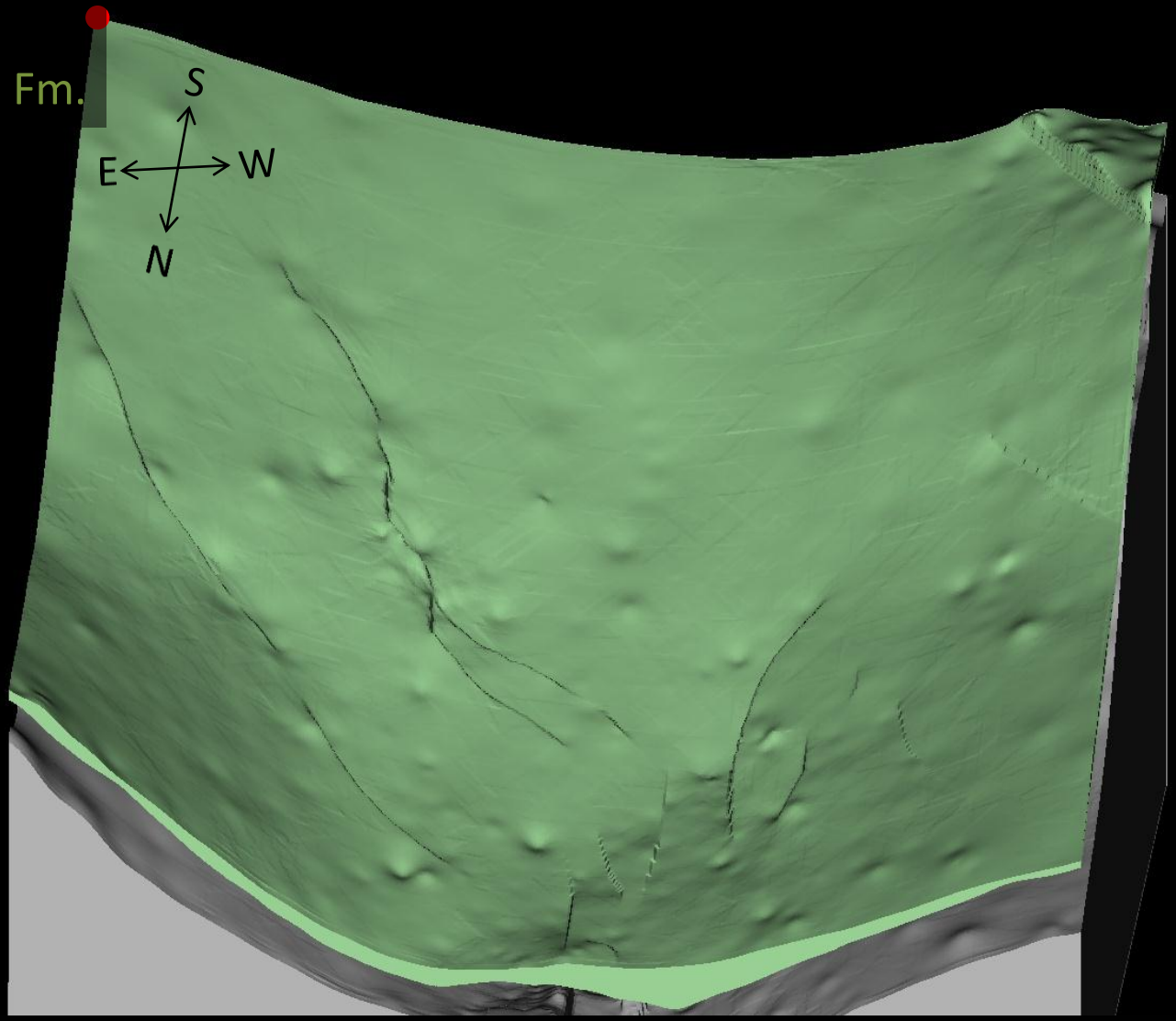
Slightly fossiliferous limestone

North Dakota Geological Survey

GI-141

Winnipeg Group

-Roughlock Fm.
-Icebox Fm.
-Black Island Fm.



Winnipeg Group

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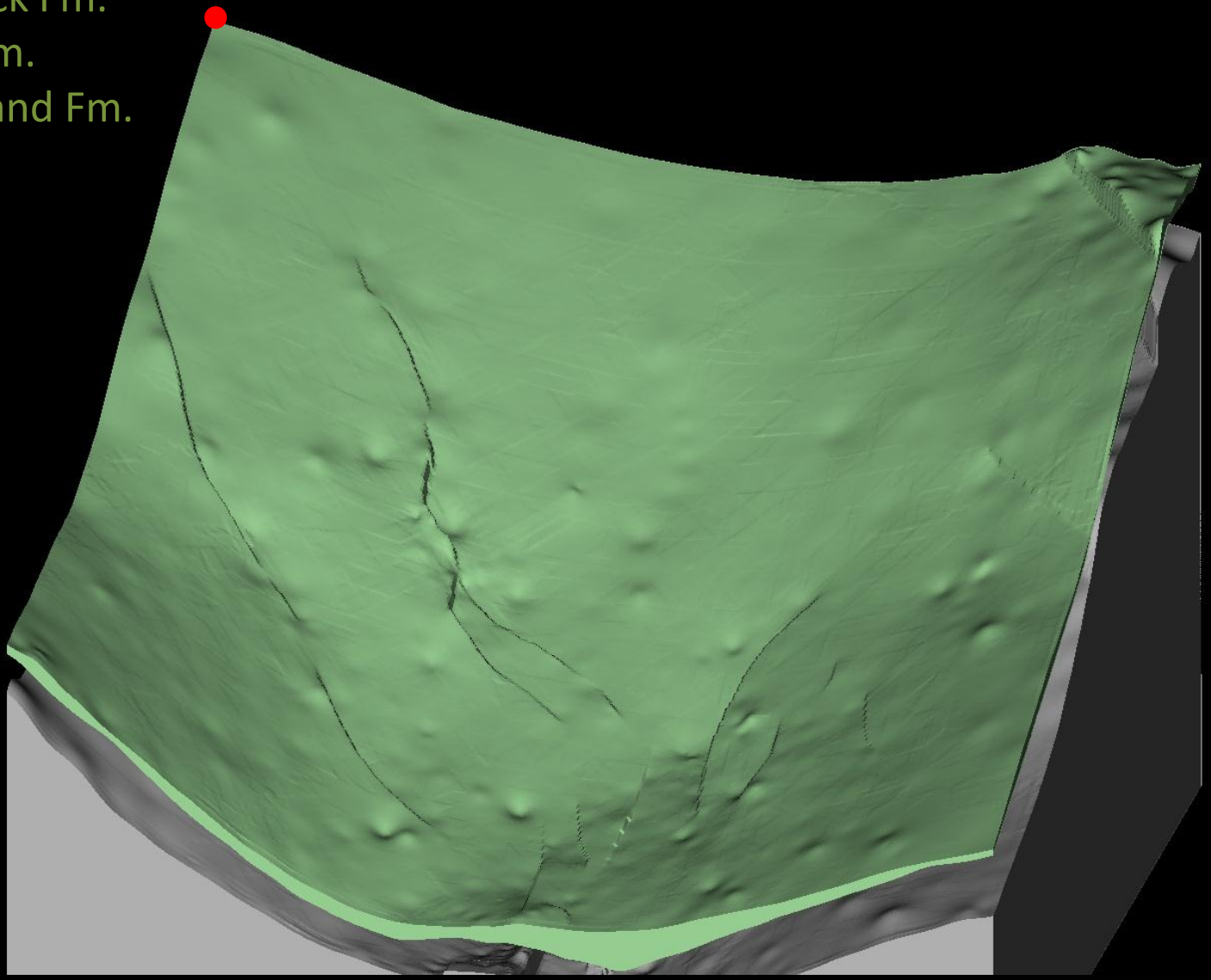

North Dakota
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GI-141

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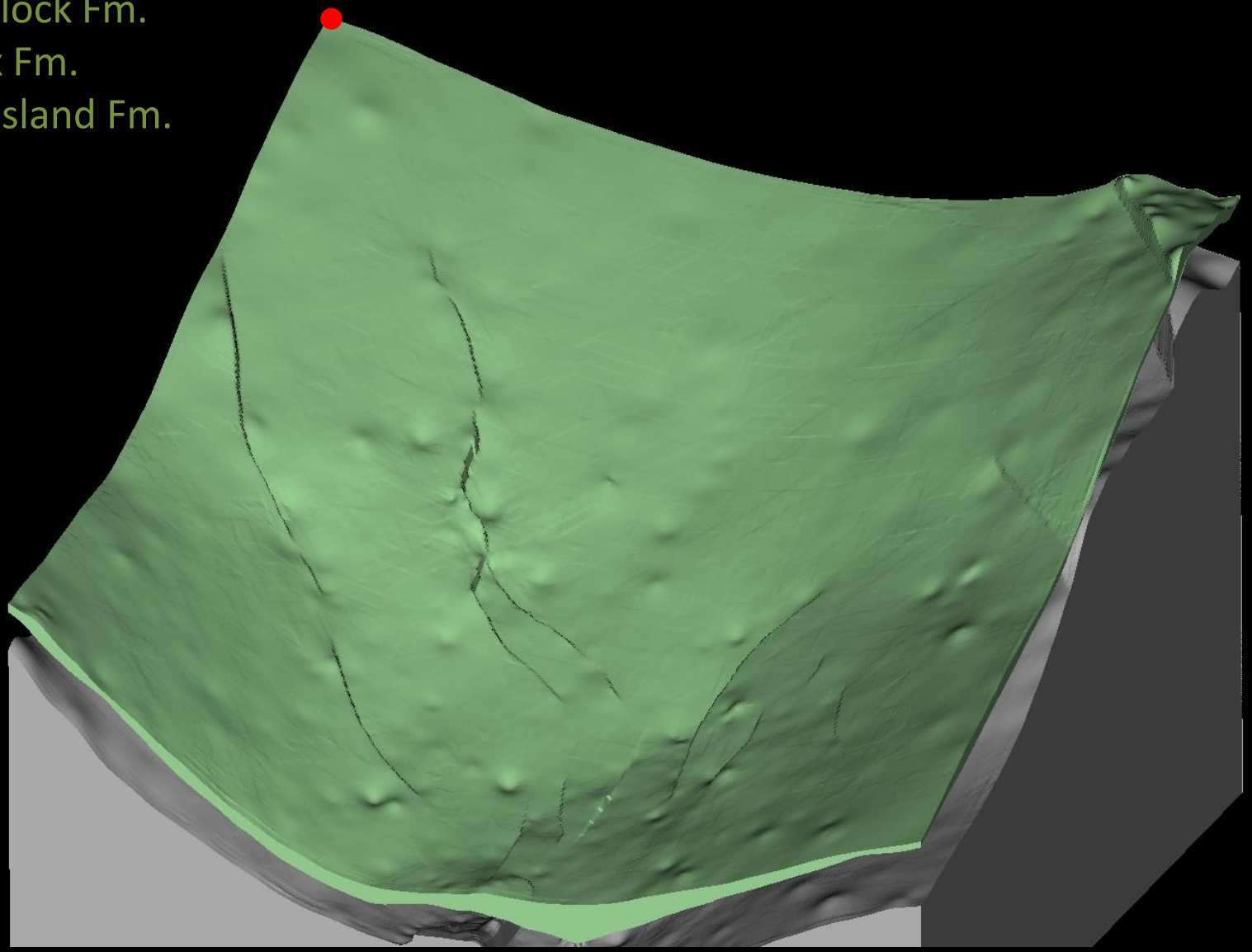

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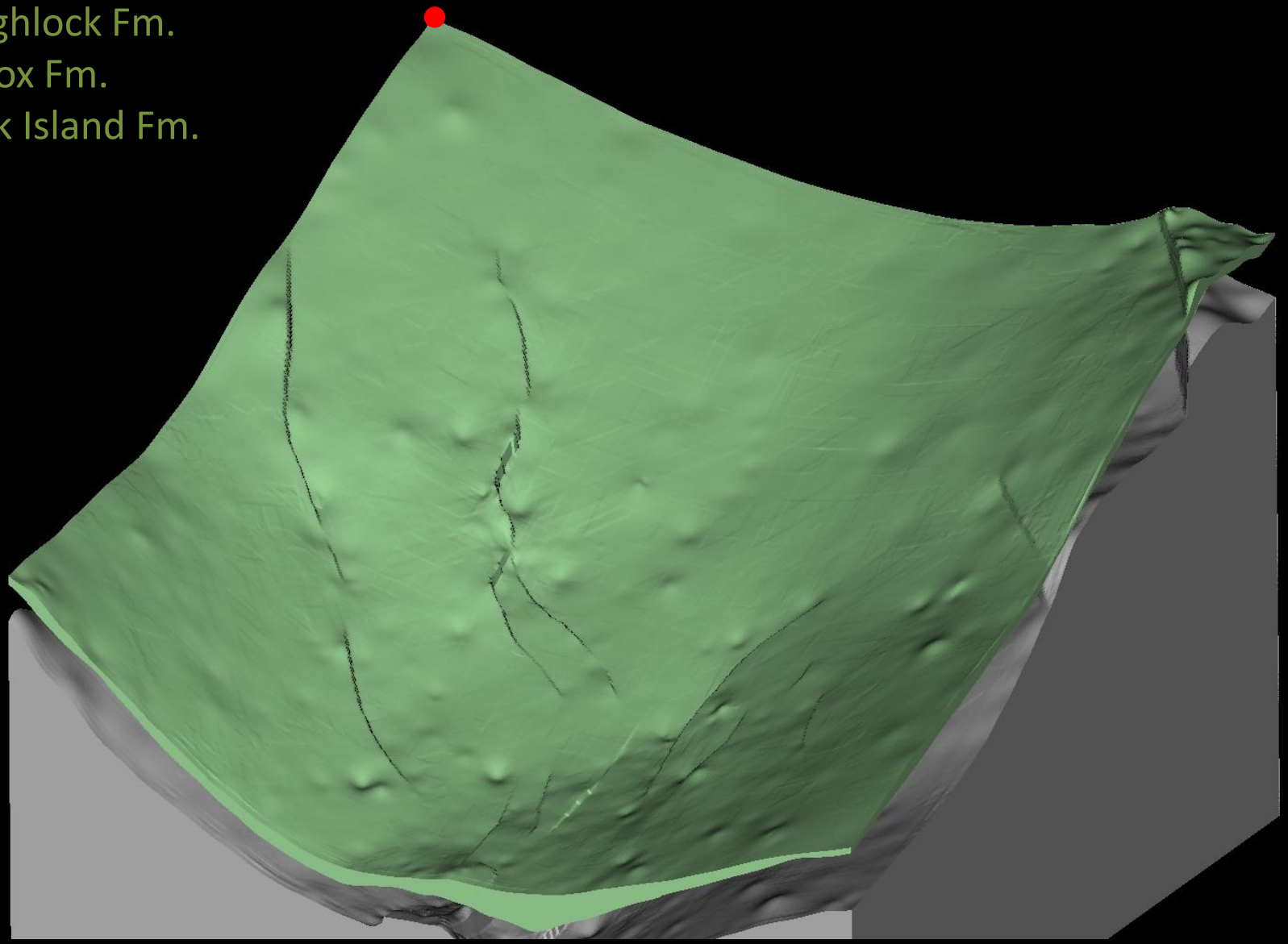

North Dakota
Geological Survey

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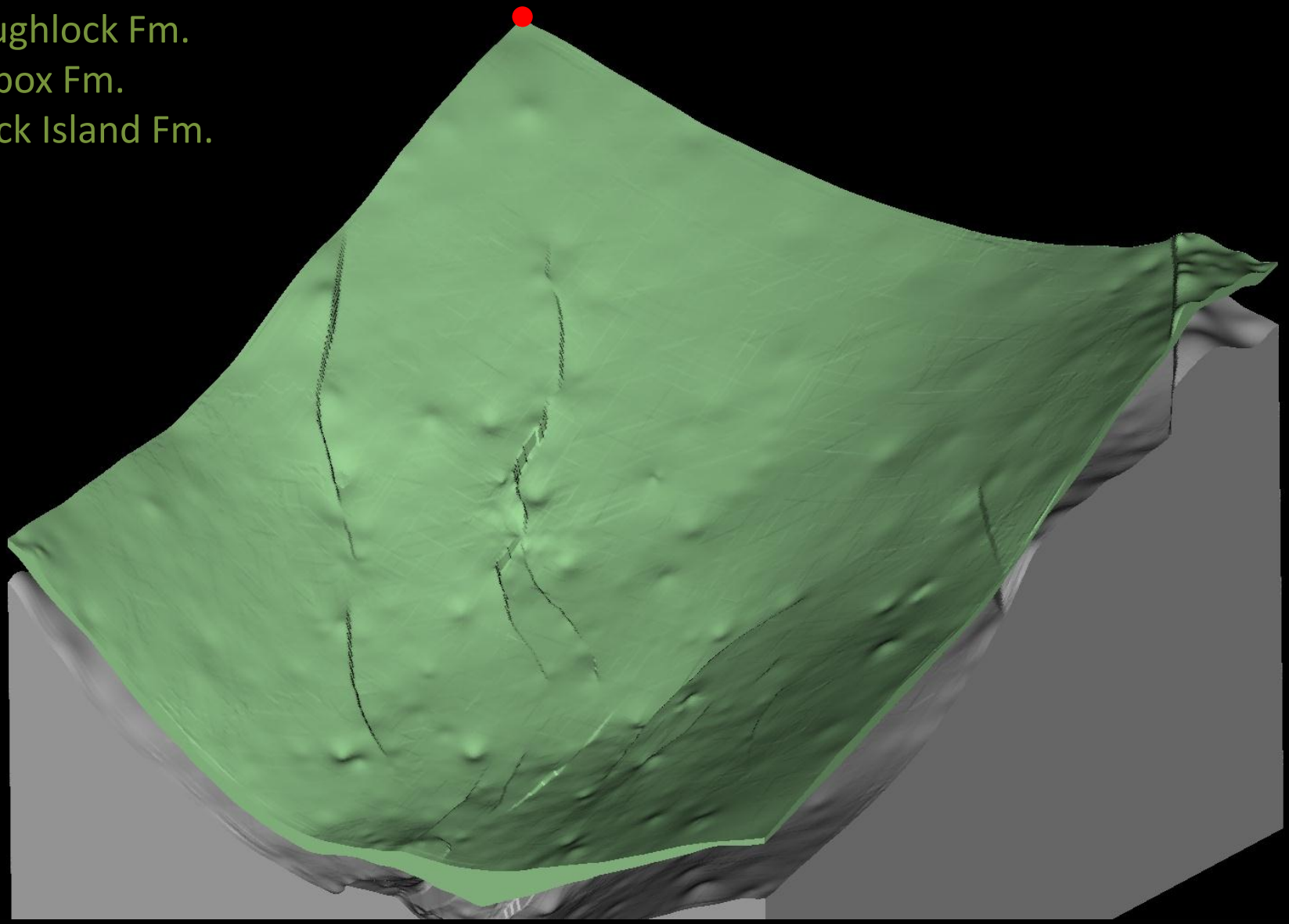

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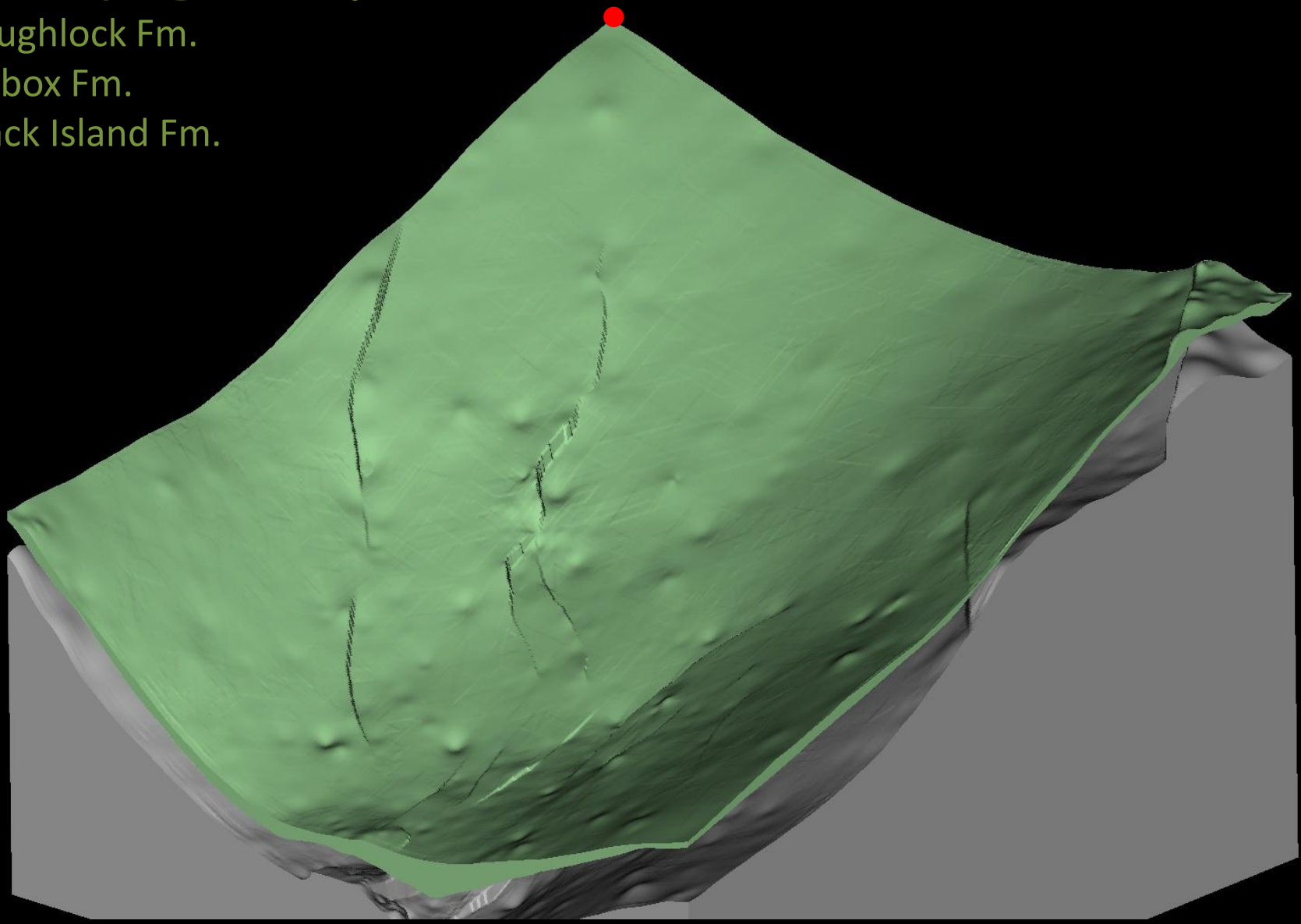

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Winnipeg Group

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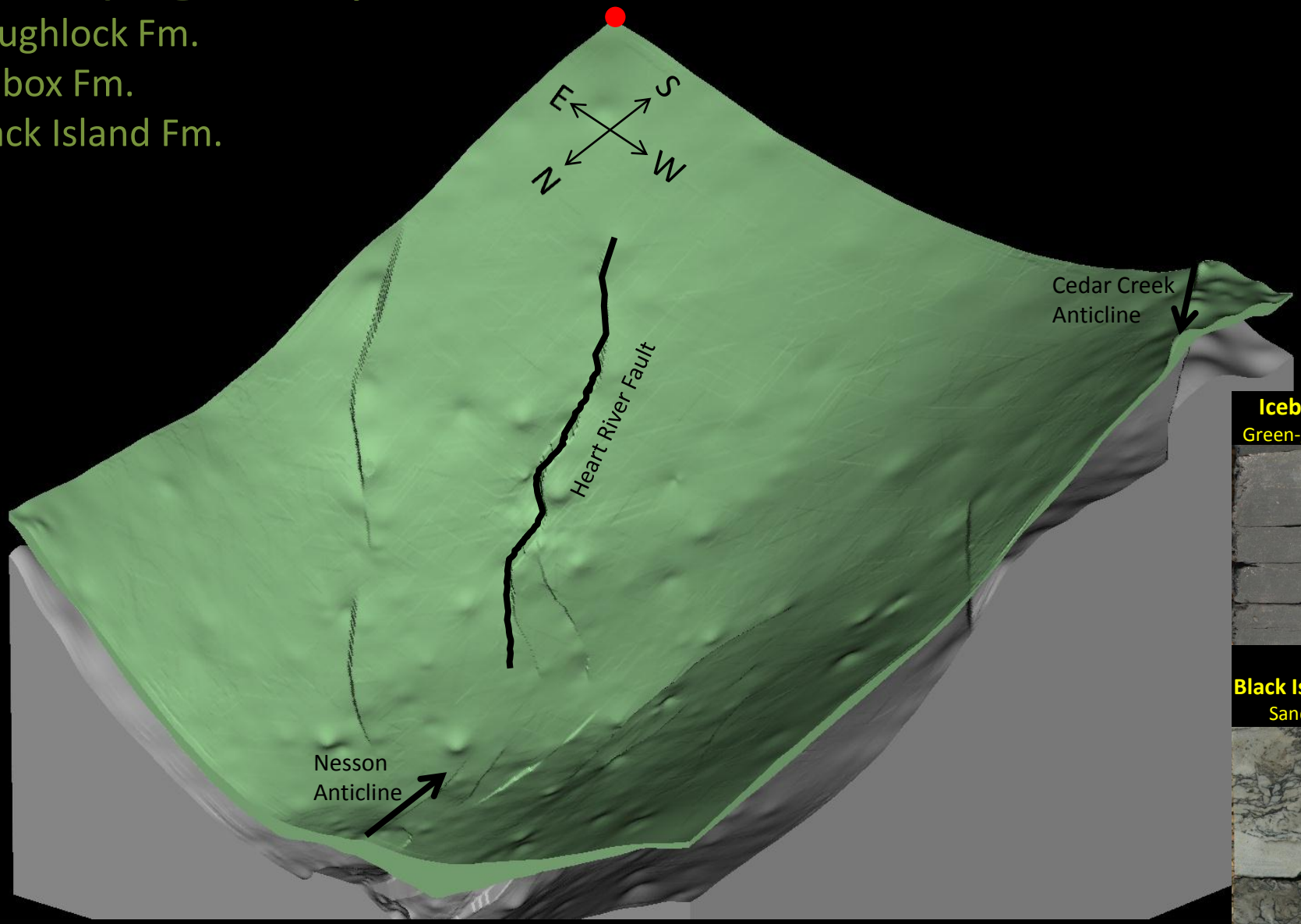

Icebox Fm.
Green-grey shale

Black Island Fm.
Sandstone

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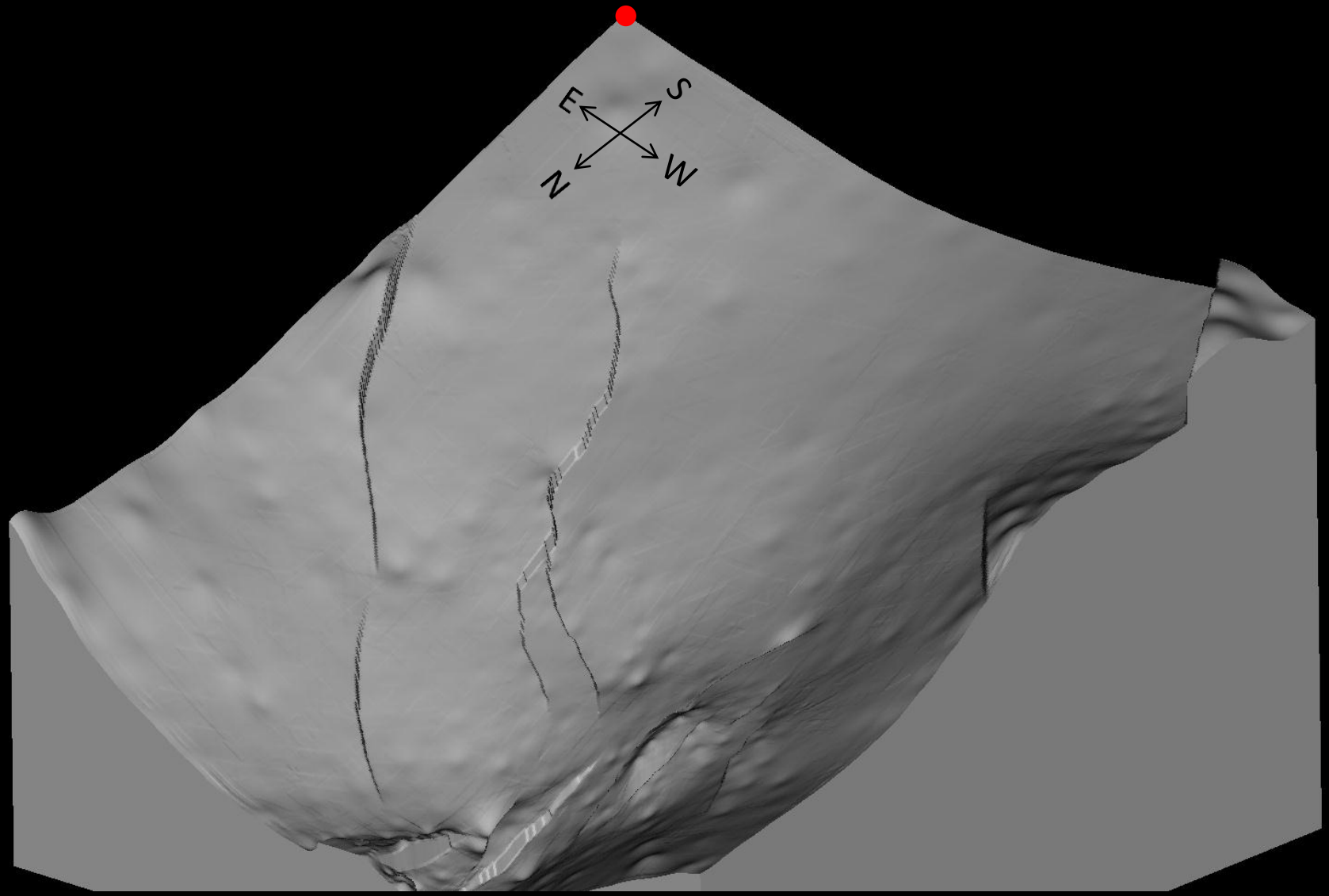
Precambrian Basement



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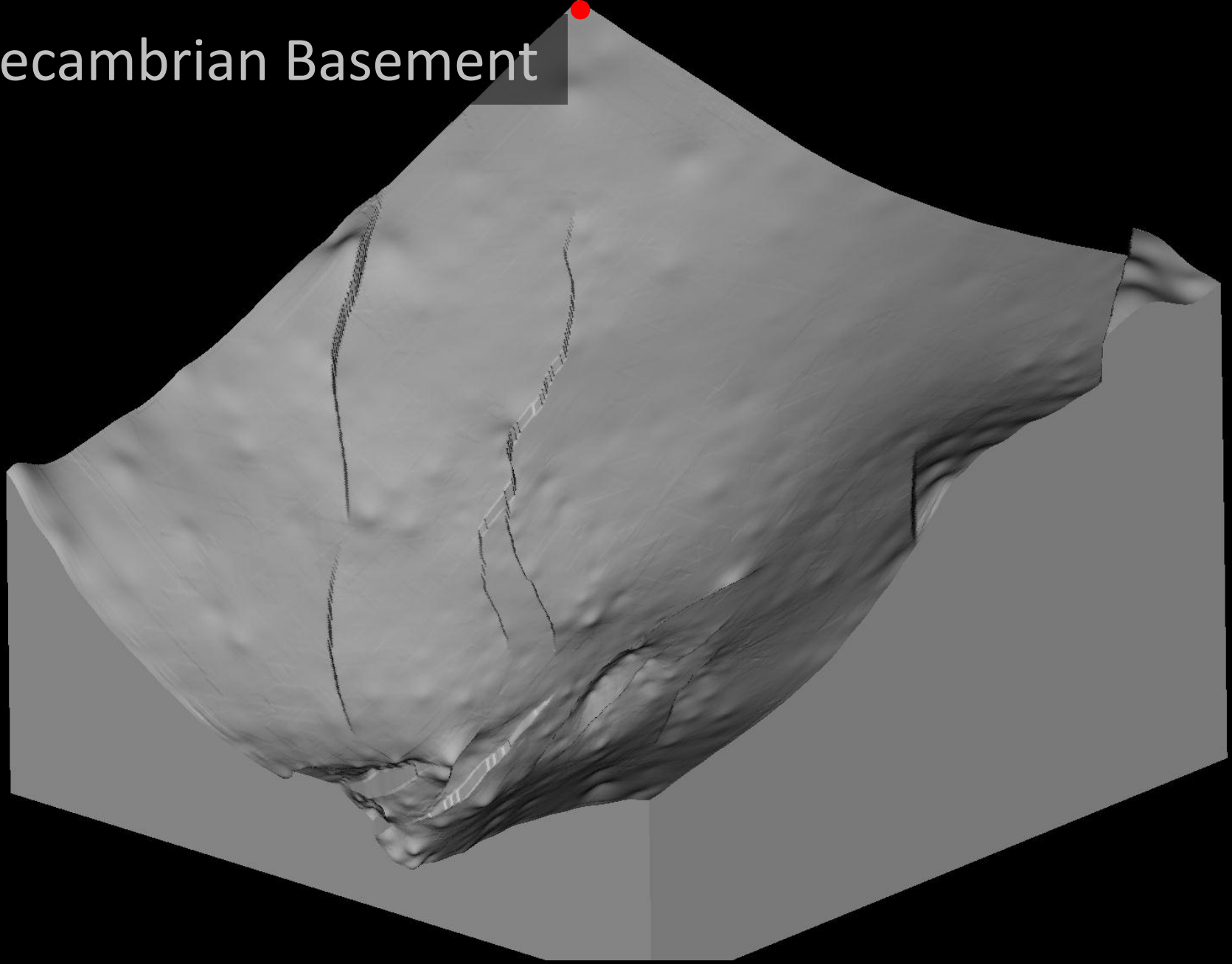
GI-141

Precambrian Basement



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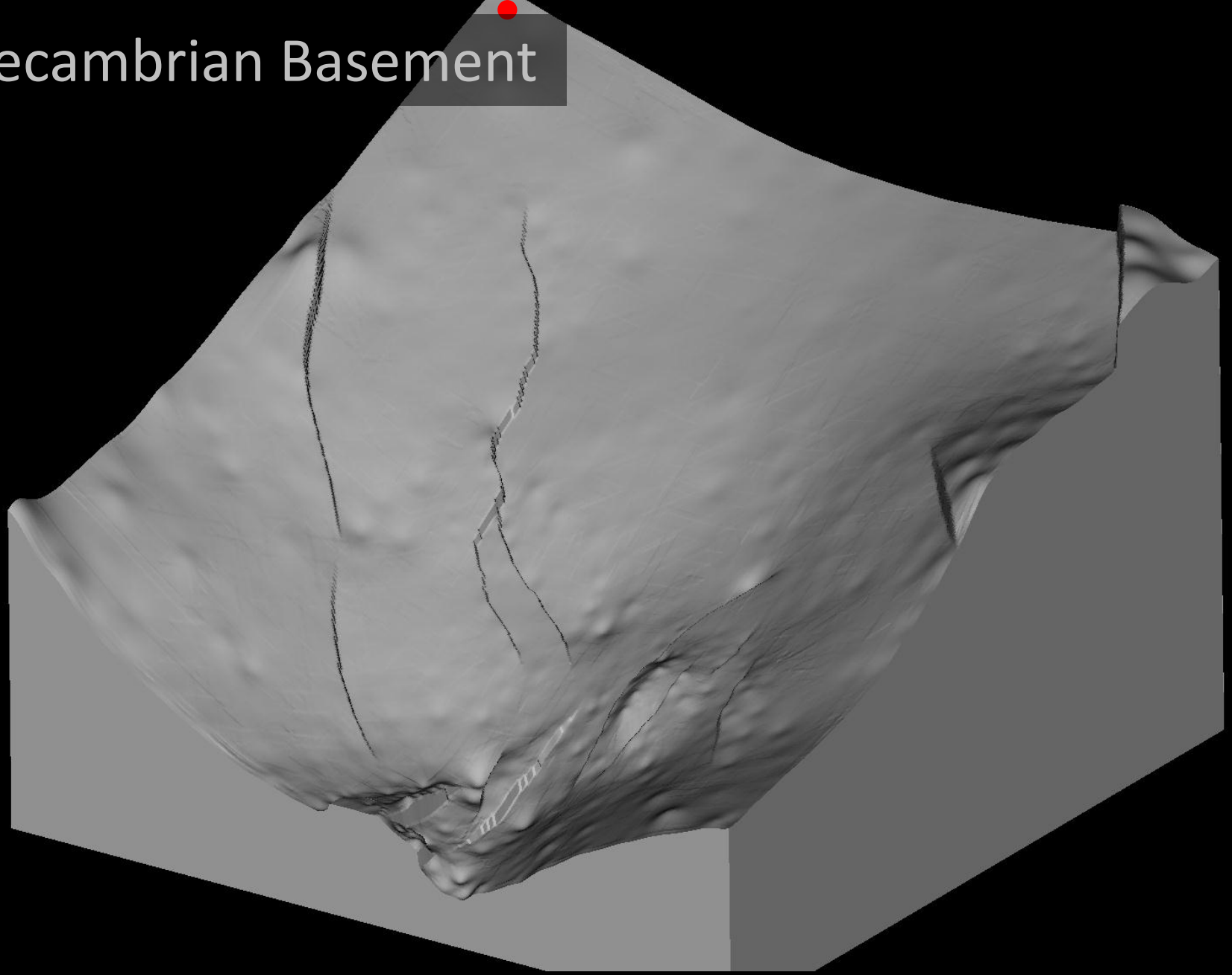
Precambrian Basement



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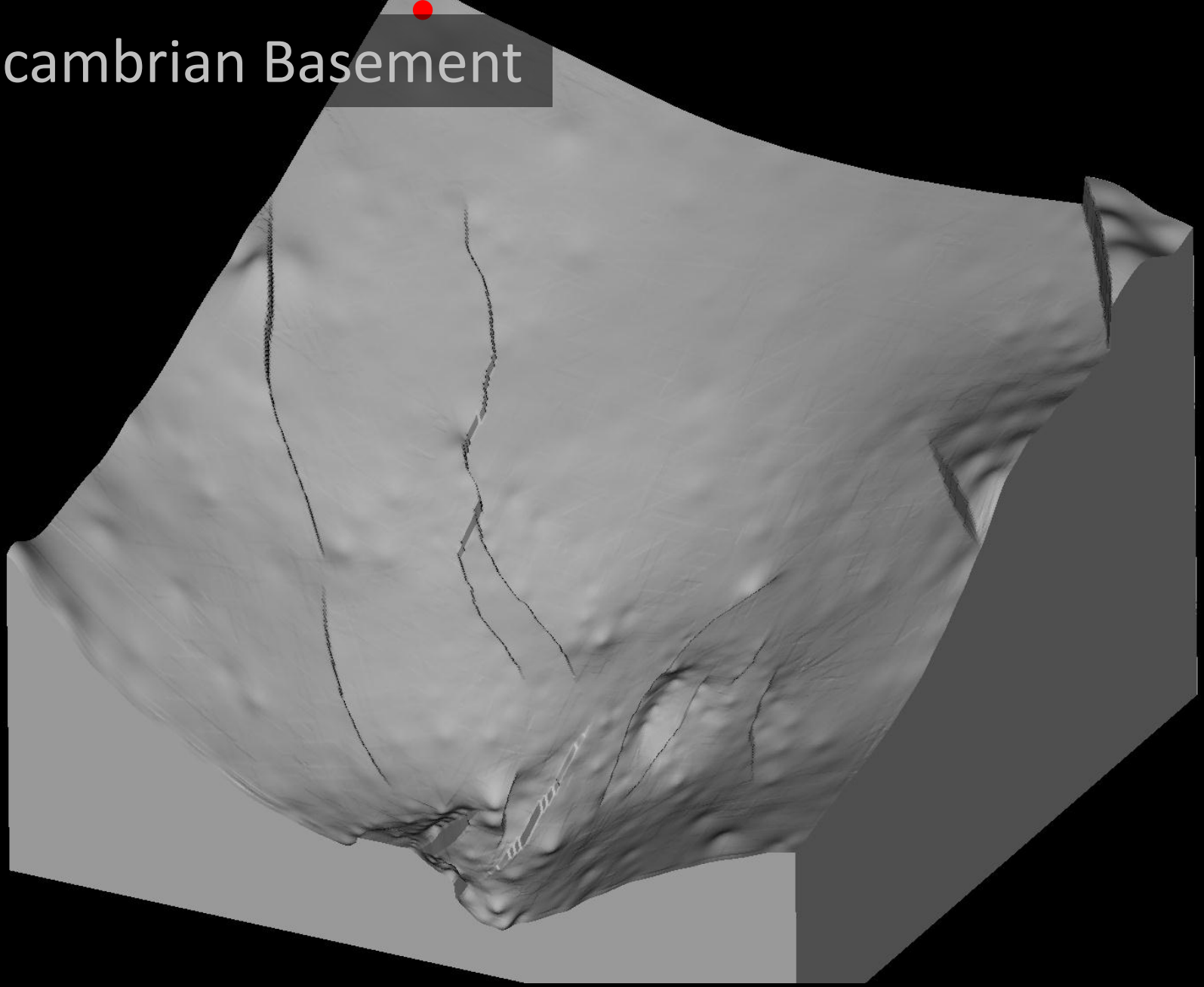
Precambrian Basement



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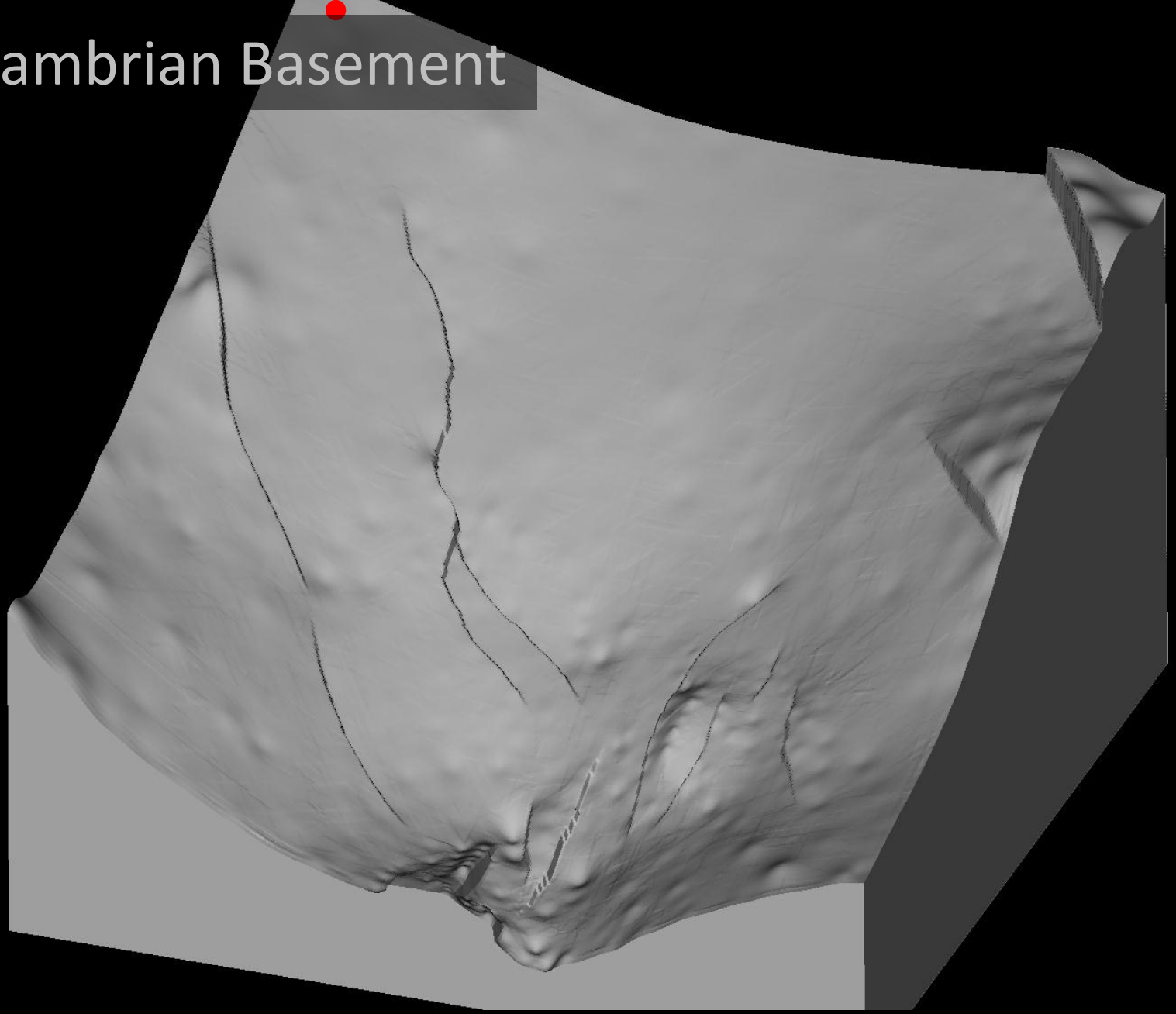

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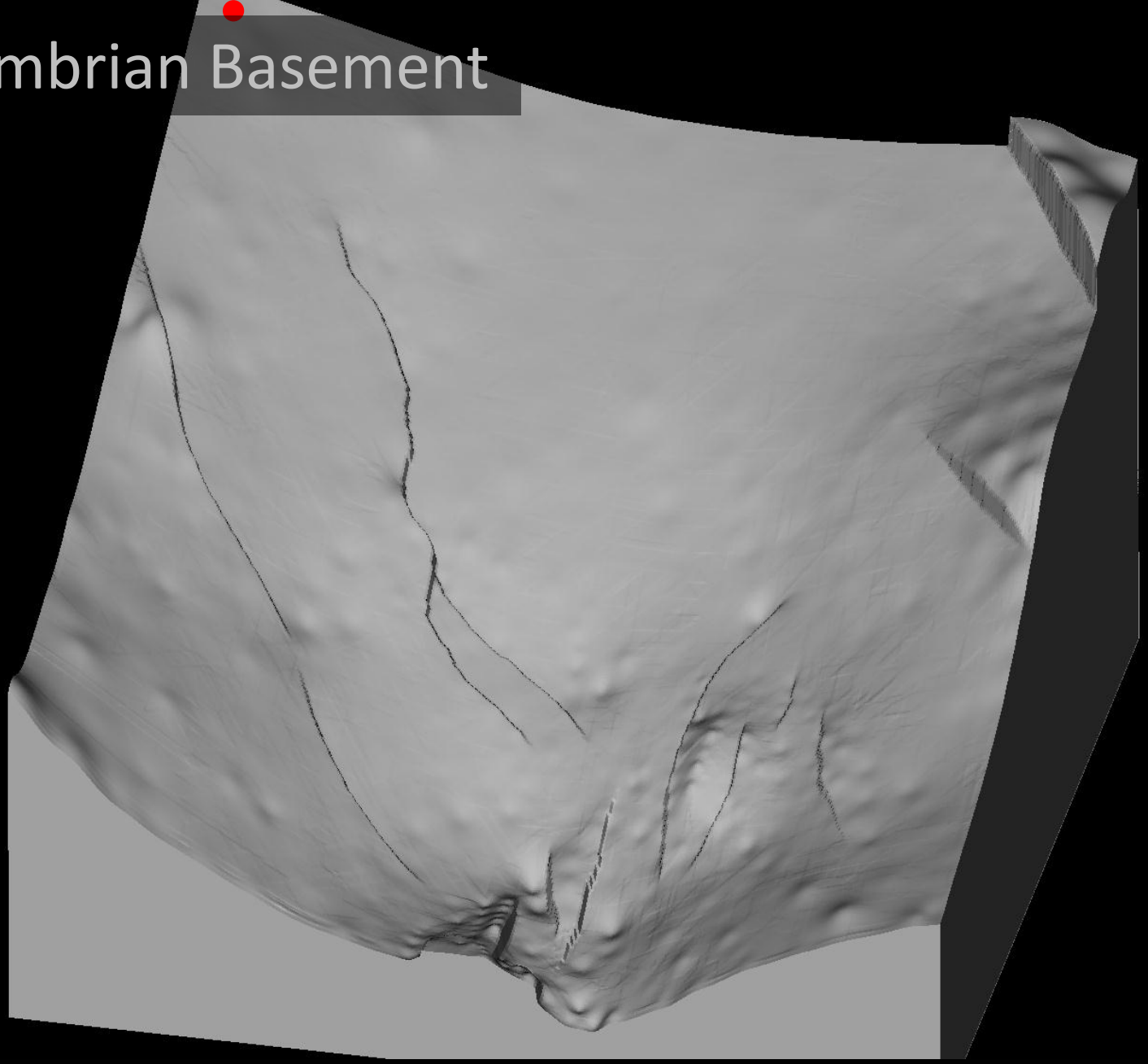

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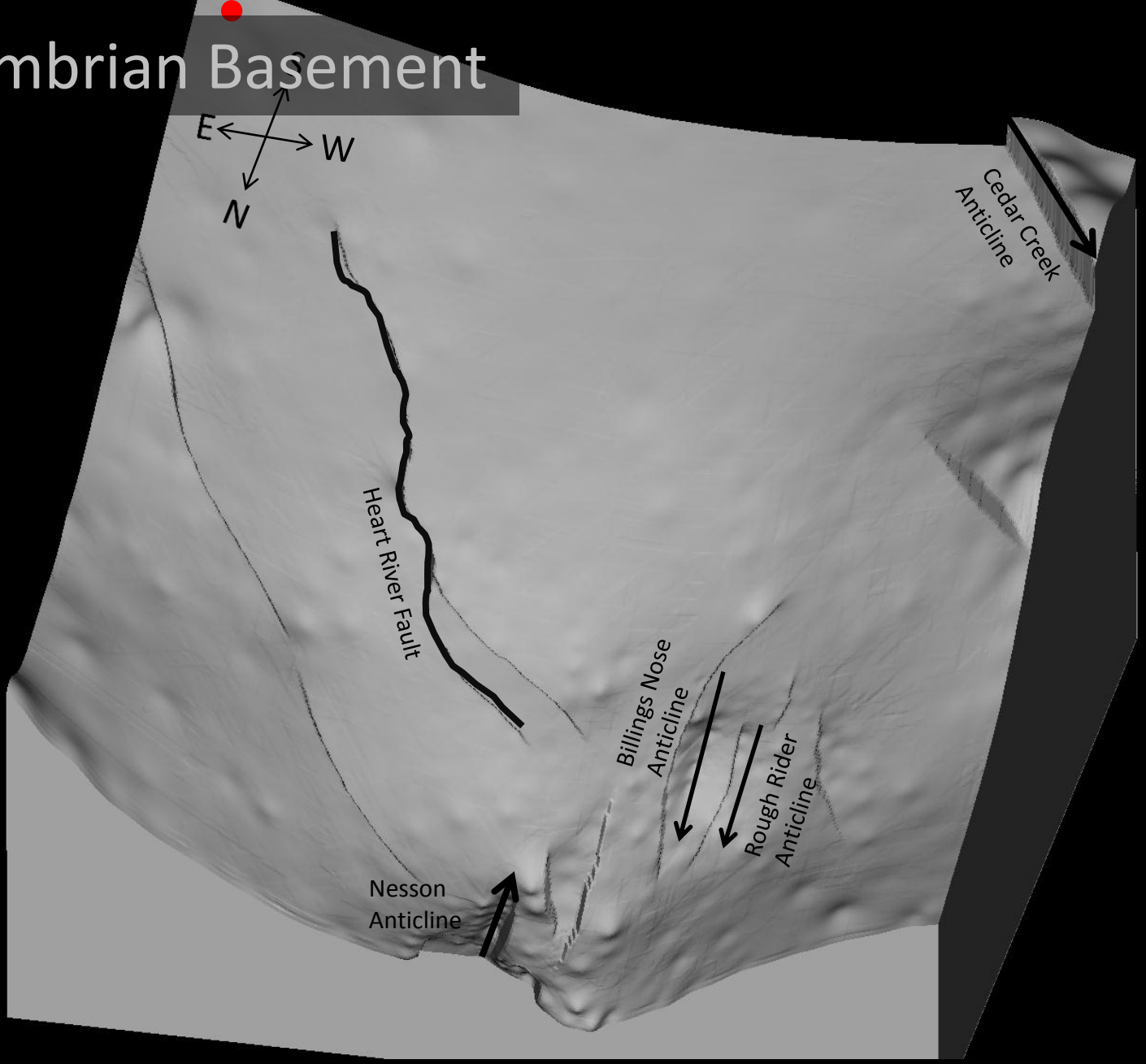

Precambrian Core Examples

Chlorite schist/gneiss

Mafic granulite

Andesitic gneiss

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