IDAHO–SNAKE RIVER DOWNWARP PROVINCE (017)

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INTRODUCTION

The Idaho-Snake River Downwarp Province is approximately 70,000 sq mi in size and comprises all of Idaho except for the southeastern part. The province is bordered on the west by the Columbia Plateau, on the east by the western Montana disturbed belt and the Yellowstone volcanic region, and on the south by the Basin and Range physiographic Province. The central part of the Province is occupied by the Idaho batholith. The batholith is bordered on the north and southeast by Proterozoic rocks of the Belt Supergroup and on the west by thick sequences of volcanics of the Columbia Plateau basalt. The southern part of the province comprises the late Tertiary Snake River Downwarp, which is considered to have potential for hydrocarbon deposits. The remainder of the province is mainly intrusive, metamorphic, and volcanic rocks that have little or no potential for hydrocarbon deposits.

The Snake River Downwarp in southern Idaho is a large arcuate structural graben 350–400 mi long and 50–75 mi wide extending from southeastern Oregon to Yellowstone National Park in northwestern Wyoming. Initial rifting may have begun in Miocene time, accompanied by downwarping, left-lateral displacement, and extrusion of volcanics (Warner, 1977). Prior to rifting, the area of southwestern Idaho and southeastern Oregon may have been occupied by a depositional basin where thick deposits of early Tertiary age were deposited (Warner, 1980). By early Miocene time, the basin was occupied by a large lake (“Lake Bruneau” of Miller and Smith, 1967), where 5,000–7,000 ft of lacustrine sediments were deposited (Sucker Creek Formation) (figs. 1, 2). Total thickness of tertiary deposits in this region may have been 30,000 ft or more. The Sucker Creek is exposed at several localities in southwestern Idaho and southeastern Oregon, and approximately 5,000 ft of the section has been penetrated in several wells. The formation consists of lignitic shale, clay, sandstone, diatomite, ash, tuff, oolitic limestone, and some lava flows. Numerous gas and some oil shows have been reported in shallow water wells and wells drilled in the section for petroleum (Warner, 1977, 1980).

Rifting and graben growth in Pliocene time occurred on the north side of the Lake Bruneau Basin, marking the initiation of the modern Snake River Downwarp. During this time, a second lake formed (Lake Idaho), which occupied the approximate position of the present-day Snake River Plain. As much as 9,000 ft of Pliocene-Pleistocene lacustrine clay, sandstone, conglomerate, algal and oolitic limestone, ash, tuff, and basalt were deposited (Poison Creek, Chalk Hills, and Glenn's Ferry formations. Thickness of both the Lake Idaho and Lake Bruneau deposits is greatest in the western part of the downwarp.

The Lake Idaho beds are overlain by the Snake River basalts of Pleistocene and Holocene age, which are exposed at the surface over much of the Snake River Plain (Malde and Powers, 1962).

Four conventional plays are described. They are Miocene Lacustrine (Lake Bruneau) Play (1701), Pliocene Lacustrine (Lake Idaho) Play (1702), Pre-Miocene Play (1703), and Older Tertiary Play (1704).

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CONVENTIONAL PLAYS

1701. MIOCENE LACUSTRINE (LAKE BRUNEAU) PLAY (HYPOTHETICAL)

This hypothetical play is based on the presence of as much as 5,000–7,000 ft or more of primarily lacustrine lignitic shale, clay, sandstone, diatomite, oolitic limestone, ash, tuff and lava flows of Miocene age, mainly in the southwestern part of the Snake River Downwarp.

Reservoirs: Potential reservoirs are fluvial and lacustrine sandstones and fractured oolitic and algal carbonates.

Source rocks, timing and migration of hydrocarbons:. Source rocks are organic-rich lacustrine shale, probable oil shale, and lignitic and carbonaceous shales or coal. Biogenic gas generated soon after burial and accumulated in adjacent reservoirs. Extensive faulting and fracturing along with increased heat flow in the Pliocene probably resulted in renewed migration of some earlier deposits into a reconstituted reservoir system, and in places heating of source rocks into the thermal stages of oil or gas generation. Numerous gas and some oil shows have been reported to be present in the Sucker Creek (Miocene) lacustrine beds in both shallow water wells and wells drilled for petroleum.

Traps:. Traps are fault blocks, folds, and stratigraphically isolated sandstone, siltstone, or carbonate units, sealed by fluvial and lacustrine shaly beds or volcanics.

Resource potential:. Drilling depths to potential Miocene reservoirs range from 5,000 ft to as much as 15,000 ft or more in the central southwestern part of the downwarp to very shallow on the north flank near the outcrops. The play is considered high-risk and probably gas prone. Temperature gradients are high in much of the area, and reservoir size and quality may be affected by intermixing tuff and ash deposits.

1702. PLIOCENE LACUSTRINE (LAKE IDAHO) PLAY (HYPOTHETICAL)

This hypothetical play is based on the presence of as much as 7,000–9,000 ft of fluvial and lacustrine clay, sandstone, conglomerate, algal and oolitic limestone, ash, tuff and basalt of Pliocene age in the southwestern part of the Snake River Downwarp.

Reservoirs: Potential reservoirs are fluvial and lacustrine sandstone, siltstone, conglomerate, and oolitic or algal carbonates.

Source rocks, timing, and migration:. Source rocks are organic-rich lacustrine shale, probable oil shale, and lignitic and carbonaceous shales or coal of Pliocene age. Timing and migration of hydrocarbons is similar to that of the Miocene Lacustrine (Lake Bruneau) play (1701), except that the Pliocene Lacustrine beds are shallower and more likely to contain biogenic gas and less thermal gas. Gas and oil shows have been reported from these beds also.

Traps:. Traps are fault blocks, folds, and stratigraphically isolated sandstone, siltstone or carbonate units, sealed by fluvial and lacustrine shaly beds or volcanics; they are similar to those of the Miocene Lacustrine (1701) play, except that there may be greater incidence of small isolated stratigraphic traps in the Pliocene beds.

Resource potential:. Drilling depths range from very shallow on the north flank of the downwarp to as much as 10,000 ft or more in the southwestern part of the downwarp. The play is considered gas prone, primarily biogenic gas. Because of its high risk, the play has very low potential.

1703. PRE-MIOCENE PLAY (HYPOTHETICAL)

This hypothetical play is based on the possible presence of remnant reservoirs and traps of Paleozoic and Mesozoic age in the probable extension of Laramide thrust belts beneath the Miocene and younger downwarp fill in the northeastern part of the Snake River downwarp.

Reservoirs: Potential reservoirs are marine carbonates and clastics of Paleozoic and early Mesozoic age, which are probably highly fractured and possibly metamorphosed.

Source rocks, timing, and migration: Potential source rocks are variably organic-rich shales or shaly carbonates of Mississippian, Pennsylvanian, Permian, Triassic, and Jurassic age, most of which are probably highly mature or overmature. Original hydrocarbon generation and migration probably occurred in Late Paleozoic or Mesozoic time, but probably most of these accumulations were destroyed during Laramide uplift, thrusting, and erosion.

Traps: Most original traps probably have been destroyed. Late traps related to Mio-Pliocene downwarping and extensional fracturing could be preserved, sealed by Miocene or Pliocene downwarp fill.

Resource potential:. This play is considered very high risk and would require an unusual combination of structural–stratigraphic factors to coalesce in order for a preserved hydrocarbon accumulation to be present.

1704. OLDER TERTIARY PLAY (HYPOTHETICAL)

This hypothetical play is based on the probable presence of a thick section of older Tertiary, and possibly even older, rocks (potentially partly marine) in the southwestern part of the Snake River Downwarp. Regional projections suggest that these rocks may be present in the subsurface but have not been drilled.

Reservoirs: Fluvial, lacustrine, and possibly marine clastics and carbonates of Early Tertiary age are potential reservoirs.

Source rocks, timing and migration:. Potential source rocks are Lacustrine and possibly marine, variably organic-rich shales, lagoonal beds, coaly or carbonaceous beds, and carbonates. Most of the section may be buried sufficiently to reach the highly mature or overmature thermal stage. Hydrocarbons probably would have begun generating by Middle to Late Tertiary time and continued generating and migrating through a series of diverse tectonic and igneous events.

Traps:. Possible traps would be pre-Miocene fault blocks, related structures, and folds, and clastic or carbonate stratigraphic traps in older Tertiary rocks.

Resource potential:. Much of the possible area of distribution of these rocks extends beyond the border of the Province into southeastern Oregon. The section is buried under a relatively unknown, but probably thick, section of younger Tertiary rocks. Thus, because of this and possible adverse high thermal gradients related to igneous and late tectonic activity, temperatures at depth may be excessive. This hypothetical play is considered to be probably gas prone, deep, and excessively high risk, although data are sparse to absent.

UNCONVENTIONAL PLAYS

There are no unconventional plays described in this province report. However, unconventional plays listed in the surrounding provinces may include parts of this province. Individual unconventional plays are usually discussed under the province in which the play is principally located.

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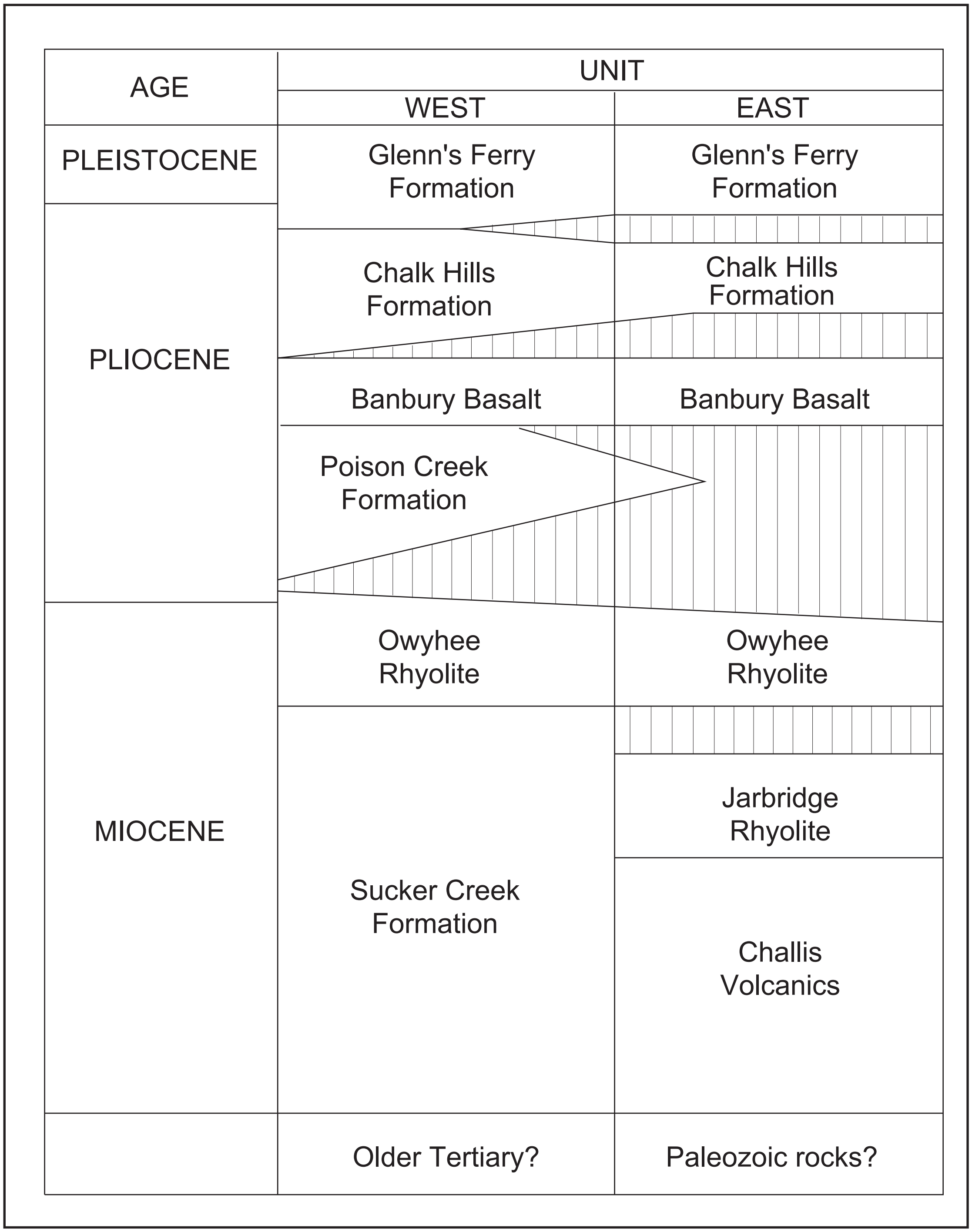
AGE
UNIT
WEST
EAST
PLEISTOCENE
Glenn's Ferry Formation
Glenn's Ferry Formation
PLIOCENE
Chalk Hills Formation
Chalk Hills Formation
Banbury Basalt
Banbury Basalt
Poison Creek Formation
MIOCENE
Owyhee Rhyolite
Owyhee Rhyolite
Jarbridge Rhyolite
Sucker Creek Formation
Challis Volcanics
Older Tertiary?
Paleozoic rocks?