

THE GEOLOGICAL SURVEY OF WYOMING

HORACE D. THOMAS, State Geologist

REPORT OF INVESTIGATIONS No. 6

**THE GOOSE EGG FORMATION
(PERMO - TRIASSIC)
OF EASTERN WYOMING**

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by

C. A. BURK¹ AND HORACE D. THOMAS²

ABSTRACT

The name Goose Egg formation is here proposed for a sequence of interbedded red to ochre shales and siltstones, thin limestones, gypsums, and limestone breccias typically exposed at the western end of Casper Mountain, near the Goose Egg Post Office in central Wyoming. The Goose Egg formation can be recognized in outcrops and in the subsurface throughout the eastern half of Wyoming, and is known to be a facies of the Dinwoody and Phosphoria formations of western Wyoming. The Goose Egg is Middle Permian and Lower Triassic in age, but the systemic boundary can be recognized only locally. The Goose Egg formation unconformably overlies the Tenstep, Casper, Hartville, or Minnelusa formations, and is conformably overlain by the Chugwater or Spearfish formations.

INTRODUCTION

The need for a formal stratigraphic name for the unit here named Goose Egg formation has long been recognized. In an unpublished manuscript prepared by Thomas in 1932, titled *The Freezeout Formation — a new name for Permian strata in central and southeastern Wyoming*, the nomenclature of the Middle Permian and the Early Triassic rocks was reviewed and it was proposed that the redbed facies of the Phosphoria and Dinwoody formations was worthy of a distinctive name. The intent to apply the name Freezeout formation to the redbed facies was submitted by letter to the Committee on Geologic Names of the U. S. Geological Survey and a reply, dated January 21, 1933, was received to the effect that the application of the name to the sequence involved "would be unfortunate". The judgment of this group was respected, and accordingly the manuscript was never submitted for publication. Instead, in his 1934 paper describing the intertonguing of the Phosphoria and the Dinwoody formations with redbeds in central and southeastern Wyoming, Thomas used the unwieldy name, "Intertongued phase of Phosphoria and Dinwoody age" (p. 1671).

The need for a name for the strata in question has persisted through the years, however. The literature is replete with references to "Dinwoody and Phosphoria equivalents", "Embar equivalent", "Redbeds facies of the Embar", "Redbeds facies of the Phosphoria", "Redbeds phase of the Phosphoria", "Embar of oil geologists", "Embar (?)", "Eastern redbeds facies", "Permian red shale and evaporite sequence" and many other terms all referring to the beds here called the Goose Egg formation. After many years of work with these strata, the writers are fully convinced that a formal name is necessary.

Under the usual conditions it is possible to establish rock units for cartographic or stratigraphic use whose boundaries coincide with systemic or other time boundaries, but sedimentary rocks and regional stra-

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tigraphy are not simple and do not always follow patterns which lend themselves to the ideal classification and nomenclature. Long ago, in discussing this very problem with Alexander L. du Toit, he remarked that stratigraphic units may be likened to pigeon holes in a post office since most letters that come will fit nicely into a specific pigeon hole, but that sometimes unusual parcels show up which necessitate the tearing out of a partition between two pigeon holes in order to accommodate them. And this is the case with Goose Egg formation.

There are numerous stratigraphic units in Wyoming which are useful and effective in regional mapping or stratigraphy which are similarly comprised. For instance, the Casper formation of the Laramie Range is made up of both Pennsylvanian and Permian rocks. Recognition of the Pennsylvanian and Permian parts can be accomplished only paleontologically, and to separate lithologically similar rocks into two formations of different ages for mapping or for differentiation in the subsurface seems completely impractical at present. Other examples could be cited.

The age of rocks comprising a formation has no effect on the usefulness of that formation in geological work. Just as a unit made up of rocks representing two different systems may serve in a practical fashion, so may a unit whose age cannot even be determined. The Nugget sandstone is a practical and readily recognizable stratigraphic unit in western Wyoming even though it is classed as Jurassic by Imlay (1952) and as Triassic by Shaw and McGrew (1955).

Locally, with good exposures, that part of the Goose Egg formation which represents the Triassic Dinwoody formation can be separated from that part which represents the Permian Phosphoria formation. Unfortunately, in most places it is impossible to separate the beds of the two ages, or the separation can be done only questionably. In dealing with subsurface stratigraphy, the top of the Dinwoody equivalent is well-marked, but the top of the Phosphoria equivalent generally cannot be determined. Together, however, they comprise a practical stratigraphic unit in eastern Wyoming, both on the surface and in the subsurface.*

TYPE DESIGNATION

The name Goose Egg formation is here proposed for a sequence of interbedded red to ocher* shales and siltstones, thin limestones, gypsums, and limestone breccias typically exposed near the Goose Egg Post Office in central Wyoming, from which the name is derived. These strata crop

*Since the preparation of this article, the American Stratigraphic Commission has published "Nature, usage, and nomenclature of rock-stratigraphic units", Bull. American Assn. Petrol. Geol., Vol. 40, No. 8, 1956, pp. 2003-2014. It is therein pointed out that a formation "may include stratigraphic breaks" (p. 2006) and may comprise rocks "deposited in different epochs, periods, or eras" (p. 2007).

*The color term, ocher, as used herein refers to a deeper, richer red than that of the Chugwater, and might be described as a rich rust red or burnt sienna which in places may even become dusky red-purple. Certain beds in the Triassic Popo Agie formation of Wyoming have been referred to as "ocher beds", but they are ocher-yellow, not ocher-red.

out at the western end of Casper Mountain in the NW $\frac{1}{4}$ Sec. 12, T. 32 N., R. 81 W., Natrona County, Wyoming (cf. Goose Egg Quadrangle, U. S. Geological Survey, 7.5 Minute Topographic Series). At this locality the strata dip 25° to 30° west in an arcuate outcrop at the western plunge of the Casper Mountain arch. Following is a description of the rocks exposed:

SECTION NEAR GOOSE EGG POST OFFICE, NATRONA COUNTY, WYOMING
(NW $\frac{1}{4}$ Sec. 12, T. 32 N., R. 81 W.)

Chugwater formation (in part)

250+ feet. Shale and siltstone, brick-red, slightly sandy, evenly bedded, poorly resistant.

Goose Egg formation (new name) - 380 feet

- 10 feet Shale and siltstone, red to ocher, sandy, with thin partings of very fine-grained sandstone and white crystalline gypsum. This unit grades downward into limestone and sandy limestone, and generally is poorly resistant.
- 10 feet Limestone, mottled pale-green to purple or gray, finely crystalline, dense, slightly sandy, platy, irregularly ripple-marked, with thin partings of green waxy shale; generally resistant and forms a small hogback. This limestone and the underlying sandstone represent the Little Medicine tongue of the Dinwoody formation.
- 8 feet Sandstone, pale-green to tan, fine-grained to very fine-grained, slightly calcareous, generally dense, platy, ripple-marked, with few thin partings of green waxy shale; slightly resistant, forming local small hogbacks with the overlying limestone.
- 48 feet Shale and siltstone, red to ocher, sandy, with few thin partings of white, crystalline gypsum; slightly sandier in upper part with few thin beds of dense platy fine-grained sandstone. This unit is poorly resistant and forms a narrow swale between more resistant limestone beds.
- 6 feet Limestone, light-gray to pale-purple, hard, dense, platy; somewhat lighter in color at base and irregularly pitted. With the underlying gypsum and limestone breccia, this unit forms a low, irregular hogback. This limestone represents the feather-edge of the Ervay tongue of the Phosphoria formation.
- 98 feet Gypsum, white to light-gray, generally dense, massive to poorly bedded, slightly argillaceous and sandy, irregularly interbedded with minor amounts of light gray limestone breccia and red to ocher shales and siltstones, slightly more argillaceous and less gypsiferous in upper 30 feet. This sequence is generally resistant, and with the overlying limestone forms an irregular rounded hogback.
- 40 feet Shale and siltstone, red to ocher, slightly sandy, with few thin partings of white crystalline gypsum; sandier and more gypsiferous in upper few feet, grading upward into gypsum and limestone breccia. This unit is poorly resistant, and forms a low swale between hogbacks formed by beds stratigraphically above and below it.
- 4 feet Limestone, gray to light-gray, hard, dense, "crinkly", with irregular small gray to dark-gray chert nodules. This unit and the underlying 18 feet of strata are regularly resistant and form a low hogback. These rocks represent the Forelle tongue of the Phosphoria formation.
- 2 feet Shale, red to ocher, slightly sandy, generally soft and platy, slightly gypsiferous.
- 4 feet Limestone, gray to light-gray, dense, hard, "crinkly", irregularly bedded with overlying shale.
- 10 feet Limestone, mottled pale-purple to light-gray, dense, hard, "crinkly", very platy.

The Goose Egg Formation

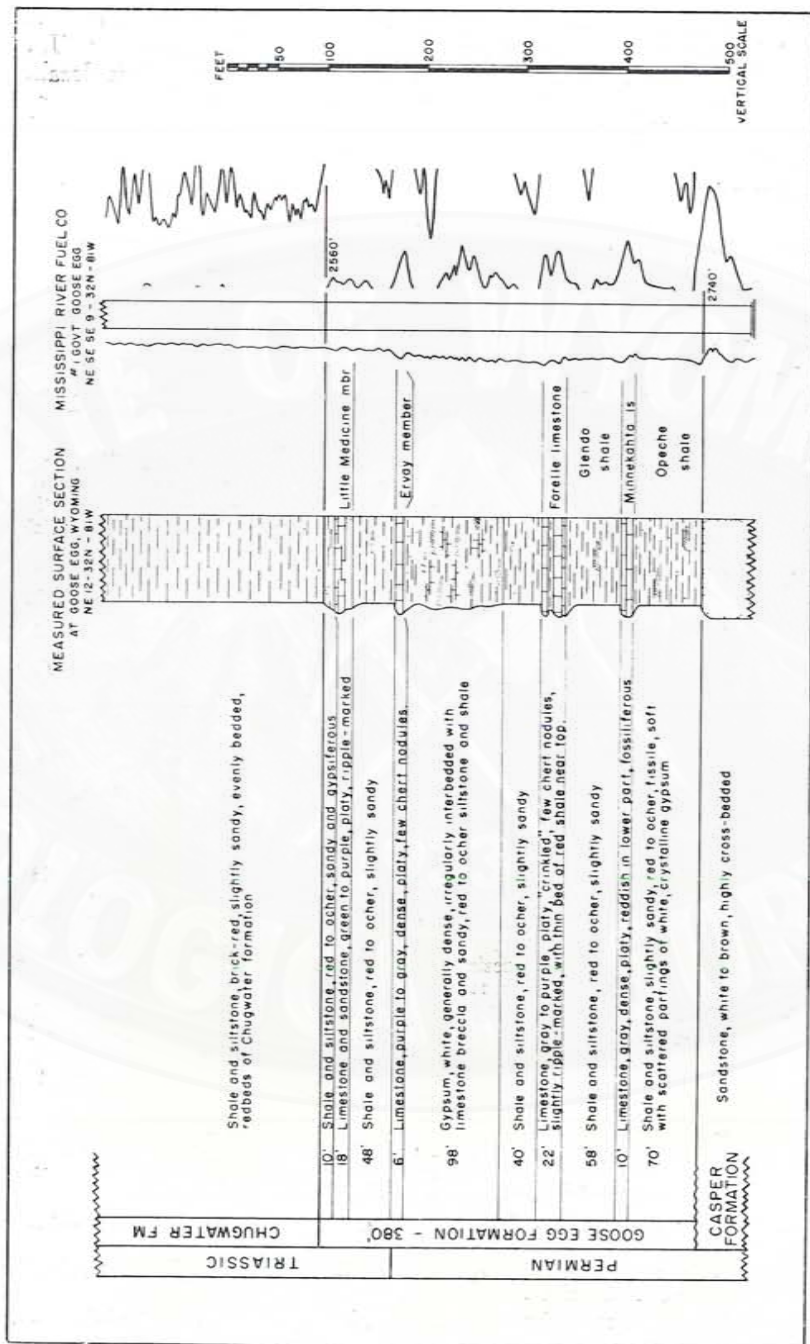


Fig. 1. Generalized lithology of the Goose Egg formation at the type locality, showing electrical log characteristics of the formation in the nearby subsurface.

- 2 feet Limestone, gray to light-gray, dense, hard, slightly "crinkly". This limestone and the overlying 20 feet of strata are resistant and form a low hogback, and represent the Forelle tongue of the Phosphoria formation.
- 58 feet Shale and siltstone, red to ocher, slightly sandy, with few thin partings and lenses of white crystalline gypsum. This sequence is poorly resistant and forms a low swale between more resistant limestones. This unit represents the Glendo shale of central and eastern Wyoming.
- 10 feet Limestone, light-gray to gray, reddish in lower part, hard, dense, platy, irregularly pitted surface, fossiliferous. This limestone is resistant and forms a small hogback or ledge, and represents the Minnekahta tongue of the Phosphoria formation.
- 70 feet Shale and siltstone, red to ocher, slightly sandy, with few thin partings and lenses of white crystalline gypsum. This unit is poorly resistant and forms a low swale between the overlying limestone and the Casper formation. This shale and siltstone sequence represents the Opeche shale of central and eastern Wyoming.

Casper formation (in part)

- 50+ feet Sandstone, tan to brown, generally medium-grained to fine-grained, quartzose, calcareous, highly cross-bedded, very resistant.

The Goose Egg sequence in this area has been examined previously by several geologists. Lee (1927, p. 49) described the section and reported a fauna from the Minnekahta limestone consisting of ". . . *Pinna peracuta*, *Schizodus ferrieri*, *Pteria?* sp., *Plagioglypta canna*". Thomas (1940a) later examined these exposures and slightly modified Lee's description of the sequence. The Goose Egg strata are exposed at several places adjacent to the type section, and an examination of some of these exposures shows a sequence very similar to that of the type locality. A section measured by Faulkner (1950) three miles to the southwest agrees favorably with the type section as described here. The Goose Egg interval can be recognized easily on the electrical logs of wells drilled in this area (Fig. 1), and minor units can be distinguished locally on these logs.

LITHOLOGIC VARIATIONS

The shales and siltstones of the Goose Egg sequence generally can be distinguished from the overlying redbeds of the Chugwater formation by their darker, ocher, color. This distinction is not as apparent at the type locality as at most outcrops in eastern Wyoming. The Goose Egg beds are generally sandier, more gypsiferous, and somewhat more resistant than those in the Chugwater sequence. Thin limestone beds are common in the Goose Egg in central Wyoming but are not conspicuous in the eastern part of the State, and there other characteristics must be relied upon to distinguish the Goose Egg from overlying strata.

The Goose Egg formation can be recognized easily in the subsurface throughout eastern Wyoming, and can be distinguished readily from the overlying Chugwater formation on electrical logs. The Goose Egg consistently has a much higher resistivity on electrical logs than the overlying shales and siltstones. The thin limestones in the Goose Egg generally are very dolomitic in well cuttings, and anhydrite is encountered in the subsurface rather than gypsum.

The Goose Egg formation can be distinguished easily in outcrops from the sandstones and argillaceous limestones of the underlying Ten-

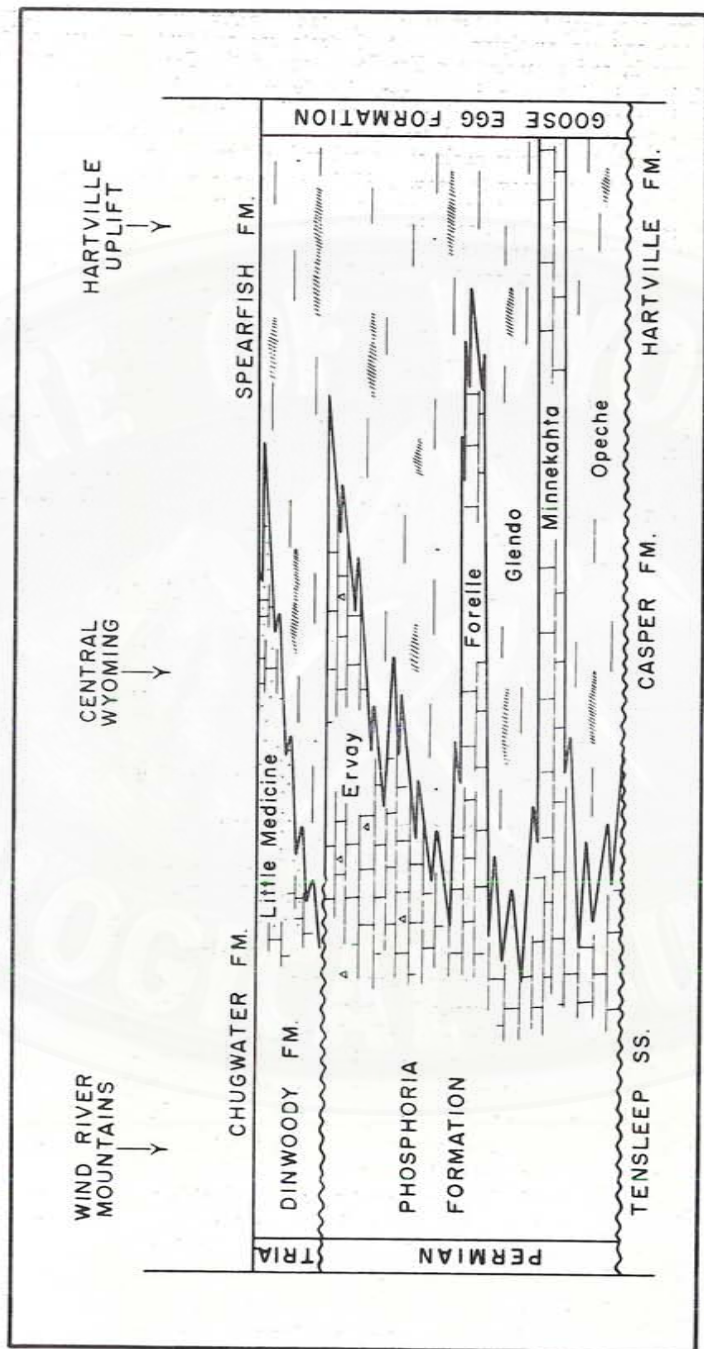


Fig. 2. Diagram showing stratigraphic relationships of the Phosphoria and Dinwoody formations and the Hartville Uplift, Wyoming, between the Wind River Mountains and the Hartville Uplift, Wyoming.

sleep, Casper, Hartville, or Minnelusa formation. Locally, there is an irregularly developed argillaceous limestone unit at the base of the Goose Egg that often makes this distinction difficult in the subsurface. The high resistivity of the underlying strata locally obscures the base of the Goose Egg formation on electrical logs, but with the aid of drilling samples this contact generally can be accurately established in the subsurface.

STRATIGRAPHIC RELATIONS

In the Wind River Mountains of western Wyoming, the Phosphoria is made up of an interbedded succession of light-colored limestones and dolomites, chert, and dark siltstones and claystones (King, 1947). The overall thickness is about 300 feet. The formation has yielded beautifully preserved diversified faunas which indicate a Middle Permian age — Gaudelupian for the greater part, and possibly Leonardian for the lowest part.

The conspicuous upper dolomite member of the Phosphoria along the Wind River Range is overlain by a succession of greenish gray dense pyritic dolomitic siltstones, sandy dolomites, greenish gray silty shales, and thin dense dolomitic sandstones comprising the Dinwoody formation. The Dinwoody ranges from 50 to 90 feet thick in the Lander area and carries a marine mollusk and brachiopod fauna which dates it as earliest Triassic (Newell and Kummel, 1942).

Strata of Late Permian age (Ochoan) are apparently absent in Wyoming but the Dinwoody overlies the Phosphoria with insignificant evidence of unconformity and with but slight lithologic change. The two units are superficially very much alike and for that reason were originally included by Darton in a single formation — the Embar. The name Embar, however, generally has been abandoned (Thomas, 1934, pp. 1655-56, 1670-71). The Phosphoria and Dinwoody aggregate some 350 to 400 feet of strata along the Wind River Range and in general are easily recognized and separated both at the surface and in the subsurface.

Eastward, the Phosphoria and Dinwoody are largely replaced by redbeds, but tongues of those formations penetrate the redbed facies in that direction. Although rocks of typical Phosphoria and Dinwoody lithology are not present in the eastern half of Wyoming, the equivalent rocks can be correlated at the surface and in the subsurface throughout the eastern part of the State (Thomas, 1934 and 1940b; Wyoming Geological Association, 1956).

The eastward extending limestone tongues of the Phosphoria formation have been correlated with named units having their type localities elsewhere, such as the Minnekahta and Forelle limestones, or a special name has been given, such as Ervay (Fig. 2). Tongues of redbeds which penetrate the Phosphoria from the east have been similarly correlated with the Opeche and Glendo shales. In sections where these units can be differentiated, they may be treated as members of the Goose Egg formation. Similarly, the Little Medicine tongue of the Dinwoody may be designated as the uppermost member of the Goose Egg. Where the

Erway tongue is absent or cannot be conclusively recognized, the entire interval between the Forelle and Little Medicine may be indicated as the Freezeout member (Thomas, 1934, p. 1670).

The Goose Egg formation of the Rattlesnake Hills, about 35 miles west of the type locality, is particularly important for several reasons. The section was first described in 1934 (Thomas, pp. 1672-77) and further discussed in 1948 (Thomas, pp. 91-92), when the Opeche, Minnekahta, Glendo and Forelle were differentiated. This is the westernmost locality where the Goose Egg is typically developed at the surface. Westward, where the Paleozoic rocks again appear at the surface at Conant Creek, about 30 miles west of the Rattlesnake Hills, normal Phosphoria and Dinwoody have replaced the Goose Egg (Sheldon *et al.*, 1953, pp. 35-36). The Rattlesnake Hills also constitute the easternmost place where typical Phosphoria brachiopods have been found. They occur profusely in the Erway and afford conclusive correlation of that member with the uppermost Phosphoria dolomite of the Wind River Range. The Rattlesnake Hills section also allows the correlation of the Goose Egg formation with the Phosphoria and Dinwoody of the Big Horn Basin. Tourtelot (1952), by means of correlated surface sections, has illustrated the stratigraphic relations between the two areas.

The limestone tongues become less prominent eastward (Fig. 2) and none is persistent throughout all of eastern Wyoming (Thomas, 1949, Fig. 10; Wyoming Geological Association, 1956). Regional correlations now suggest that perhaps the Minnekahta and the Forelle limestones of central Wyoming may not exactly correlate with the type Minnekahta of the Black Hills and with the type Forelle of the Laramie Basin, but more detailed stratigraphic studies would be necessary before the present correlations could be disproved.

The Goose Egg formation rests unconformably on the Pennsylvanian or early Permian strata of the Tensleep, Casper, Hartville, or Minnelusa formations throughout Wyoming (Love, 1954). Near the northern, northeastern, and south-central borders of Wyoming, the Goose Egg formation thins markedly, apparently by depositional overlap onto this unconformity, so that only the younger part of the unit is present in those areas. The Goose Egg is conformably overlain by the Triassic Chugwater formation throughout central Wyoming, or by its partial equivalent, the Spearfish formation, in the easternmost part of the State.

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