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OVERVIEW OF FIELD TRIPS: TRIASSIC BIOSTRATIGRAPHY OF NORTHWESTERN NEVADA (OR: "IN THE FOOTSTEPS OF 'SI' MULLER")

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The Triassic localities in the Basin and Range Province of northwestern Nevada to be visited during this three-day field trip include the five classic places within this region of greatest significance for marine Triassic paleontology and biostratigraphy (Fig. 1.1). Although occurrences of Triassic fosssils at many other localites in this region are notable for one reason or another, these five are the most important: Fossil Hill in the Humboldt Range, Favret Canyon in the Augusta Mountains, South Canyon in the New Pass Range, New York Canyon in the Gabbs Valley Range, and West Union Canyon in the Shoshone Mountains.

Geologically, the Basin and Range Province is a large area of the western U.S. characterized by numerous, mostly north-south trending, mountain ranges separated by valleys of about equal width. The distinctive physiography of the province was aptly described by Major C. E. Dutton, a late 19th Century geologist and explorer, as resembling "an army of caterpillars crawling northward out of Mexico." The Basin and Range landscape results from Miocene to Recent block-faulting that at the latitude of northern Nevada extends from the east face of the Sierra Nevada along the Nevada-California border to the west front of the Wasatch Mountains in central Utah. This region undergoing roughly east-west extension forms part of a broad soft boundary between the North American and Pacific tectonic plates whose relative motion has the sense of a NNW-trending, right-lateral transform.

In the northwestern Nevada part of the Basin and Range Province, several categories of rocks of different ages are represented. The "basins" or valleys contain thick alluvial and lacustrine deposits of Quaternary age. In the intervening mountain ranges, exposures of bedrock, listed in order of increasing age, are: (1) widespread Cenozoic volcanic rocks, (2) scattered plutons of Cretaceous and Jurassic granitic rocks, (3) lower Mesozoic sedimentary and volcanic rocks generally believed to have been deposited in an extensive back-arc basin, and (4) highly deformed Paleozoic basinal strata that most workers agree were emplaced onto the continental margin by large-scale thrust faulting during the Late Devonian-mid Mississippian (the Roberts Mountains thrust during the "Antler orogeny") and again in the Late Permian-Early Triassic (the Golconda thrust during the "Sonoma orogeny") (Silberling and Roberts, 1962). Unmetamorphosed exposures of lower Mesozoic strata tend to be widely separated and isolated from one another

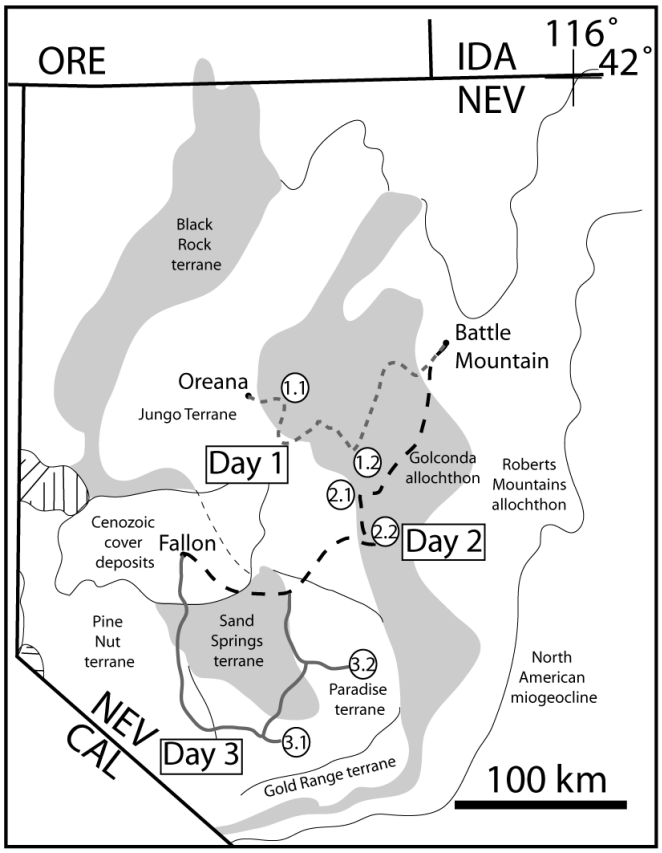

FIGURE 1.1. Terranes of western Nevada (after Silberling, 1991) showing routes of roadlogs.

In the areas to be visited on this field trip, the lower Mesozoic strata, together with the previously deformed Paleozoic rocks, were disrupted by two deformations within the span of late Middle Jurassic to Late Cretaceous time. The older of these deformations was the stronger, resulting in as much as hundreds of kilometers of NNW-SSE structural shortening and reflecting large left-lateral shear along the continental margin (Oldow, 1984). As a result of these deformations, the lower Mesozoic strata occur in several different, fault-bounded, allochthonous terranes having different stratigraphic and structural histories. Consequently, pronounced juxtapositions in facies occur at terrane boundaries. Although all of these terranes

FIGURE 1.2. Siemon Muller (after Keen et al., 1971).

are thought to have been deposited in the same extensive back-arc basin, their original paleogeographic positions and relationships to one another are not obvious. A variety of names has been applied to essentially the same "lithotectonic assemblages" (Oldow, 1984) or terranes (Speed, 1978; Silberling et al., 1984, 1987); those used here are from the summary by Silberling (1991).

The field trip stops are in places where preservation of megafossils is relatively good and hence where the effects of structural disruption and metamorphism are the least. Nonetheless, most of the lower Mesozoic strata are in the lower green schist or higher grade of metamorphism, with conodont alteration index (CAI) values in most places of 4-5 and higher, palynomorphs have never been recovered, and paleomagnetic directions have been regionally reset.

With the exception of the first stop on the first day, visits to all of the other localities to be visited during this three-day field trip, are in fact following in the footsteps of one man: Siemon Wm. "Si" Muller (1900-1970), who was a professor of geology at Stanford University (Fig. 1.2). With this one exception, Muller either discovered or was the first to intensely study and collect from nearly all of the known localities of Triassic megafossils in the region. In doing so he amassed large collections, the remains of which are now in storage at the U.S. Geological Survey center in Denver, Colorado.

Professor Muller's life was truly extraordinary. Born of Danish and German parents in eastern Russia, he was at the White Russian naval academy in Vladivostok when in 1917 it was overrun by the Bolsheviks. Muller and other cadets commandeered the training vessel and escaped to China, where he learned English before making his way to the United States. He graduated in geology from the University of Oregon, and then attended Stanford University from which he received his PhD in 1930, having studied under James Perrin Smith just prior to Smith's death. The study area for his MS and PhD theses was in the Gabbs Valley Range of Nevada (Stop 1 on field-trip Day 3). Prof. Muller became the acknowledged expert on the stratigraphy and shelly fossils of the marine Triassic in the U.S. and, additionally, was highly regarded as a regional and structural geologist.

Less well known, perhaps, is that because knowledge of the engineering problems presented by frozen ground was mostly in the Russian-language literature, he became during World War II the leading North American expert in this field. Working with the Alaskan Division of the U.S. Army's Air Transport Command, he coined the term "permafrost" and wrote the first English-language textbook on this subject. Because of this interruption in his paleontologic and geologic research, and perhaps also because he was simply overwhelmed by the great volume of his observations and collections, as well as his devotion to teaching, he died before publishing the results of much of his research. Ironically, Muller was among the few, perhaps the only person, elected to the presidency of The Paleontological Society who never published a description of a fossil.