Introduction

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Lower Anisian Ammonoids from the northern Humboldt Range (northwestern Nevada, USA) and their bearing upon the Lower-Middle Triassic Boundary

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ABSTRACT

The northern Humboldt Range section is of critical importance because it provides the most complete low paleolatitude ammonoid record across the Lower-Middle Triassic boundary. The various Lower Anisian faunas, including that of the *Caurus* Zone, are therefore respectively well constrained at their lower limit by the Spathian *Haugi* Zone and their upper limit by the early Middle Anisian *Hyatti* Zone. The newly established Lower Anisian sequence is divided into, in ascending order, the *Japonites welteri, Pseudokeyserlingites guexi* beds, *Mulleri* and *Caurus* Zones. Consequently, the scope of the Lower Anisian substage for low paleolatitude faunas is substantially enlarged. Furthermore, this sequence emphasizes the differences between the next underlying latest Spathian *Haugi* Zone, whose substage assignment has been hitherto a matter of controversy, and the various overlying biochronologic units here referred to the Lower Anisian substage.

Recognition of correlative units is hindered by the generally agreed upon pronounced paleolatitudinal distribution of Lower Anisian ammonoids and more prosaically, by both the scarcity and unreliability of low paleolatitude data. Around the Lower-Middle Triassic boundary, the latest Spathian *Haugi* Zone provides the most widely applicable biochronological marker available. Its correlatives are the Canadian *Subrobustus* Zone and the Siberian *Spiniplicatus* Zone. The Lower-Middle Triassic boundary is thus placed above the *Haugi* Zone and its correlatives, and below the varied, ill-correlated faunas of Lower Anisian age. The Nevada record demonstrates that the *Paracrochordiceras-Japonites* pair of low paleolatitude affinity has little significance for intra-substage correlations. The *Pseudokeyserlingites guexi* beds are expected to have correlatives in California (Inyo Range) and in China (Qinghai). Unfortunately, none of these additional occurrences is known to display clear superpositional relationships with respectively older or younger faunas. Both the *Mulleri* and *Caurus* Zones of the northern Humboldt Range are assumed to correlate at least partly with the more comprehensive British Columbia *Caurus* Zone and the upper part of the Siberia *Taimyrensis* Zone. These preliminary rough correlations, as yet not formally demonstrated, are amenable to further refinements when a more detailed scheme of the British Columbia Lower Anisian will be made available.

Two new genera and fifteen new species are also described.

1. Introduction

This paper deals with Lower Anisian ammonoids from northwestern Nevada. The studied sequence spans throughout the lower part of the Fossil Hill Member (Prida Formation, Star Peak Group) and is geographically restricted to the northern Humboldt Range (Pershing County, see Fig. 1), the only area where the oldest Fossil Hill strata escaped subsequent Middle Triassic uplift and erosion (Nichols & Silberling 1977).

The Fossil Hill Member yielded only few Lower Anisian ammonoids in comparison with its wealth of Middle and Upper Anisian ammonoids. Out of the long list of Anisian ammonoids described by Hyatt & Smith (1905) and Smith (1914), only *Isculites meeki* (Hyatt & Smith) actually turned out to be a Lower Anisian taxon.

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The presence of the *Caurus* Zone, indicative of the Lower Anisian substage (Tozer 1967), was not firmly established until recently in the northern Humboldt Range by Silberling & Wallace (1969) and Silberling & Nichols (1982).

Additional Lower Anisian faunas discovered between the *Haugi* Zone (Spathian) and the *Caurus* Zone are newly reported here. The scope of the Lower Anisian substage is substantially enlarged, at least with regard to low paleolatitude faunas, by being subdivided into four biochronologic units. Hence, the initially one-zone Lower Anisian substage concept advocated by Silberling & Tozer (1968) is furtherly developed and

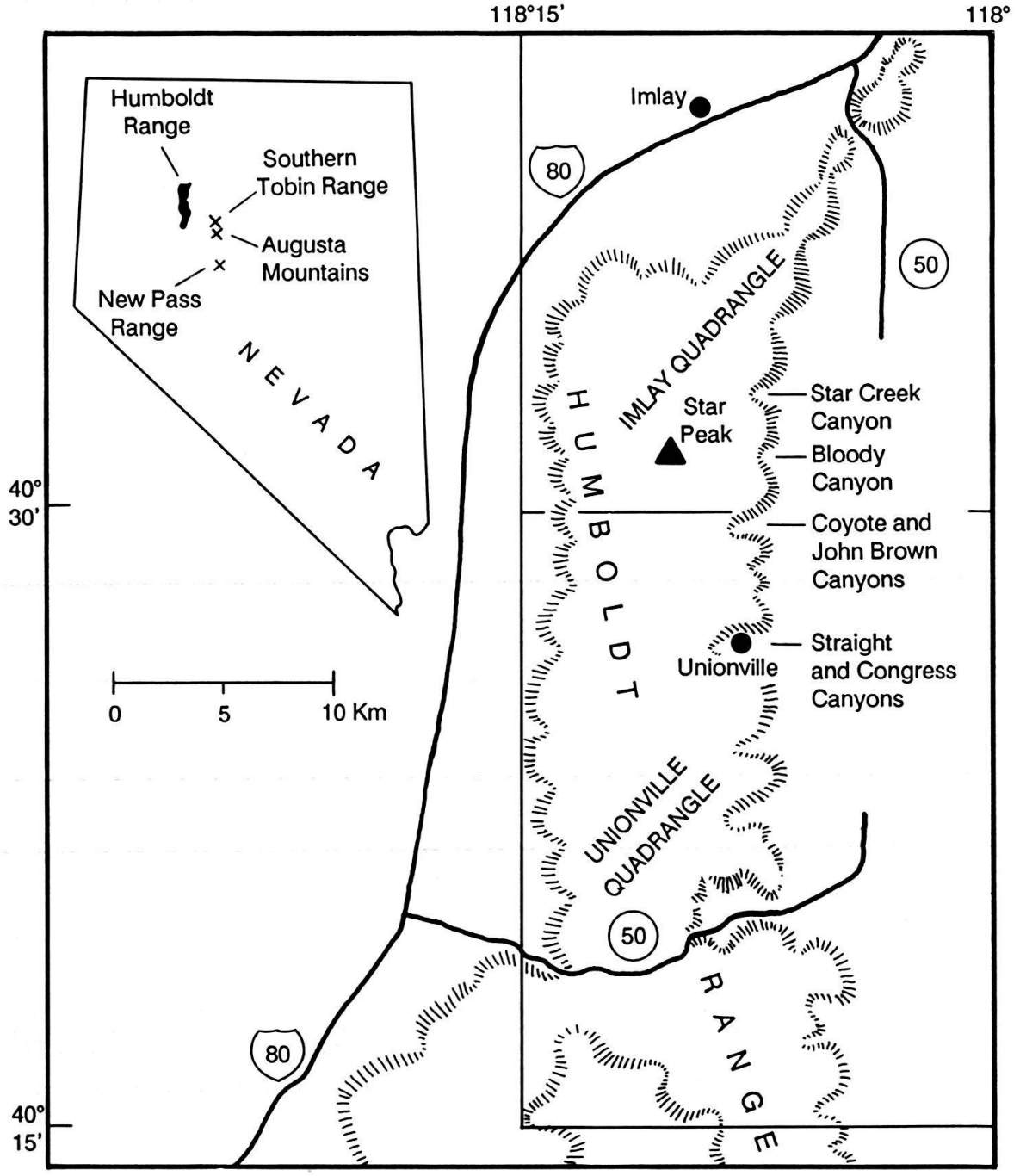

Fig. 1. Index map showing the location of northern Humboldt Range and other place names referred to in the text.

the threefold substage division of the Anisian by TOZER (1974, 1981b) gains appreciable support.

Owing to the apparent paleolatitudinal pattern of ammonoids distribution (TOZER 1982, WANG 1985, DAGYS 1988a), the Lower Anisian substage remains one of the less well understood time intervals of the Triassic period. In addition, a second major, inevitable obstacle comes from the general scarcity of low paleolatitude Lower Anisian marine deposits. The present results obtained from the northern Humboldt range contribute a great deal to the knowledge of the substage faunal content but correlations at zonal rank with other contemporaneous sequences are still a matter of conjecture. On the other hand, the whole of this unusually complete Spathian and Anisian faunal succession gives valuable insights into the Lower-Middle Triassic and Lower-Middle Anisian boundaries respectively.

2. Stratigraphic context

Block-faulting synsedimentary tectonics has been shown to play a major role during deposition of both the mainly calcareous Star Peak Group (NICHOLS & SILBERLING 1977) and the underlying volcanic Koipato Group (BURKE 1973). Lower Anisian strata, as well as the whole of the Fossil Hill pile were deposited below the wave base, in a euxinic environment. To its greatest paleogeographic extent, the Fossil Hill blanketed an area exceeding 5000 km^2 as estimated by NICHOLS & SILBERLING (1977). Subsequent Middle Triassic uplift and erosion of the central part of the basin at least partly accounts for the comparatively modest, present distribution of the oldest strata, i.e. Lower Anisian of the Fossil Hill Member. These are only known to occur in the northern Humboldt Range, that is at the northwestern limit of what is presently left of the Star Peak Basin.

On a much smaller scale and for our purpose, the effects of synsedimentary tectonics cannot be here disregarded when trying to set up a biochronologic scale of early Anisian time in the northern Humboldt Range. Because of nearly total absence of lithological markers and of variable sedimentation rates of the oldest Fossil Hill strata, partial Lower Anisian sequences of each section were linked by means of their own faunal content, in order to obtain the most comprehensive sequence as possible.

In the northern Humboldt Range, SILBERLING & WALLACE (1969) recognized two major basement highs, running more or less North-South, formed by the Koipato Group (namely the Star-Humboldt and the Arizona highs). The oldest age-diagnostic fossils found on top of both highs are of *Hyatti* Zone age, thus indicating that these highs underwent non-deposition and shallow to subaerial erosion, approximately until the Lower-Middle Anisian boundary. A third, comparatively minor high can be discerned between the Star-Humboldt and Arizona basement highs. The so-called Coyote high occurs along the same "ridge" as defined by the two former highs (Fig. 2). However, the latter differs in that its activity spanned at least the entire Lower Member deposition time (Spathian) and ceased approximately at the onset of the Anisian stage.

East of the Star-Humboldt and Coyote basement highs, the Carbonate Unit of the Lower Member is affected by sudden lateral facies changes portrayed in Figure 2. The distribution of the facies belt apparently matches the North-South trend delineated by the three basement highs. The deepest facies of the Carbonate unit are confined to the