ABSTRACT

In this study, we describe lower Pliensbachian to lower Toarcian ammonoids from 10 stratigraphic sections in the New York Canyon and Westgate areas of the Luning Embayment, Gabbs Valley, and Clan Alpine Mountain Ranges, west-central Nevada, USA. Ammonoid biostratigraphy based on 408 specimens representing 23 genera and 50 species indicates the presence of the Whiteavesi, Freboldi, Kunae, and Carlottense zones of the Pliensbachian and the Kanense Zone of the lower Toarcian. The following five new species are established (in alphabetical order): *Nodicoeloceras middlegatense* n. sp., *Nodicoeloceras nevadaense* n. sp., *Prodactylioceras westgatenses* n. sp., *Protogrammoceras* (*Matteiceras*) *tipperi* n. sp., and *Reynesocoeloceras corvalani* n. sp. A volcanic ash bed within the basal New York Canyon type V section yielded a $^{206}Pb/^{238}U$ Chemical Abrasion-Isotope Dilution-Thermal Ionization Mass Spectrometry (CA-ID-TIMS) age of 188.98 ± 0.11 Ma from the middle-upper part of the Whiteavesi Zone, which will contribute to the refinement of the early Pliensbachian timescale, an interval that is at present poorly constrained.

INTRODUCTION

The Lower Jurassic stratigraphy of west-central Nevada has been the focus of numerous studies dating back to the early- to mid-1900s, with original research efforts aimed primarily at mapping and describing the extent of Jurassic units (Muller and Ferguson, 1936; Ferguson and Muller, 1949; Silberling, 1959; Corvalán, 1962). Later studies used plate tectonic theory and the understanding of the Cordilleran terranes (*e.g.*, Jones *et al.*, 1977; Coney *et al.*, 1980) to decipher the lithotectonic assemblages, depositional environments, and biostratigraphy of the region (Stanley 1971; Stanley *et al.*, 1971; Speed, 1979; Smith, 1981; Taylor *et al.*, 1983; Oldow, 1984; and others). Despite these studies, however, there is no detailed temporal framework for the Pliensbachian and Toarcian stratigraphy of west-central Nevada. This is essential in order to: 1) correlate local lithostratigraphy through new taxonomic and biochronologic information over this time interval; 2) further document and improve the standard North American ammonoid zone scheme for parts of the Pliensbachian (Smith *et al.*, 1988) and Toarcian (Jakobs *et al.*, 1994); 3) provide new information relevant to low-latitude ammonoid paleobiogeography on the relatively stable craton margin (*e.g.*, Smith and Tipper, 1986; Smith, 2006); and 4) support subsequent studies aimed at understanding long-term biogeochemical and sedimentological changes that may be related to the causes and dynamics of the protracted Pliensbachian–Toarcian mass extinctions (*e.g.*, Pálfy and Smith, 2000; Caruthers *et al.*, 2013 and references therein).

Here we assess ammonoid taxonomy and biochronology of the Pliensbachian–Toarcian transition in the Luning Embayment of west-central Nevada, USA. Ammonites were collected and described from 10 stratigraphic sections representing two areas within the embayment, namely at New York Canyon in the Gabbs Valley Range, and at Westgate in the Clan Alpine Mountain Range (Text-fig. 1A). In total, seven sections were measured in the New York Canyon area and three in Westgate (Text-figs. 1C, 1D; 2). The Westgate Ridge Section is a compilation of data presented by Corvalán (1962) and Smith (1981), with new information collected by the current study. Data for the New York Canyon type V Section are also compiled from Smith (1981) and the current study. Data presented for all remaining stratigraphic sections described herein are new. Although certain Pliensbachian ammonite species have been previously identified from the Luning Embayment and used to help establish the current Pliensbachian zone scheme of western North America, as described by Smith *et al.* (1988), a full account of the Pliensbachian–Toarcian transition and the taxonomic diversity within this embayment has not been presented previously.

GEOLOGICAL SETTING

The Luning Embayment is a Mesozoic cratonal, carbonate-rich sequence deposited on crystalline basement in west-central Nevada during the Triassic–Jurassic (Ferguson and Muller, 1949). The embayment is considered a component of the Walker Lake Terrane, and was accreted to the craton prior to the Jurassic (Silberling, 1959; Oldow, 1978; 1984; Taylor and Smith, 1992). The Lower Jurassic Sunrise Formation is a eustatically controlled, shallow- to deeper-water marine sequence that sits conformably above limestones of the Upper Triassic Gabbs Formation (Taylor *et al.*, 1983). The Sunrise Formation has been subdivided into five conformable members which, stratigraphically from the base, include the Ferguson Hill, Five Card Draw, New York Canyon, Joker Peak, and Mina Peak members (Text-fig. 1B; Taylor *et al.*, 1983).

At the base of the Sunrise Formation, the Ferguson Hill Member consists of 55 m of carbonaceous siltstone and limestone that are of Hettangian to early Sinemurian age (Text-fig. 1B; Taylor *et al.*, 1983; Guex, 1995; Taylor, 1998; Ritterbush *et al.* 2016). It is overlain by the 100 m thick transgressive series of fine-grained, dark gray to black carbonaceous mudstone and siltstone of the Five Card Draw Member of Sinemurian age (Taylor *et al.*, 1983; 2001; Taylor, 1998; Porter *et al.*, 2014). The 120 m thick New York Canyon Member overlies this lithologically homogenous unit (Taylor *et al.*, 1983; 2001) and is a regressive, shallow-water succession that consists of moderately thick beds of bioclastic wackestone and packstone