THE FIRST FIND OF EURYCEPHALITINAE (JURASSIC AMMONITINA) IN NEW ZEALAND AND ITS BIOGEOGRAPHIC IMPLICATIONS

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UPPERMOST TEMAIKAN strata from southwest Auckland Province, North Island, New Zealand, have recently yielded a small fauna of Middle Jurassic ammonites previously believed to be endemic to the eastern Pacific borderlands, although a single fragment of the new species described below was previously reported in a large Tethyan assemblage from Papua, New Guinea, by Westermann and Callomon (1988). The New Zealand assemblage consists of the dimorphic pair *Xenocephalites* (δ) and *Lilloettia* (Ω) with close morphologic ties to species from the latest Bathonian Steinmanni Standard Zone of the Andean Province (Riccardi et al., 1989). This new find permits direct time-correlation of the uppermost part of the Temaikan Stage (Marwick, 1951, 1953) with the East-Pacific latest Bathonian Steinmanni Zone and with the East-Tethyan Late Bathonian *Macrocephalites apertus* Association. The upper Temaikan Stage of south Otago Province, southeastern South Island, New Zealand, has also yielded rare representatives of the Tethyan Macrocephalitinae, so that the New Zealand area in the late Middle



FIGURE 1-Map of part of the upper Awakino Valley showing the Te Whakapatiki Stream section containing the Eurycephalitinae fauna (locality R17/f566), redrawn from New Zealand Mapping Series 260, sheet R17.



FIGURE 2—Stratigraphic column for the Te Whakapatiki Stream section showing the position of the Eurycephalitinae fauna and other key Temaikan-Heterian species.

Jurassic was in the overlap area of Tethyan and East-Pacific Subrealms.

LOCATION AND STRATIGRAPHY

The Eurycephalitinae fauna is known from a single locality (R17/f566, Grid reference R17/6750 0047) on the southern bank of Te Whakapatiki Stream, 320–330 m upstream (in a direct line) from its confluence with the Awakino River (Figure 1), Upper Awakino Valley, Mahoenui, southwest Auckland Province, North Island, New Zealand.

The outcrop consists of a 2-m-thick, pebbly, medium-grained sandstone, which is the highest bed of an unnamed formation of the Rengarenga Group (Fleming and Kear, 1960) exposed along the Te Whakapatiki Stream. This horizon is underlain (Figure 2) by a sequence of dominantly fine- to medium-grained sandstones belonging to this formation, and overlain by a sequence dominated by mudstone and fine- to very fine-grained sandstones placed in the Oraka Formation of the Kirikiri Group (of Fleming and Kear, 1960), although the mudstone-dominated lower portion may well belong to a second new formation. Both the Rengarenga and Kirikiri Groups are part of the Triassic to Jurassic Murihiku Supergroup (Campbell and Coombs, 1966), as are the south Otago beds that have yielded Macrocephalitinae. In southwest Auckland the Murihiku Supergroup was folded into the Kawhia Regional Syncline (Suggate, 1978) during the Rangitata Orogeny (Kingma, 1959). The section exposed along the Te Whakapatiki Stream, Awakino River, and adjacent minor tributaries of the Awakino River (Figures 1 and 2) consists of beds on the western limb of the syncline.

This locality (R17/f566), collected by Hudson on three occasions in 1984-1985, has yielded a rich mollusc-dominated fauna (Geology Department, University of Auckland, AU 11429 including C1422-C1427, AU 11474, AU 11524), which contains in addition to Xenocephalites and Lilloettia the following taxa: rhynchonellid and terebratuloid brachiopods, Rotularia, Palaeonucula, Nuculana, Retroceramus (Retroceramus) n. sp. A aff. R. galoi, Camptonectes (Camptonectes) cf. C. laminatus, Entolium (Entolium) sp., Oxytoma (Oxytoma) sp., Propeamussium (Parvamussium) clammoseum, Ostreinae gen. and sp. indet., Vaugonia (Vaugonia) kawhiana, Anisocardia (Antiquicyprina) sp., Astarte sp., Neocrassina sp., Goniomya (Goniomya) sp., Pleuromya milleformis, Lytoceras sp., Conodicoelites flemingi, and poorly preserved wood. The Eurycephalitinae fauna is 45 m below the first appearance of Retroceramus (Retroceramus) galoi (Heterian local stage index) and 260 m above the lowest Temaikan fauna recorded in this section, and is therefore of Temaikan age. Although the fauna contains a number of characteristic Heterian species (including Vaugonia (Vaugonia) kawhiana and Conodicoelites flemingi), the Retroceramus species present is similar to, but not conspecific with, Retroceramus(R.)galoi and therefore the fauna must be Temaikan, probably very high in the Temaikan. The Temaikan-Heterian boundary is not seen clearly in this section due to a lack of exposure between this locality (R17/f566) and the lowest Heterian fauna, but this boundary is not likely to be much higher than the Eurycephalitinae fauna.

SYSTEMATIC PALEONTOLOGY

Suborder Ammonittina Hyatt, 1889 Superfamily Stephanocerataceae Neumayr, 1875 Family Sphaeroceratidae Buckman, 1920 Subfamily Eurycephalitinae Thierry, 1976 Genus Xenocephalites Spath, 1928 Xenocephalites Grantmackiei n. sp. Figure 3.1, 3.2

Xenocephalites cf. neuquensis (Stehn, 1924). Westermann and Callomon, 1988, p. 75, Pl. 15, figs. 5 a, b.

Diagnosis – Relatively evolute and round-whorled Xenocephalites with extremely coarse, prorsiradiate costae.

Description. — Complete diameter 40–45 mm. Phragmocone unknown. Adult body chamber three-quarters of a whorl long, with subcircular, slightly depressed-ovate section and relatively large umbilicus. Aperture "simple" and projected. Ornamentation extremely coarse, sharp and prominent, from umbilical slope and crossing over venter, consisting of prorsiradiate biplicate costae and a few simple ribs; last half-whorl with only 8 primaries and 14 secondaries. Septal suture unknown.

Remarks. — This new species is closest to Xenocephalites neuquensis (Stehn, 1924), from which it differs apparently only in the nonflexuous, prorsiradiate costae that are not reduced on the inner flank. Xenocephalites neuquensis is known from the Steinmanni Zone, uppermost Bathonian, of the Andes (Riccardi et al., 1989) and, very rarely, from the Bodenbenderi Zone, basal Callovian, of southwest Mexico (Sandoval et al., 1990).

Etymology. - In honour of Jack A. Grant-Mackie, New Zealand paleontologist and geologist at the University of Auckland.

Repository. – Holotype: complete body chamber, C1422 (Figure 3.1, 3.2), Department of Geology, University of Auckland. Material and occurrence. – Three complete body chambers



FIGURE 3-1, 2, Xenocephalites grantmackiei n. sp., holotype, complete, lateral and ventral views, $\times 1$, C1422. 3-6, Lilloettia aff. L. boesei (Burckhardt). 3, 4, with one-quarter whorl of body chamber, lateral and ventral views, $\times 1$, C1424; 5, 6, mature body chamber, lateral and ventral views, $\times 1$, C1426.



FIGURE 4-World distribution of Middle Bathonian-Early Callovian Eurycephalitinae and Macrocephalitinae (Late Mid-Jurassic reconstruction of Gondwana and Southern Laurasia modified after Stevens, 1989).

 TABLE 1-Measurements (in mm) of Xenocephalites grantmackiei n. sp., holotype (C1422).

Diameter	Whorl height	Width	Umbilicus	Primaries/ halfwhorl	Second- aries/ halfwhorl
40	16	20	11	8	14

(including C1422 and C1423) and several fragments (all from AU 11429), all somewhat deformed by partial crushing, from the horizon with *Lilloettia* aff. *L. boesei* (R17/f566) in the upper Temaikan at Te Whakapatiki Stream, Upper Awakino Valley, Mahoenui, southwest Auckland, western North Island, New Zealand.

Genus LILLOETTIA Crickmay, 1930 LILLOETTIA aff. L. BOESEI (Burckhardt, 1927) Figure 3.3–3.6

Description. — Shell sphaeroconic, probably somewhat compressed, highly involute with umbilicus about 8 percent of diameter, and vertical umbilical slope; however, all specimens incomplete and somewhat deformed by lateral crushing. Largest fragment one half-whorl of a body chamber with 80–90 mm complete diameter (C1426); a smaller specimen with a 50-mm diameter and three-quarters whorl of body chamber (C1424) presumably immature. Immature ornamentation at 30–45 mm diameter of dense, rectiradiate costae, including about 10–12 blunt primaries and 35–40 sharp secondaries per half-whorl. Subsequently, primaries become coarser (relative to size) and somewhat prorsiradiate. Adult body chamber bears extremely coarse ribs on outer half of flank and venter only, about 28 per half-whorl, which are markedly prorsiradiate and highest on venter. Aperture and septal suture unknown.

Remarks. — This poorly known macroconch most closely resembles *Lilloettia boesei* in whorl shape, coiling, and ornamentation, but our form differs in the coarser ventral costae of the body chamber. *Lilloettia boesei* is known from the upper Steinmanni Zone, latest Bathonian, of southwest Mexico (Sandoval et al., 1990).

Repository.—Almost complete, possibly immature specimen, C1424 (Figure 3.3, 3.4) and incomplete large body chamber, C1426 (Figure 3.5, 3.6), Department of Geology, University of Auckland.

Material and occurrence.—The two illustrated larger specimens as well as about 25 fragments and juvenile specimens probably of the same species (mostly from AU 11429 which includes C1424–C1427, although AU 11474 contains a fragment of an adult body chamber and three juveniles and AU 11524 contains two juveniles) from the upper Temaikan horizon with Xenocephalites grantmackiei n. sp. (R17/f566) at Te Whakapatiki Stream, Upper Awakino Valley, Mahoenui, southwest Auckland, western North Island, New Zealand.

BIOGEOGRAPHY

The distribution of the sphaereoceratid subfamily Eurycephalitinae was thoroughly investigated by Callomon (1984), Riccardi et al. (1989), Sandoval et al. (1990), and Riccardi and Westermann (in press). The known stratigraphic range of the subfamily extends from the Late Bajocian *Megasphaeroceras* to the mid-Oxfordian *Araucanites* (and possibly the early Kimmeridgian *Epicephalites*), and the previously known geographic distribution from the northern Yukon of Arctic Canada to the Antarctic Peninsula (Figure 4). Eurycephalitinae are frequently dominant among the ammonite faunas of the East-Pacific borderlands from Late Bajocian to Early Callovian times in what has been called the East-Pacific Realm (Westermann, 1981) or, better, Subrealm of the Tethyan Realm.

For later Bathonian to early Callovian times, sexual dimorphism is well documented, but it is so strongly developed that correspondence even between genera has not been clearly established. Most microconchs are presently lumped together in the morphogenus Xenocephalites, whereas the macroconchs are placed into different morphogenera including the ubiquitous Lilloettia. The Xenocephalites-Lilloettia pair is well documented for the Upper Bathonian, mostly Steinmanni Zone, of the Andes and southwestern Mexico, i.e., the Andean Ammonite Province, and (significantly) the Upper Bathonian and Lower Callovian of western North America. In contrast, the western Pacific borderlands of the time were inhabited by Eurasian Boreal and Tethyan faunas. Rich Tethyan Macrocephalitinae and Perisphinctidae faunas often dominated the western and southeastern borderlands of the Tethyan ocean as far eastward as eastern Indonesia and New Guinea (Westermann and Callomon, 1988). The Mid-Jurassic ammonite biogeography of the southern Pacific, however, has remained poorly known, with no ammonite records from southernmost South America and eastern Australia (nonmarine) and poor records from Antarctica and the New Zealand-New Caledonia area.

The occurrence of Xenocephalites and Lilloettia here documented extends the East-Pacific Subrealm to the New Zealand area during the late Bathonian (Figure 4) where it overlaps with the Indo-Southwest Pacific Subrealm. We also confirm the earlier single record (Speden, 1960) from New Zealand of Macrocephalites, i.e., M. parki (Wilkens), which we consider to be a close relative of the mid-Bathonian M. bifurcatus Boehm, a wellknown species from eastern Indonesia and Papua New Guinea (Westermann and Callomon, 1988). Several additional specimens of *M. parki* have since been collected from beds slightly older than the Xenocephalites-Lilloettia assemblage. Thus, New Zealand during mid-Bathonian-early Callovian time lay in the overlap area of the Tethyan and East-Pacific Subrealms. The single known specimen of Xenocephalites grantmackiei n. sp. from Papua New Guinea is regarded as having drifted there postmortem.

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