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GEOLOGIC AGE REFINEMENTS OF WEST COAST EOCENE MARINE MOLLUSKS

Richard L. Squires
Department of Geological Sciences,
California State University,
Northridge, CA 91330

ABSTRACT

Modifications of the molluscan stage ranges of 20 gastropod and 11 bivalve marine species/subspecies from the West Coast are summarized from the author's research during the last years. The stage ranges are extended based on the presence of species in various formations in the central Transverse Ranges, southern California. Illustrations are also provided for the taxa.

INTRODUCTION

Since 1974, I have been engaged in research on the taxonomic composition, biostratigraphy, and geologic age studies of the molluscan fauna of certain Eocene marine formations in California. Most of my work has been in the central Transverse Ranges, southern California, and has focused on the Llajas Formation, Simi Valley (Squires, 1984); the Juncal Formation and Matilija Sandstone(?), Whitaker Peak area (Squires, 1987); and the Caliente(?) Formation, northern Lockwood Valley area (Squires, in press).

Based on my research, and utilizing West Coast molluscan stages (Fig. 1), I have been able to extend the molluscan stage ranges of 20 gastropods (Table 1) and 11 bivalves (Table 2). Most of these species can now be extended chronostratigraphically into the early Eocene ("Capay Stage"). All the species/subspecies are commonly occurring throughout the Eocene of the West Coast, and these geologic age refinements will prove useful in future biostratigraphic and paleobiogeographic studies, as well as in evolutionary studies.

The purpose of this article is to bring together all these molluscan species/subspecies into one manuscript. This will be more convenient to the researcher. In addition, illustrations of the species are included (Pls. 1 and 2). Previously, the stage extensions were mentioned in monographic length works by Squires (1984, 1987, in press). In the case of *Turritella andersoni*, see the other article by Squires in this symposium volume.

MOLLUSCAN STAGES

Clark and Vokes (1936) informally proposed five molluscan provincial Eocene stages for the West Coast (California, Oregon, and Washington). These stages are "Meganos," "Capay," "Domengine," "Transition," and "Tejon." They recognized two faunal zones in their "Capay Stage." Givens (1974) showed that the upper faunal zone of the "Capay" should be considered part of the "Domengine Stage," and he resticted the use of the "Capay Stage" to their lower faunal zone of the "Capay Stage." It is in this restricted sense that the "Capay" is used in this present report. Saul (1983) and Squires (1984, 1987, in press) regarded the "Meganos Stage" as latest Paleocene-early Eocene age, the restricted "Capay Stage" of Givens (1974) as early Eocene age, the "Domengine Stage" as late early through early middle Eocene age, and the "Transition Stage" as middle Eocene age. Squires (1984, 1987) regarded the "Tejon Stage" as late middle Eocene and/or late Eocene age. Such ages are used for this present report (Fig. 1).

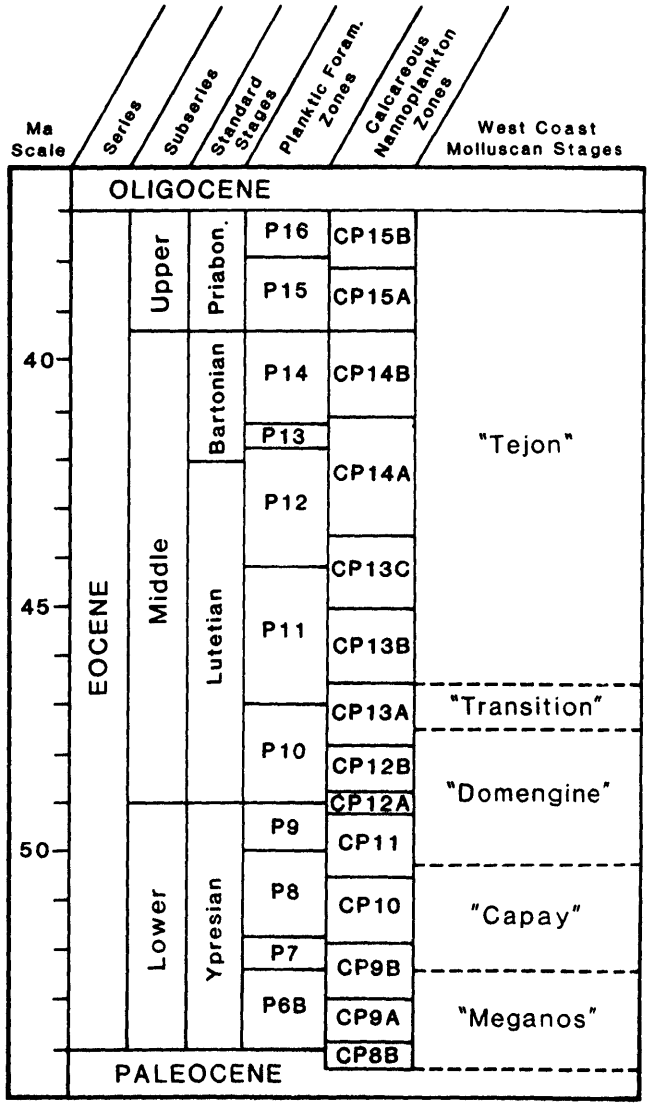

Figure 1. Correlation of West Coast Eocene molluscan stages (after Saul, 1983) with millions of years scale (Ma), series, subseries, standard stages. planktic foraminifera zones, and calcareous nannoplankton zones (all after Haq, Hardenbol, and Vail, 1987).

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Plate 1

Figures 1-20. Gastropods whose stage ranges have been extended by Squires (1984, 1987, in press). Apertural view unless otherwise stated.

1. *Homalopoma umpquaensis domenginensis* Vokes, x5, height 7.5 mm, width 6.5 mm, LACMIP hypotype 7694, CSUN loc. 979, "Capay Stage," Juncal Formation?, northern Lockwood Valley area. = LACMIP loc. 16081
2. *Turritella andersoni* Dickerson, side view, x5, height 10 mm, width 4 mm, LACMIP hypotype 7695, CSUN loc. 979, "Capay Stage," Juncal Formation?, northern Lockwood Valley area. = LACMIP 16081
3. *Turritella buwaldana* Dickerson, abapertural view, x 4.7, height 10 mm, width 5 mm, LACMIP hypotype 7696, CSUN loc 981, "Capay Stage," Juncal Formation?, northern Lockwood Valley area. = LACMIP loc. 16142
4. *Turritella uvasana hendoni* .l. Merriam, x2.4, height 16 mm, width 10 mm, LACMIP hypotype 7697, CSUN loc. 987, "Capay Stage," Juncal Formation?, northern Lockwood Valley area. = LACMIP loc. 16175
5. *Architectonica* (*Stellaxis*) *cognata* Gabb, dorsal view, x2.3, greatest diameter 14.5 mm, LACMIP hypotype 7698, CSUN loc. 983, "Capay Stage," Juncal Formation?, northern Lockwood Valley area. = LACMIP loc. 16110
6. *Bittium dumblei*? (Dickerson), abapertural view, x4, height 11 mm, width 3.5 mm, LACMIP hypotype 7456, CSUN loc. 845, " Capay Stage," Juncal Formaton, Whitaker Peak area. = LACMIP 16137
7. *Xenophora stocki* Dickerson, internal mold, side view, x1, height 17 mm, width 22.5 mm, LACMIP hypotype 6520, CSUN loc. 374, "Domengine Stage," Llajas Formation, Simi Valley. = LACMIP 7242
8. *Paraseraphs erraticus* (Cooper), x1.8, height 27 mm, width 6 mm, LACMIP hypotype 7456, CSUN loc. 362, "Capay Stage," Juncal Formation, Whitaker Peak area. = LACMIP loc. 16273.
9. *Amaurellina caleocia* Vokes, abapertural view, x4.9, height 7 mm, width 6 mm, LACMIP hypotype 7707, CSUN loc. 979. "Capay Stage," Juncal Formation?, northern Lockwood Valley area. = LACMIP loc. 16081
10. *Natica* (*Naticarius*) *uvasana* Gabb, x6, height 5 mm, width 5.5 mm, LACMIP hypotype 7709, CSUN loc. 987, "Capay Stage," Juncal Formation?, northern Lockwood Valley area. = LACMIP loc. 16175
11. *Galeodea* (*Gomphopages*) *meganosensis* Vokes, abapertural view, x2.7, height 15 mm, width 13 mm, LACMIP hypotype 7474, CSUN loc. 845, "Capay Stage," Juncal Formation, Whitaker Peak area. = LACMIP loc. 16137
12. *Galeodea* (*Caliagaleodea*) *californica* Clark, internal mold, abapertural view, x1, height 30 mm, width 26 mm, LACMIP topotype and hypotype 6530, CSUN loc. 374, "Domengine Stage," Llajas Formation, Simi Valley. = LACMIP loc. 7242
13. *Olequahia domenginica* (Vokes), abapertural view, x1, height 52 mm, width 28 mm, LACMIP hypotype 6533, CSUN loc 374, "Domengine Stge," Llajas Formation, Simi Valley. = LACMIP loc. 7242
14. *Clavilithes tabulatus* (Dickerson), x1, height 85 mm, width 38 mm, LACMIP hypotype 7478, CSUN loc. 827, "Capay Stage," Juncal Formation, Whitaker Peak area. = LACMIP loc. 16153
15. *Strepsidura ficus* (Gabb) abapertural view, x1.25, height 27 mm, width 18 mm, LACMIP hypotype 6543, CSUN loc. 452 "Capay Stage," Llajas Formation, Simi Valley. = LACMIP loc. 16364
16. *Lyria andersoni* Waring, x2, height 18 mm, width 9 mm, LACMIP hypotype 6550, CSUN loc. 498, "Domengine Stage," Llajas Formation, Simi Valley. = LACMIP 16189.
17. *Lyrischapa lajollaensis* (Hanna) x1, height 34 mm, width 25 mm, LACMIP hypotype 6551, CSUN loc. 373, "Domengine Stage," Llajas Formation, Simi Valley. = LACMIP 16211.
18. *Trypanotoma stocki* (Dickerson), x2.5. height 17 mm, width 5 mm, LACMIP hypotype 6556, CSUN loc. 371, "Domengine Stage," Llajas Formation, Simi Valley. Not *Domenginella claytonensis* (Gabb). = LACMIP 16115
19. *Conus caleocius* Vokes, x2, height 17 mm, width 8 mm, LACMIP hypotype 6558, CSUN loc. 498, "Domengine Stage," Llajas Formation, Simi Valley. = LACMIP 16189
20. *Conus remondii* Gabb, abapertural view, x5, height 7 mm, width 4 mm, LACMIP hypotype 7499, CSUN loc. 219, "Domengine Stage," Matilija Sandstone?, Whitaker Peak area. = LACMIP 16100

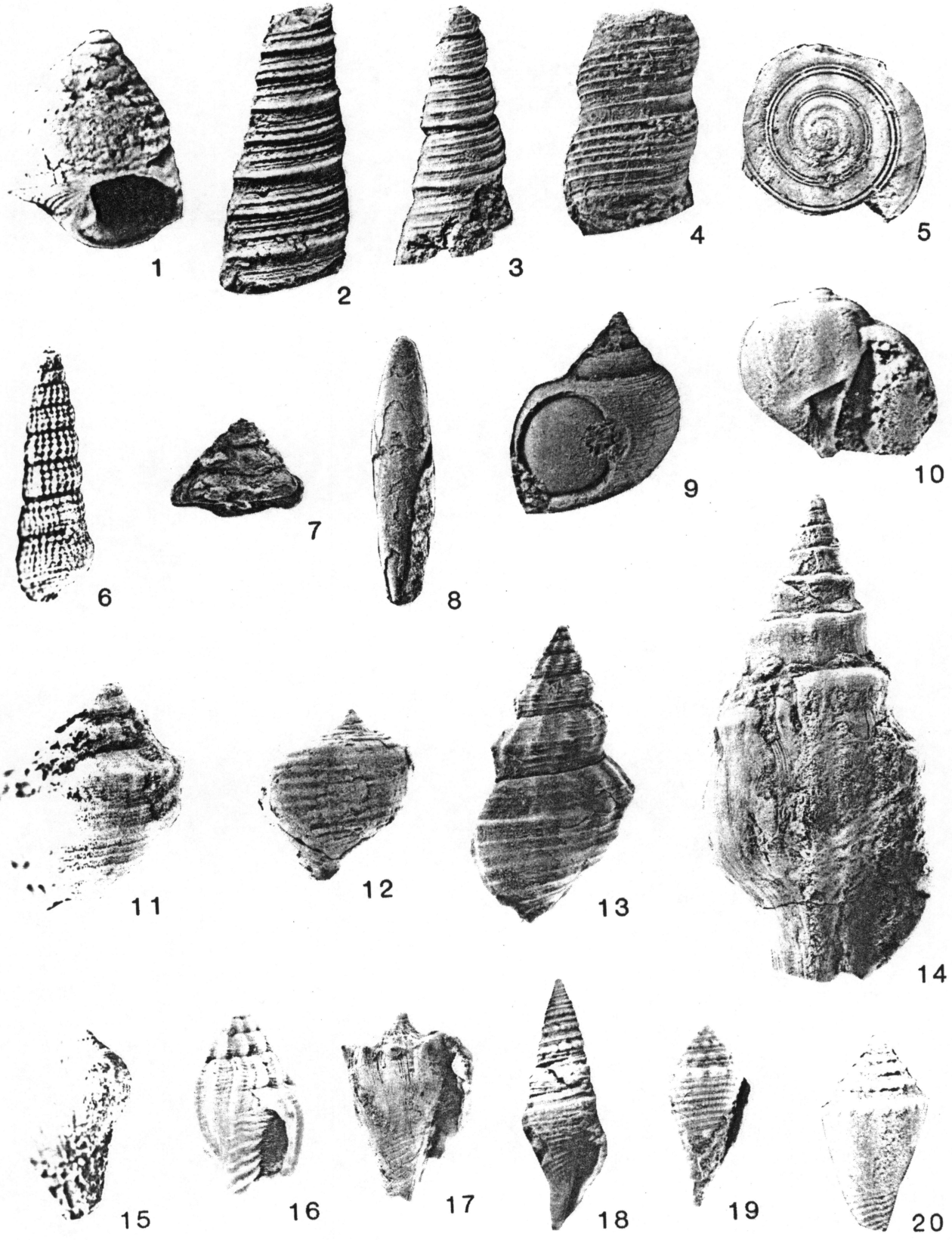
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Plate 2

Figures 1-11. Bivalves whose stage ranges have been extended by Squires (1984, 1987, in press). Left valve unless otherwise stated.

1. *Barbatia* (*Cucullaearca*) *cliffensis* Hanna, partial right valve, x3, length 13 mm, height 8 mm, LACMIP hypotype 7507, CSUN loc. 828, "Domengine Stage," Matilija Sandstone?, Whitaker Peak area. = LACMIP 16191
2. *Miltha packi* (Dickerson), x0.8, length 76 mm, height 68 mm, LACMIP hypotype 7571, CSUN loc. 362, "Capay Stage," Juncal Formation, Whitaker Peak area. = LACMIP 16273
3. *Claibornites diegoensis* (Dickerson), right valve, x1, length 35 mm, height 33mm, UCLA hypotype 59281, CSUN loc. 374, "Domengine Stage," Llajas Formation, Simi Valley. = LACMIP 7242
4. *Venericardia* (*Pacificor*) *aragonia joaquinensis* (Vokes), right valve, x1.6, length 22 mm, height 25 mm, LACMIP hypotype 7525, CSUN loc. 815, "Capay Stages," Juncal Formation, Whitaker Peak area. = LACMIP 16401
5. *Glyptoactis* (*Claibornicardia*) *domenginica* (Vokes), x2.5, length 12 mm, height 12 mm, LACMIP hypotype 6575, CSUN loc. 371, "Domengine Stage," Llajas Formation, Simi Valley. = LACM 16115
6. *Glyptoactis* (*Claibornicardia*) *sandiegoensis* (Hanna), x1.6, length 22 mm, height 25 mm, LACMIP hypotype 7527, CSUN loc. 844, "Capay Stage," Juncal Formation, Whitaker Peak area. = LACMIP 16119
7. *Crassatella uvasana* Conrad, x1, length 60 mm, height 58 mm, LACMIP hypotype 6577, CSUN loc. 374, "Domengine Stage," Llajas Formation, Simi Valley. = LACMIP 7242
8. *Solena* (*Eosolen*) *novacularis* (Anderson and Hanna), x1, length 60 mm, height 23 mm, LACMIP hypotype 6585, CSUN loc. 374, "Domengine Stage," Llajas Formation, Simi Valley. = LACMIP 7242
9. *Pitar* (*Calpitaria*) *uvasanus* (Conrad), x1.5, length 19 mm, height 16 mm, LACMIP hypotype 6590, CSUN loc. 371, "Domengine Stage," Llajas Formaton, Simi Valley. = LACMIP 16116
10. *Pitar* (*Lamelliconcha*) *joaquinensis* Vokes, x2.2, length 16 mm, height 12 mm, LACMIP hypotype 7536, CSUN loc. 237, "Domengine Stage," Matilija Sandstone?, Whitaker Peak area. = LACMIP 16080
11. *Corbula* (*Caryocorbula*) *dickersoni* Weaver and Palmer, x2.8, length 11.5 mm, height 7 mm, LACMIP hypotype 7539, CSUN loc. 807, "Capay Stage," Juncal Formation, Whitaker Peak area. = LACMIP 16191