dary. Furthermore it is probable that most of the "Capay" Stage is missing in the Simi Valley area, and only uppermost "Capay" (sensu Givens) is present. Certainly the lower Llajas has yielded no mollusks restricted to "Martinez" or "Meganos" stages as suggested by Miles (1981, p. 100), but mollusks indicative of these stages have been recovered from the Santa Susana Formation.

TURRITELLAS AND VENERICARDIAS OF THE SIMI VALLEY AREA

Species, subspecies, and varieties of *Turritella* figured from Paleogene deposits of the Simi Valley area are listed in Appendix 1. Some of these I consider to be unrecognizable, e.g., *T. hannai* NELSON; some are synonyms; and at least two are as yet undescribed. Seventeen taxa (see Figure 2) occur in the Paleogene of the Simi Valley area, and the recognized forms are figured on Plates 1-2. Of the stocks indicated, the *T. buwaldana* stock is most in need of further study.

Large turritellas are found today only in tropical seas, and their presence in the Paleogene of the Simi Valley suggests that these formations were deposited in warmer water than is presently found at this latitude. Reported depth range of turritellas is just subtidal to 150m (e.g., Merriam, 1941, p. 14; Thorson, 1957, p. 510; Saul, 1983, p. 42), and they are characteristic of fine-grained level-bottom shelf areas of low turbulence (Yonge & Thompson, 1976, p. 88). The sediment grain size, stratigraphic position, and geographic distribution of the turritellas in the Simi Valley Paleocene rocks suggests that the different lineages are indicative of different water depths. The shallowest living of these was apparently the *T. reversa* stock. *Mesalia martinezensis* occurs commonly with *T. reversa*, and it too is suggestive of shallow-water, near-shore areas. Although a complex of factors doubtless delimited the turritella habitats, it seems possible to list the stocks in an order reflective of increasing water depth and decreasing turbulence: *T. reversa*, *T. buwaldana*, *T. andersoni*, and *T. uvasana*. As indicated in Figure 2, the *T. reversa* stock is represented at the base and the top of the Santa Susana and the base of the Llajas Formations. The *T. buwaldana* stock is present near the top of the Santa Susana Formation and in the lower Llajas Formation. The *T. andersoni* stock is found through more of the Simi Valley section than any of the other stocks. Its species may have been better able to cope with softer, muddier bottoms than were species of the *T. uvasana* stock which are most abundant in fine-grained, clean-sand deposits.

Species, subspecies, and varieties of previously figured venericardias from the Simi Valley area are listed in Appendix 2. Of the 10 taxa previously recorded, I recognize 4 and add *V.* (*P.*) *mulleri* VERASTEGUI based on unphotogenic specimens from UCLA loc. 3121. A more suitable specimen, also from the *T. i. pachecoensis* Zone but from the Santa Monica Mountains, is figured (Pl. 1, fig. 8). Turner's (1938, p. 50) *V. hornii lutmani* from the "Santa Susana shale" is undoubtedly *V.* (*P.*) *h. susanaensis* VERASTEGUI (Pl. 1, fig. 14), and *V.* (*P.*) *h. lutmani* TURNER has not been found. Six venericardias (see Figure 2) are present in the Simi Valley environs.

The venericardias also appear to fit a water-depth pattern similar to that of the turritellas. The *Venericardia* (*?Venericor*) *venturensis* stock was doubtless the shallowest, nearest shore lineage and may have been able to inhabit brackish water. The *V.* (*Pacificor*) *aragonia* lineage appears to diverge from the *V.* (*Pacificor*) *hornii* lineage in the late Paleocene. Thus it can be recovered from nearer shore, shallower water deposits of "Meganos" through "Domengine" Stages. The *V.* (*P.*) *hornii* stock is typically associated with *Turritella andersoni* and *T. uvasana* stocks in more stable, offshore habitats.

PLATE 2

Figs. 1-8. Turritellas and venericardias of the "Capay" Stage.

1. *Turritella meganosensis protumescens* MERRIAM & TURNER, 1937; x1; UCLA 59371; UCLA loc. 6616, S of Las Llajas Canyon, Santa Susana Quad.; Llajas Fm.

2-3. *Turritella buwaldana crooki* MERRIAM & TURNER, 1937; x2; UCLA loc. 6615, Chivo Canyon, Santa Susana Llajas Fm. 2. UCLA 59372. 3. UCLA 59373. This subspecies is also present in the "Meganos" Stage.

4. *Turritella uvasana infera* MERRIAM, 1941; x2; UCLA 59359; UCLA loc. 6616, S of Las Llajas Canyon, Santa Susana Quad.; Llajas Fm. This subspecies is also present in the "Meganos" Stage.

5. *Turritella andersoni susanae* MERRIAM, 1941; x1.75; UCBMP 15295, Holotype; UCB loc. A-993, Las Llajas Canyon, Santa Susana Quad.; Llajas Fm. Photo by T. Susuki.

6. *Venericardia* (*Pacificor*) *hornii lutmani* TURNER, 1938; x.75; UCLA 59381; UCLA loc. 4244, Hot Springs Canyon, Topatopa Mts. Quad.; lower Juncal Fm.

7-8. *Venericardia* (*Pacificor*) *aragonia joaquinensis* (VOKES, 1939); UCB loc. 7193, Bus Canyon, Calabasas Quad.; Llajas Fm. 7. x.75; UCBMP 37432. 8. x1; UCBMP 37433; This species is also present in the "Domengine" Stage.

Figs. 9-18. Turritellas and venericardias of the "Domengine" Stage.

9, 16-17. *Venericardia* (*Pacificor*) *hornii calafia* STEWART, 1930. 9. x1; LSJU 8099; Little River at Glide, Douglas Co., Oregon; Lookingglass Fm. [Holotype of *V.* (*P.*) *oregonensis* VERASTEGUI, 1953]. 16. x1; UCLA 59383; UCLA loc. 7071, Bus-Trough Canyon divide, Calabasas Quad.; Llajas Fm. 17. x.75; UCLA 59378; UCLA loc. 2312, Las Llajas Canyon, Santa Susana Quad.; Llajas Fm.

10-11. *Turritella andersoni lawsoni* DICKERSON, 1916; x1; UCLA loc. 5837, Simi Arroyo, Santa Susana Quad.; Llajas Fm. Photos by T. Susuki. 10. UCLA 59379. 11. UCLA 59397.

12. *Turritella andersoni lawsoni* forma *secondaria* MERRIAM, 1941; x1; UCLA 59380; UCLA loc. 5837, Simi Arroyo, Santa Susana Quad.; Llajas Fm. Photo by T. Susuki.

13-15. *Turritella buwaldana* DICKERSON, 1916; x2. 13. typical form; UCLA 59374; UCLA loc. 2777, Devil Canyon, Santa Susana Quad.; Llajas Fm. 14. round-whorled form; UCLA 59375; UCLA loc. 586, Chivo Canyon, Santa Susana Quad.; Llajas Fm. 15. slender form; UCLA 59376; UCLA loc. 586, Chivo Canyon, Santa Susana Quad., Llajas Fm.

18. *Turritella uvasana applinae* HANNA, 1927; x1; UCLA 59377; UCLA loc. 2312, Las Llajas Canyon, Santa Susana Quad.; Llajas Fm.