

FIGURE 4—*Anchura falciformis* Gabb. 1–3, hypotype, abapertural, side, and apertural views,  $\times 1$ , LACMIP 12127, locality UCLA 6044; 4, hypotypes, slab with one unmeasured and two measured specimens,  $\times 0.75$ , LACMIP 11323 and LACMIP 11324, locality UCLA 6044; 5, 6, hypotype, abapertural and apertural views,  $\times 1$ , LACMIP 11321, locality UCLA 3648; 7, 8, hypotype, abapertural view,  $\times 1$  and  $\times 2$ , UWBM 16734, locality A9254; 9, 10, hypotype, abapertural view with protoconch,  $\times 1$  and  $\times 2$ , LACMIP 11326, locality UCLA 4878; 11, 12, hypotype, abapertural view,  $\times 1$  and  $\times 2$ , LACMIP 11325, locality CIT 1018.

the anterior expansion at the posteriorward bend was relatively broad and may have developed into a short spur. In general, *A. phaba* appears to have had the same type of wing as *A. falciformis*.

The geologically oldest of the specimens identified as *A. phaba* are from the Holz Shale Member of the Ladd Formation in the Santa Ana Mountains, Orange County. These and specimens from the stratigraphically lowest outcrops of the Chatsworth Formation in Bell Canyon, Ventura County, have slightly fewer axial ribs with larger nodes and a stronger whorl angulation on the spire than specimens from younger horizons such as the Pleasants Sandstone Member of the Williams Formation in the Santa Ana Mountains, Orange County, and higher beds of the Chatsworth Formation in Dayton Canyon, Los Angeles County. Specimens from Manzanita Mountain, Santa Barbara County,

also correspond to this younger morphology which has a stronger angulation on the body whorl. The holotype from Pigeon Point appears to have intermediate characteristics.

*Anchura phaba* differs from *A. falciformis* in having a more angulate whorl profile, more numerous axial ribs that are more concave, a keel lower on the whorl, stronger cords with stronger and more nodes on them, and the basal two cords more distant from each other. The inner lip of *A. phaba* is thicker, and the parietal callus pad is thicker and more elongate than in *A. falciformis*.

*Anchura phaba* has stronger nodes, more axial ribs per whorl, a more angulate whorl profile, and thicker inner lip and parietal callus pad than *A. callosa*. It is stouter than *A. gibbera* and has stronger nodes on the keel, a shorter and broader lateral arm, stronger axial ribs, and a less protuberant parietal callus pad.

TABLE 4—Measurements in mm of *Anchura falciformis* Gabb. For abbreviations and symbols used, see introduction.

Specimen	H	Hp	Db	Dp	Dp/Hp	R	PA	S	Ct	Cp	A	Remarks
LACMIP 11321	71.0	11.7	24.2	18.8	1.61	—	26°	18.7	8	4	14	body + 7 whorls
LACMIP 11322	52.6	10.8	23.0	18.9	1.75	—	25°	23.4	7	4	14	body + 3 whorls
LACMIP 12127	64.6	10.1	21.5	15.8	1.56	—	23°	21.8	8	4	13	body + 6 whorls
LACMIP 11323	92.3	10.0	—	17.9	1.79	29.5	26°	18.1	8	4	14●	body + 9 whorls
LACMIP 11324	90.0	10.2	19.1	16.9	1.66	29.3	27°	19.6	8	4	14●	body + 7 whorls
LACMIP 11325	25.9	5.0	—	8.3	1.66	—	24°	—	8	4	12	juv. 6 whorls
LACMIP 11326	15.3	2.5	—	4.8	1.92	—	19°	—	7	3	—	protoconch + 7
UW 16734	26.8	4.7	—	7.9	1.68	—	22°	—	8	4	10	8 spire whorls

*Anchura phaba* is larger than *A. halberdopsis*, has a more angulate whorl profile, and weaker, arched, rather than straight, axial ribs.

*Type specimens.*—Holotype USNM 468578 from USGS locality M8611, paratypes USNM 485423 from USGS locality M8591, LACMIP 11327 from CIT locality 974, LACMIP 11335–11336 from LACMIP locality 6965, LACMIP 11333–11334, 11345 from CIT locality 1159, LACMIP 11330 from CIT locality 1054, LACMIP 11328–11329 from CIT locality 1057; LACMIP 11332 from CIT locality 1158.

*Type locality.*—USGS locality M8611, Southeast of Pigeon Point, San Mateo County, California.

*Measured specimens.*—See Table 5.

*Age.*—Middle to early late Campanian. Late *Turritella chicoensis* and *T. chicoensis pescaderoensis* Zones.

*Geographic distribution.*—Pigeon Point Formation, southern sequence, near Pigeon Point, San Mateo County (USGS M8611 (1 specimen); Manzanita Mountain (USGS M8591, 2 specimens), Santa Barbara County; Bell [UCLA 6996 (1 specimen); CIT 1158 (1 specimen)] and Dayton Canyons [CIT 1159 (10+ specimens), LACMIP 6965 (4 specimens)], Simi Hills, Los Angeles and Ventura Counties, in the lower part of the Chatsworth Formation of Colburn et al. (1981); Santa Ana Mountains, Orange County, California, near the top of the Holz Shale Member of the Ladd Formation. [UCLA 1527 (1 specimen), UCLA 6950 (1 specimen), CIT 1060 (1 specimen); CIT 1057 (3 specimens), LACMIP 10934 (1 specimen), CIT 1054 (2 specimens)]; Pleasants Sandstone Member of the Williams Formation [CIT 974 (1 specimen)].

*Etymology.*—Greek, *phabos*, a wild pigeon.

#### ANCHURA AINIKTA new species

Figure 5.14–5.21

*Diagnosis.*—An *Anchura* with about 14 axial ribs per whorl forming noticeable nodes on prominent carina at second spiral cord near mid-whorl; early whorls with randomly occurring varices.

*Description.*—Shell apparently small, high-spired, drawn out anteriorly into anterior rostrum; pleural angle about 20 degrees; whorls more than 14 in number, angulate submedially at second spiral cord on spire, whorl profile concave posterior to carina; suture appressed; protoconch of about four whorls; juvenile sculpture of about 28 fine, slightly curved axial ribs crossed by two spiral cords, strongest cord medially placed; mature? sculpture on spire of about 14 slightly curved axial ribs, weaker than four spiral cords; three posterior cords noded at axial ribs, first cord weak, second cord strong, forming carina, third cord nearly as strong as and close to second, fourth cord just posterior to suture, strong and unnoded; weaker fifth cord on base of whorl; randomly occurring varices present on early whorls.

*Remarks.*—All specimens assigned to this taxon are relatively

small and may be immature, because none has the adult wing. The largest specimens are natural rock molds from Horse Canyon, Santa Barbara County, California (Figure 5.20). *Anchura phaba* and *A. ainikta* occur in close proximity in the Pigeon Point Formation, and *A. ainikta* may possibly be the juvenile and adolescent stages of *A. phaba*, which are poorly understood. However, *A. ainikta* differs from *A. phaba* in having fewer spiral cords and having a double-keeled appearance to the whorls produced by the close spacing of the strong, second cord and the subequal third cord. The fourth cord is stronger on *A. ainikta* and shows on the spire just posterior to the suture thus making the whorl profile more basally angulate. In its angulate whorl profile *A. ainikta* resembles the early whorls of *A. gibbera*, but *A. gibbera* does not have varices and the keel does not appear double.

*Type specimens.*—Holotype USNM 485425; paratypes USNM 485426 from USGS locality M8756, USNM 485424 from USGS locality M8759, LACMIP 11337–11338 from UCLA locality 7135.

*Type locality.*—USGS locality M8756, 1 km SE of Pigeon Point, San Mateo County, California.

*Measured specimens.*—See Table 6.

*Age.*—Middle to early late Campanian

*Geographic distribution.*—USGS locality M8756 (2 specimens) Pigeon Point Formation, near Pigeon Point, San Mateo County; UCLA locality 7135 (2 specimens), Horse Canyon, Bates Canyon quadrangle, Sierra Madre Mountains, Santa Barbara County, California.

*Etymology.*—Greek, *ainiktos*, baffling, obscure, enigmatic.

#### ANCHURA NANAIMOENSIS (Whiteaves, 1879)

Figure 5.22–5.27

*Potamides tenuis nanaimoensis* Whiteaves, 1879, p. 121, pl. 15, fig. 9, 9a.

*Discussion.*—Three of Whiteaves' type specimens of "*Potamides tenuis*" *nanaimoensis* are immature *Anchura*. The rock mold, GSC 5763, displays three protoconch whorls, sculpture of next four whorls is indistinct because much of the shell has adhered to the mold and the sculpture is seen from the inside. The sculpture is made up of many fine arched axial ribs and about six spiral cords; the axial ribs may be more prominent on the earliest of these whorls, but the axial ornamentation becomes subordinate to the spiral. Sculpture on the remaining four whorls of the impression is clearly defined and strongly spiral, consisting of three narrow cords above the noded keel and four below. Interspaces are considerably wider than the cords. Axial sculpture is evinced as arcuate swellings that are strongest across the keel. On the earlier two of these four whorls the axial ribs are more numerous than on the later two by about a third. GSC 5763a lacks the protoconch and first teleoconch whorls. It consists of three and a half whorls, and, if it was the basis for the

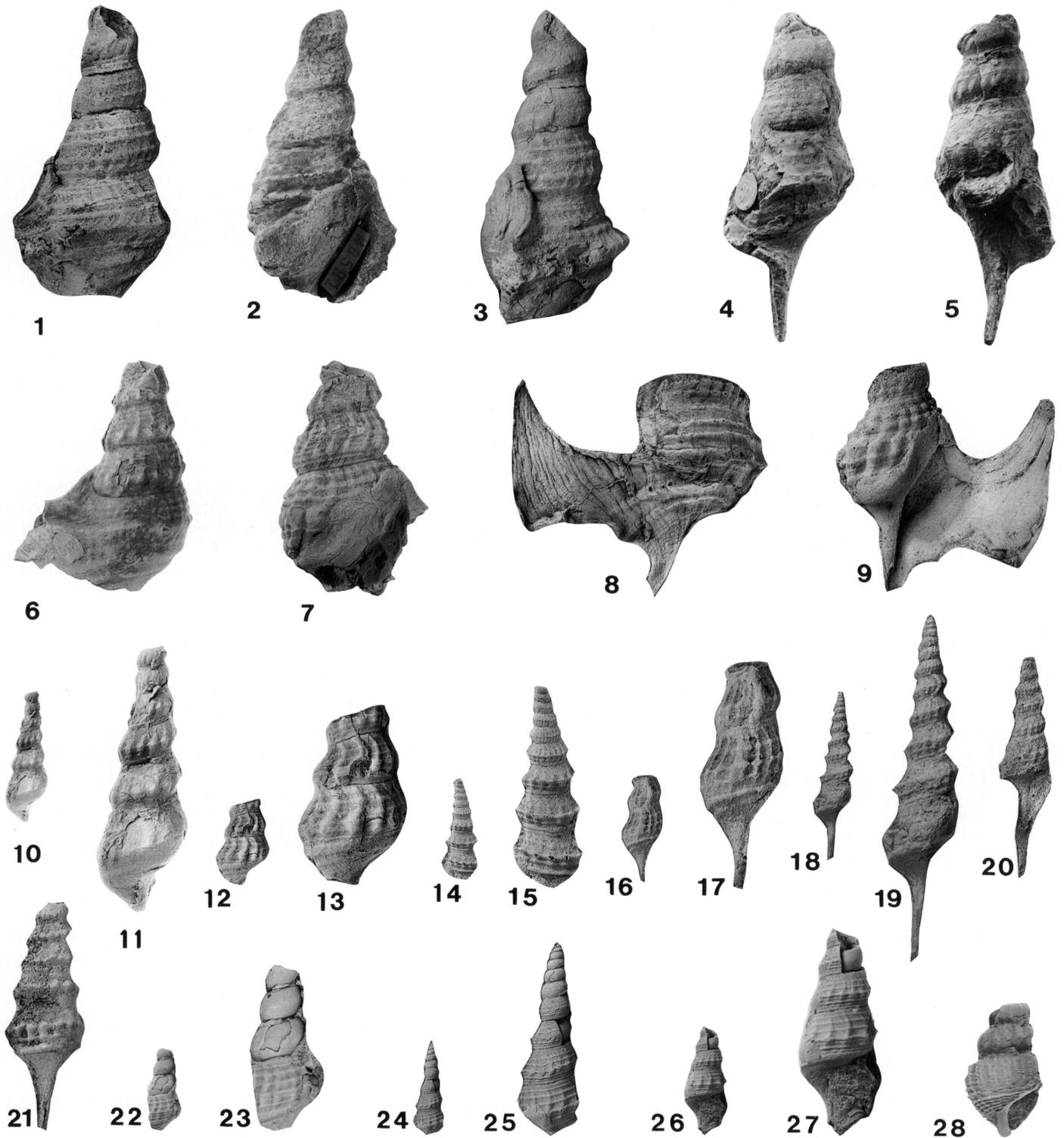


FIGURE 5—1–13, *Anchura phaba* new species. 1–3, Paratype, abapertural, side, and apertural views,  $\times 1$ , USNM 485423, locality M8591; 4, 5, paratype, abapertural and apertural views,  $\times 1$ , LACMIP 11333, locality CIT 1159; 6, paratype, abapertural view,  $\times 1$ , LACMIP 11328, locality CIT 1057; 7, paratype, apertural view,  $\times 1$ , LACMIP 11329, locality CIT 1057; 8, 9, holotype, abapertural and apertural views of latex pull,  $\times 1$ , USNM 468578, locality M8611; 10, 11, paratype, abapertural view,  $\times 1$  and  $\times 2$ , LACMIP 11345, locality CIT 1159; 12, 13, paratype, abapertural view,  $\times 1$  and  $\times 2$ , LACMIP 11332, locality CIT 1158. 14–21, *Anchura ainikta* new species. 14, 15, Paratype, latex pull,  $\times 1$  and  $\times 2$ , LACMIP 11337, locality UCLA 7135; 16, 17, paratype, abapertural view,  $\times 1$  and  $\times 2$ , USNM 485424, locality M8759; 18, 19, holotype, abapertural view,  $\times 1$  and  $\times 2$ , USNM 485425, locality M8756; 20, paratype, latex pull,  $\times 1$ , LACMIP 11338, locality UCLA 7135; 21, paratype, abapertural view,  $\times 2$ , USNM 485426, locality M8756. 22–27, *Anchura nanaimoensis* (Whiteaves). 22, 23, Syntype, side view,  $\times 1$  and  $\times 2$ , GSC 5763c; 24, 25, syntype, abapertural view of latex pull,  $\times 1$  and  $\times 2$ , GSC 5763; 26, 27, syntype, apertural view,  $\times 1$  and  $\times 2$ , GSC 5763a. 28, "*Potamides tenuis*" *nanaimoensis* (Whiteaves), syntype, not *Anchura nanaimoensis* (Whiteaves), side view,  $\times 2$ , GSC 5763b.

TABLE 5—Measurements in mm of *Anchura phaba* new species. For abbreviations and symbols used, see introduction.

Specimen	H	Hp	Db	Dp	Dp/Hp	R	PA	S	Ct	Cp	A	Remarks
USNM 468578	—	—	—	—	—	—	—	15.0	5	3	20●	latex pull
USNM 485423	52.0	10.7	26.5	17.4	1.63	—	26°	—	5	3	20●	body + 3 whorls
LACMIP 11333	57.9	9.8	21.7	16.4	1.67	14.6	23°	—	7	3	19	body + 2 whorls
LACMIP 11334	41.9	9.7	18.2	13.8	1.42	—	25°	—	6	3	—	body + 3 whorls
LACMIP 11345	23.6	4.4	8.8	7.4	1.68	—	18°	—	—	—	15	juv. 6 whorls
LACMIP 11328	40.7	9.0	20.5	16.8	1.87	—	28°	—	7	4	17	body + 3 whorls
LACMIP 11329	39.0	9.0	—	—	—	—	—	—	7	3/4	18	body + 2 whorls
LACMIP 11330	35.0	8.0	19.6	14.7	1.83	—	27°	—	8	4	20●	body + 3 whorls
LACMIP 11332	14.3	4.4	—	8.3	1.89	—	28°	—	7	3	14	3 spire whorls
LACMIP 11335	53.7	9.6	20.0	16.0	1.67	—	27°	—	6	3	16	8 whorls, no rostrum

last whorls in Whiteaves' figure 9, it has had shell breakage of the last volution. Enough shell remains to show a strong basal cord and a subordinate abapical cord.

No adult *Anchura nanaimoensis* are known. The type locality is only generally stated and covers an area where rocks of differing ages are present. These immature specimens are similar to immature *A. falciformis*, but *A. falciformis* has a broader keel involving more cords and has more and broader cords. *Anchura nanaimoensis* has more spiral cords than does *A. ainikta*. *Anchura nanaimoensis* cannot be distinguished from *A. phaba* with certainty because similar sized specimens of *A. phaba* are too poorly preserved, but *A. nanaimoensis* has a narrower pleural angle, more spiral cords, and the angulation nearer mid-whorl than does *A. phaba*. *Anchura nanaimoensis* is more strongly keeled than *A. callosa* but has fewer and weaker cords. In all of these species, very few such immature specimens have been available for study, and ranges of variability are conjectural. The number of cords per whorl, although varying by one or two in some species, is rather consistent, almost surprisingly so, through ontogeny from adolescent to adult whorls. Specimens of greater maturity are, however, needed for defining this species. In the absence of undoubtedly conspecific specimens of more maturity, well-located geographically and stratigraphically, *A. nanaimoensis* must be considered *nominum dubium*.

"*Potamides*" *tenuis* Gabb, 1864, and immature specimens of *Anchura falciformis* are common at several localities on Butte Creek and near Pentz. Although the submedial row of nodes on "*P.*" *tenuis* appears similar to the axial ribs on *A. falciformis* specimens that are near 15 mm in height, these taxa can be distinguished. Specimens of *Anchura* have a juvenile sculpture dominated by fine, arched axial ribs followed by adolescent and mature whorls with fewer axial ribs and several spiral cords that form nodes where they override the ribs. "*Potamides*" *tenuis* lacks fine, arched axial juvenile sculpture but has widely spaced, submedial nodes with other axial or spiral sculpture so fine that it is commonly indiscernible without magnification. An undescribed species similar to "*P.*" *tenuis*, but having a few widely spaced spiral cords is present in the Chatsworth Formation at Dayton Canyon (CIT locality 1159), Simi Hills, Los Angeles County, California. The spiral ribbing on this species corre-

sponds better to Whiteaves' description than does the sculpture of typical "*P.*" *tenuis*. Specimens similar to "*P.*" *tenuis* and conspecific with those from Dayton Canyon, were not included among Whiteaves' syntypes, but his description suggests that he possessed such specimens. If so, they might aid in identifying the horizon from which *A. nanaimoensis* was collected.

*Type specimens*.—Four syntypes of "*Potamides tenuis*" *nanaimoensis* Whiteaves, 1879, GSC 5763, a-c (Bolton, 1968, p. 68). One specimen, GSC 5763b, is not an *Anchura* but resembles "*Mesostoma*" *suciensis* (Whiteaves, 1879) (plate 15, figure 10; 1903, plate 44, figure 7). GSC 5763 may be the impression of 5763a, and Whiteaves' figure 9 may have been based on GSC 5763a and 5763. GSC 5763a is here chosen as the lectotype of "*Potamides tenuis*" *nanaimoensis* Whiteaves, 1879.

*Type locality*.—NW side of Hornby Island, British Columbia, Canada.

*Measured specimens*.—See Table 7.

*Age*.—Middle to late Campanian, "*pacificum* subfauna" or "*hornbyense* subfauna" (Jeletzky in Muller and Jeletzky, 1970).

*Geographic distribution*.—Probably Spray Formation (upper = late Campanian or lower = late middle to early late Campanian), northwest side of Hornby Island, British Columbia.

#### ANCHURA GIBBERA Webster, 1983

Figure 6.1–6.4

*Anchura gibbera* Webster, 1983, p. 1095, fig. 3B–E; Sundberg and Riney, 1984, p. 105, fig. 3.7.

*Description of early whorl sculpture*.—Protoconch of four rounded whorls. First four whorls of teleoconch rounded, sculptured by three narrow spiral cords and about 14 slightly stronger axial ribs; fifth whorl made slightly angulate by increasing strength of middle cord; eighth whorl noticeably angulate with about 18 weaker axial ribs and five narrow cords slightly beaded at intersections with ribs, the middle cord at the angulation and strongest.

*Remarks*.—*Anchura gibbera* is the tallest and most slender Pacific Slope *Anchura*. It is the only Late Cretaceous Pacific Slope species whose wing is known to have an anterior arm at the bend of the wing, similar to that of *A. abrupta* of the Gulf

TABLE 6—Measurements in mm of *Anchura ainikta* new species. For abbreviations and symbols used, see introduction.

Specimen	H	Hp	Db	Dp	Dp/Hp	R	PA	S	Ct	Cp	A	Remarks
USNM 485425	29.6	3.6	8.7	6.9	1.92	5.1	20°	—	4	1	14●	12 whorls, crushed
USNM 485426	21.5	3.0	6.6	5.2	1.73	4.7	19°	—	4	1	—	5 whorls, crushed
USNM 485424	19.9	4.7	8.6	6.2	1.32	—	18°	—	4	1	16●	2 whorls + rostrum
LACMIP 11337	18.8	3.5	6.5	6.2	1.77	—	17°	—	4	1	14●	10 whorls, latex pull
LACMIP 11338	38.0	4.6	9.2	6.4	1.39	7.5	17°	—	4	1	14●	7 whorls, latex pull