Stratigraphic Distribution and Zonation of Jurassic (Callovian) Ammonites in Southern Alaska

By RALPH W. IMLAY

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Studies of Callovian ammonites from southern Alaska provide correlations with lower and middle Callovian ammonite zones of Europe

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STRATIGRAPHIC DISTRIBUTION AND ZONATION OF JURASSIC (CALLOVIAN) AMMONITES IN SOUTHERN ALASKA

By RALPH IMLAY

ABSTRACT

Jurassic ammonites of early and middle Callovian Age occur in southern Alaska in the Chinitna and Shelikof Formations. Ranges of the ammonite genera and subgenera present, on the basis of the stratigraphic distribution of these fossils in Eurasia and East Greenland, show that these formations should be equivalent to at least the European zones of *Sigaloceras calloviense*, *Kosmoceras jason*, and *Erymnoceras coronatum*. Whether the basal few hundred feet of these formations is equivalent to the earliest Callovian or to the highest Bathonian, or both, cannot be demonstrated for certain.

Two ammonite zones are recognizable. The upper zone, named after *Cadoceras (Stenocadoceras) stenoloboide* (Pompeckj), is characterized by an abundance of the subgenus *Stenocadoceras*. It has been recognized west of Cook Inlet in the Paveloff Siltstone Member of the Chinitna Formation and in the upper one-sixth of the underlying Tonnie Siltstone Member. In the Talkeetna Mountains it is represented locally near the top of the Chinitna Formation. In the Alaska Peninsula it occurs in the middle member of the Shelikof Formation and in the upper fifth of the lower member.

The lower ammonite zone, named after *Cadoceras catostoma* Pompeckj, is characterized also by the presence of *C. glabrum* Imlay, all species of *C.* (*Paracadoceras*), and all species of *Lilloettia* except *L. stantoni* Imlay. These ammonites range through the entire lower part of the Chinitna Formation below the beds characterized by *C. (Stenocadoceras) stenoloboide* (Pompeckj) and *C.* (*S.*) *multicostatum* Imlay.

The lower part of the *C. catostoma* Zone is herein recognized as a subzone and is named after the most common species, *Iniskinites intermedius* (Imlay). This subzone marks the top of the range of *Parareineckeia*, of the new genus *Iniskinites*, and also of *Xenocephalites*, except for one specimen. Its lower part includes also all known specimens of evolute *Kepplerites*. Characteristic ammonites of the subzone occur in the lower 500 feet of the Chinitna Formation west of Cook Inlet and in the lower half of the lower member of the Shelikof Formation on the Alaska Peninsula.

The Callovian ammonites of southern Alaska include some genera characteristic of the Boreal realm, such as *Kepplerites*, *Cadoceras*, and *Pseudocadoceras*, and other genera characteristic of the Pacific realm, such as *Xenocephalites*, *Lilloettia*, and *Parareineckeia*. On the specific level, however, nearly all relationships are southward with Callovian ammonites in British Columbia, Oregon, and northern California. Evidently, southern Alaska during Callovian time was part of a Pacific Coast faunal province.

INTRODUCTION

The Callovian ammonites of southern Alaska described by the writer in 1953 have been restudied in order to revaluate the stratigraphic distribution of the genera and species, to establish ammonite zones for regional and continental correlations, and to date the formations and zones more precisely in terms of the standard Jurassic zones of western Europe. This study is based on biostratigraphic data compiled by Detterman and Hartsock (1966, p. 38, 39, 44–46, 48) for the Chinitna Formation west of Cook Inlet and by Arthur Grantz (written commun., Apr. 1972) for the Chinitna Formation in the Talkeetna Mountains. These data are much more accurate than those available to the writer in 1950. Likewise, study of the many fossil collections made by Arthur Grantz and associates in the Talkeetna Mountains between 1952 and 1963 has provided a check on conclusions based on data from other areas concerning ammonite associations, generic and specific variations, and stratigraphic distribution.

The study includes descriptions of two new genera, *Iniskinites* and *Chinitnites*, that succeed and are closely related to *Cranocephalites*, a genus of late Bajocian(?) to early or middle Bathonian Age. Also, two specimens of *Parareineckeia* are illustrated to show the characteristics of the small septate whorls and of the body chamber of a genus hitherto represented only by four specimens (Imlay, 1953b, p. 101, pl. 55, fig. 1, 2, 5–8; 1962, p. C25, C26, pl. 7, figs. 1–7). The biological distribution of the described species is shown in table 1.

STRATIGRAPHIC SUMMARY

On the west side of Cook Inlet between Iniskin Bay and Tuxedni Bay the Callovian is represented by the Chinitna Formation which, as described by Detterman and Hartsock, 1966, p. 40–47), consists of two siltstone members separated by a sandstone unit 30–200 feet thick. The lower member, named

TABLE 1.—*Some Callovian ammonite genera and species described herein, showing biological relationships and relative numbers available for study.*

Famiy	Genus and species	Number of specimens
Kosmoceratidae	*Kepplerites chisikensis* Imlay, n. sp	2
Cardioceratidae	*Chinitnites chinitnaensis* Imlay, n. gen., n. sp	102
	parviformis (Imlay)	22
	Iniskinites magniformis (Imlay)	7
	abruptus (Imlay)	9
	martini (Imlay)	3
	intermedius (Imlay)	12
Reineckeiidae	*Parareineckeia shelikofana* (Imlay)	2

the Tonnie Siltstone Member, is roughly equivalent to the lower two-thirds of the Chinitna Formation, as classified by Imlay (1953b, p. 51). It thins northward from 1,300 to 800 feet, rests sharply on the Bowser Formation, and north of Chinitna Bay is marked basally by pebbles or by channel conglomerates that locally cut as much as 200 feet into the Bowser Formation. The upper member, named the Paveloff Siltstone Member, ranges in thickness from 900 to 1,350 feet, is thickest in the central part of the area, is generally marked basally by a sandstone unit, and is overlain unconformably by the Naknek Formation. This unconformity is most conspicuous where the Paveloff Siltstone Member is thinnest.

The Shelikof Formation on the Alaska Peninsula between Wide Bay and Puale Bay consists of three members, as originally described by Capps (1923, p. 97–101) and later summarized by Martin (1926, p. 192–199), Imlay (1953b, p. 48, 49), and Burk (1965, p. 27). The lower member consists of 800 to 1,800 feet of siltstone and sandy siltstone, contains limestone concretions throughout, and in its lower part has many thin beds of volcanic ash. These ash beds, plus associated fossils, serve to differentiate the basal beds of the lower member from similar siltstone beds in the underlying Kialagvik Formation. The middle member consists of 1,000 to 3,500 feet of massive gray sandstone interbedded with some siltstone and conglomerate. Its upper part grades laterally and vertically into the adjoining siltstone members. The upper member consists of 900 to 1,500 feet of siltstone, contains some beds of sandstone and limestone, and is overlain unconformably by conglomerate at the base of the Naknek Formation.

The Chinitna Formation in the Nelchina area is overlain by the Naknek Formation with a marked unconformity that becomes angular to the north. At some places the Chinitna Formation rests concordantly but disconformably on *Cranocephalites*-bearing beds which are older than Callovian and which correlate faunally with the lower part of the Bowser Formation west of Cook Inlet (Imlay, 1962, p. C2; Detterman and Hartsock, 1966, p. 35–40). At many other places in the Talkeetna Mountains, the Chinitna Formation rests directly and unconformably on beds of middle to late Bajocian Age (Grantz, written commun., 1959).

The Chinitna Formation crops out extensively in the southern Talkeetna Mountains but has been mapped in detail only in the southeasternmost part of those mountains, known as the Nelchina area (Grantz, 1960a, b; 1965). North of Horn Mountains in the Nelchina area the formation has been divided into two unnamed members, whereas south of the mountains it has been mapped as a single undivided unit of siltstone and shale that contains limestone concretions and thin sandstone beds. The lower member north of the mountains comprises two facies: (1) a northern facies that consists of cobble conglomerate and conglomeratic sand siltstone, contains many fossil wood and coal fragments, attains a thickness of 100 feet, and lies in channels cut in the underlying rocks and (2) a southern facies that consists of sandstone and siltstone, contains marine mollusks, and attains a thickness of as much as 1,500 feet. The upper member north of Horn Mountains consists of siltstone and shale, contains limestone concretions and thin sandstone beds, thickens southward from 0 to 800 feet or more, and is similar in appearance to the entire Chinitna Formation south of Horn Mountains (Grantz, 1965; written commun., 1972).

CALLOVIAN AMMONITE SUCCESSION

WEST OF COOK INLET

Most of the fossil collections from the Chinitna Formation between Iniskin Bay and Tuxedni Bay (Imlay, 1953b, p. 65–71) have been described stratigraphically with respect to member boundaries by Detterman and Hartsock (1966, p. 44–46, 48) and are depicted herein on columnar sections (fig. 1) modified from those authors (1966, pl. 5). This information permits fairly accurate determinations of the stratigraphic ranges of many ammonite species (fig. 2) and necessitates revision of interpretations previously published (Imlay, 1953b, p. 50) which were based on much less accurate stratigraphic data. These ranges show clearly that the ammonites of the formation occur as two assemblages or zones. Of these, the upper assemblage is dominated by *Cadoceras* (*Stenocadoceras*) *stenoloboide* (Pompeckj)

and by *C.* (*S.*) *multicostatum* Imlay and ranges from the upper sixth of the Tonnie Siltstone Member to the top of the formation. The lower assemblage is characterized by *Cadoceras catostoma* Pompeckj, *Lilloettia buckmani* (Crickmay), and by species of the subgenus *Cadoceras* (*Paracadoceras*) and ranges through most of the Tonnie Siltstone Member. These ammonites in the lower assemblage are likewise associated in the lower two-fifths of the Tonnie Siltstone Member with *Iniskinites*, n. gen., and *Xenocephalites*.

TALKEETNA MOUNTAINS

The stratigraphic position of most of the fossil collections from the Chinitna Formation in the Nelchina area of the Talkeetna Mountains has been located fairly accurately by Arthur Grantz (written commun., 1972) and is depicted herein on generalized columnar sections (fig. 3). His information permits determinations of the stratigraphic ranges of ammonite taxa within the Chintna Formation in the Talkeetna Mountains (fig. 4 and 5) These ranges show that both the upper member northwest of Limestone Hills and the lower member east of those hills correlate very well with the Tonnie Siltstone Member below the lowest occurrences of *Cadoceras* (*Stenocadoceras*) *multicostatum* Imlay and *C.* (*S.*) *stenoloboide* (Pompeckj). This correlation is based on the presence of *Lilloettia buckmani* (Crickmay), *Cadoceras catostoma* Pompeckj, *C. glabrum* Imlay, *Chinitnites, Iniskinites, Kepplerites* (evolute forms), certain species of *Paracadoceras* and *Xenocephalites*, and on the absence of *Stenocadoceras*. The presence of *Chinitnites chinitnaensis* Imlay, n. sp., directly above *Iniskinites* in the upper member northwest of Limestone Hills corresponds to the stratigraphic position of these taxa within the Tonnie Siltstone Member west of Cook Inlet (fig. 2). It seems, therefore, that *Chinitnites* ranges higher than *Iniskinites* and that the species *C. chinitnaensis* marks the middle part of the range of *Cadoceras catostoma*.

The upper member of the Chinitna Formation between Limestone Hills and Horn Mountains has yielded ammonites only in its lower two-thirds, and these are also identical with species in the Tonnie Siltstone Member west of Cook Inlet. The basal part of the upper member is probably about the same age as the underlying lower member, as shown by the presence of *Iniskinites*. The middle third correlates with the highest part of the Tonnie Siltstone Member, as shown by an occurrence of *Cadoceras* (*Stenocadoceras*) *multicostatum* Imlay (USGS Mesozoic loc. 25308) at a position slightly lower than the highest occurrence of the subgenus *Paracadoceras* (USGS Mesozoic loc. 24224), which ranges through the lower two-thirds of the upper member. This relationship is of age significance because *Paracadoceras* west of Cook Inlet does not range above the very base of the Paveloff Siltstone Member (see USGS Mesozoic loc. 22524 in Detterman and Hartsock, 1966, p. 48), and *Stenocadoceras multicostatum* is not known below the upper sixth of the underlying Tonnie Siltstone Member.

ALASKA PENINSULA

The stratigraphic distribution of ammonite species within the members of the Shelikof Formation between Wide Bay and Puale Bay (fig. 6) is based on 35 fossil collections for which fairly accurate stratigraphic data are available. These collections include 18 from the lower member, 16 from the middle member, and 1 that is possibly from the basal part of the upper member. The biostratigraphic data (Imlay, 1953b, p. 69–71) as not nearly so accurate as data available for the members of the Chinitna Formation west of Cook Inlet (figs. 1 and 2) because fewer collections are involved, lateral changes are much greater within the members of the Shelikof Formation, and many of the fossil collections made before 1944 could not be so precisely located on the available maps as on aerial photographs. Nonetheless, the ranges of ammonite species within the lower and middle members of the Shelikof Formation correspond approximately to their ranges within the members of the Chinitna Formation. It follows, therefore, that the same ammonite assemblages are recognizable.

Recent reexamination of ammonite collections from the Shelikof Formation of the Alaska Peninsula, previously reported by Imlay (1953b, table 6 opposite p. 72), shows that *Paracadoceras* is lacking; *Xenocephalites* is known only from Chignik Bay (USGS Mesozoic loc. 29342); *Kepplerites* and *Iniskinites* are known only from one place about 500 feet above the base of the formation at Wide Bay (USGS Mesozoic loc. 19793); *Parareineckeia* is represented only by one specimen obtained about 200 feet lower at Wide Bay (USGS Mesozoic loc. 21355); and the only common taxa present are *Lilloettia, Cadoceras, C.* (*Stenocadoceras*), and *Pseudocadoceras*. The lower member is characterized by *Lilloettia buckmani* (Crickmay) in association with *Cadoceras catostoma* Pompeckj and *C. glabrum* Imlay. The middle member is characterized by *C.* (*Stenocadoceras*) *stenoloboide Pompeckj and C.*(*S.*)

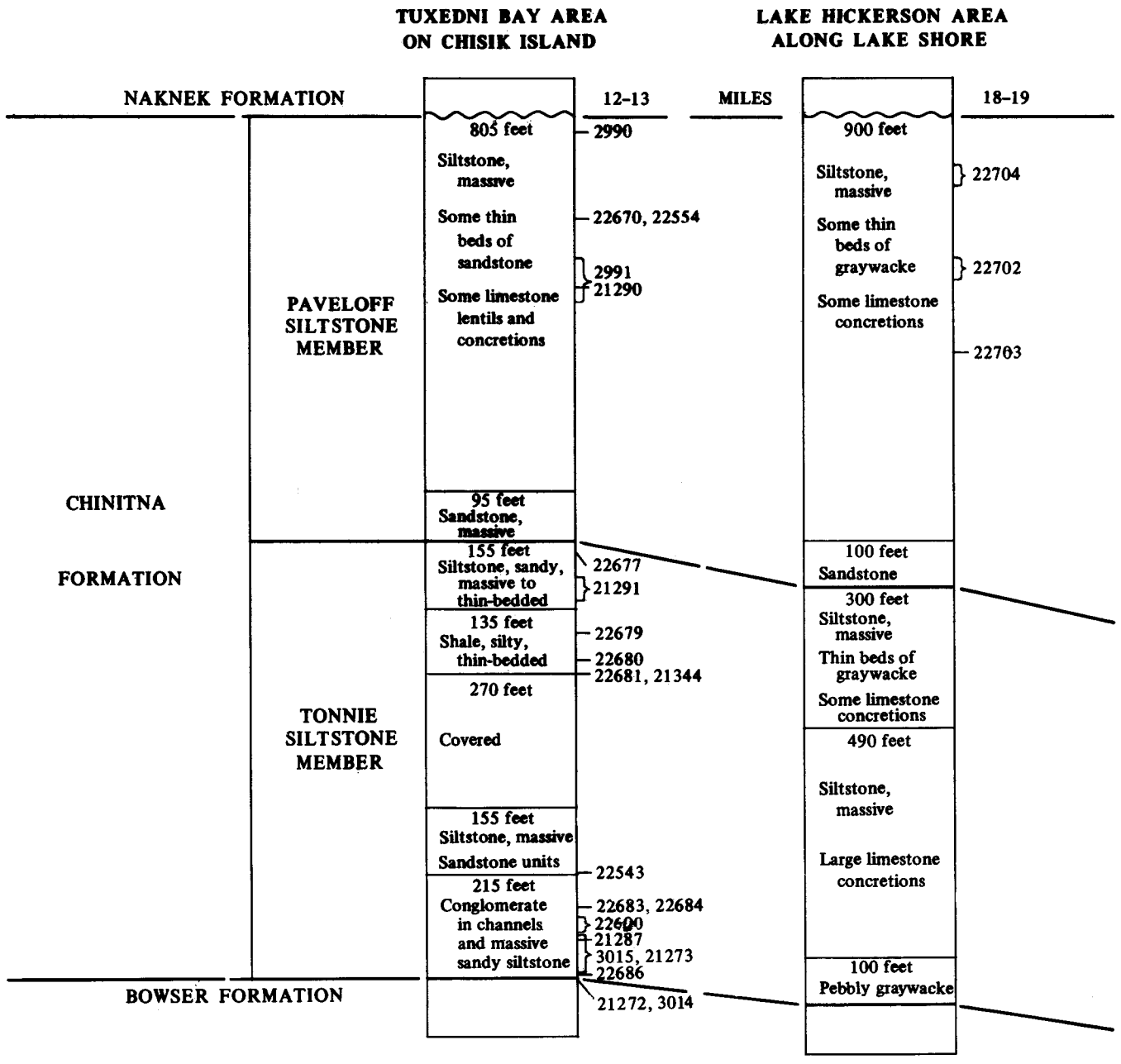
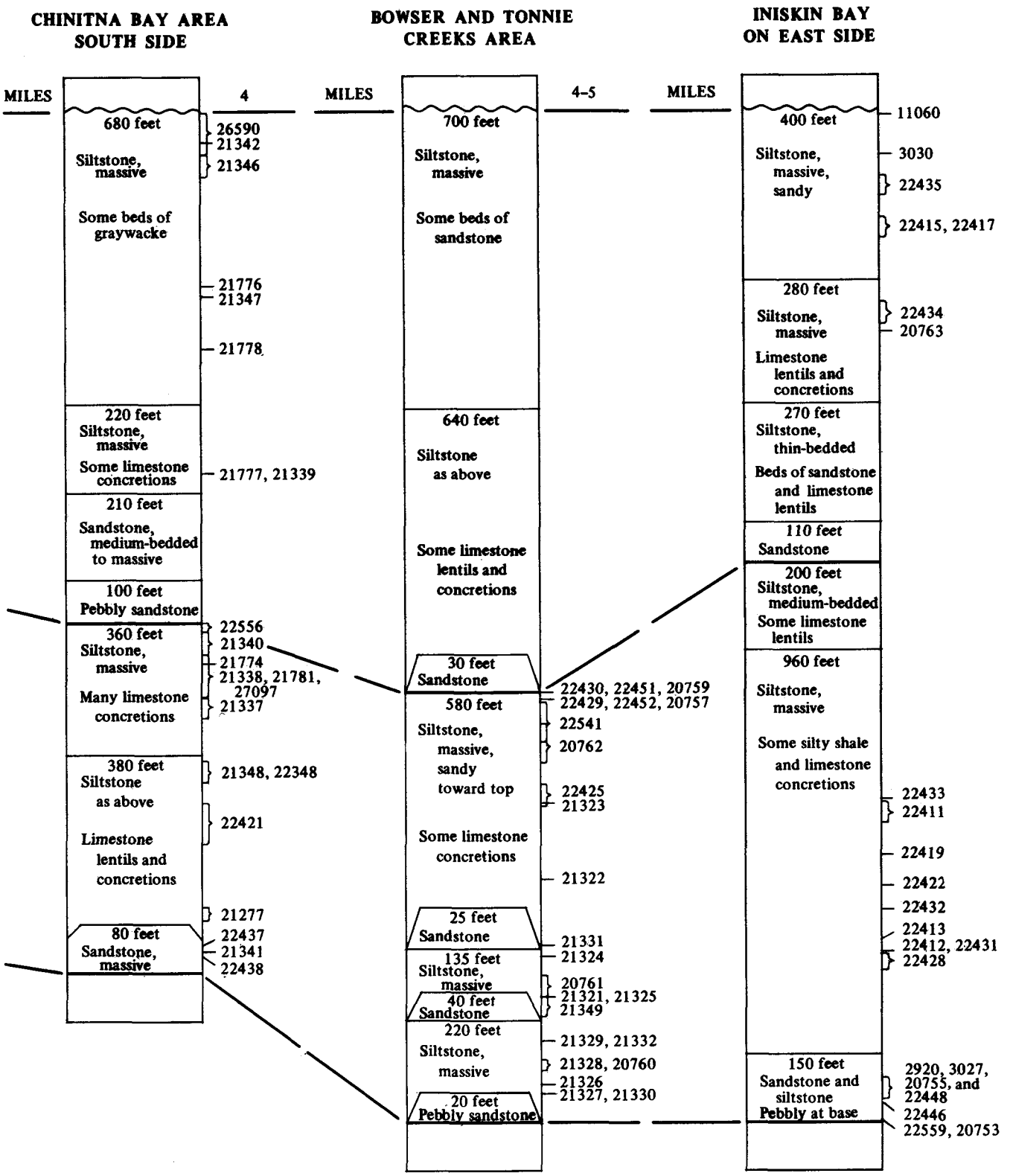


FIGURE 1.—Stratigraphic positions of some ammonite localities in the Chinitna

SOUTH



Formation west of Cook Inlet (data from Detterman and Hartsock, 1966, p. 44–48, pl. 5).

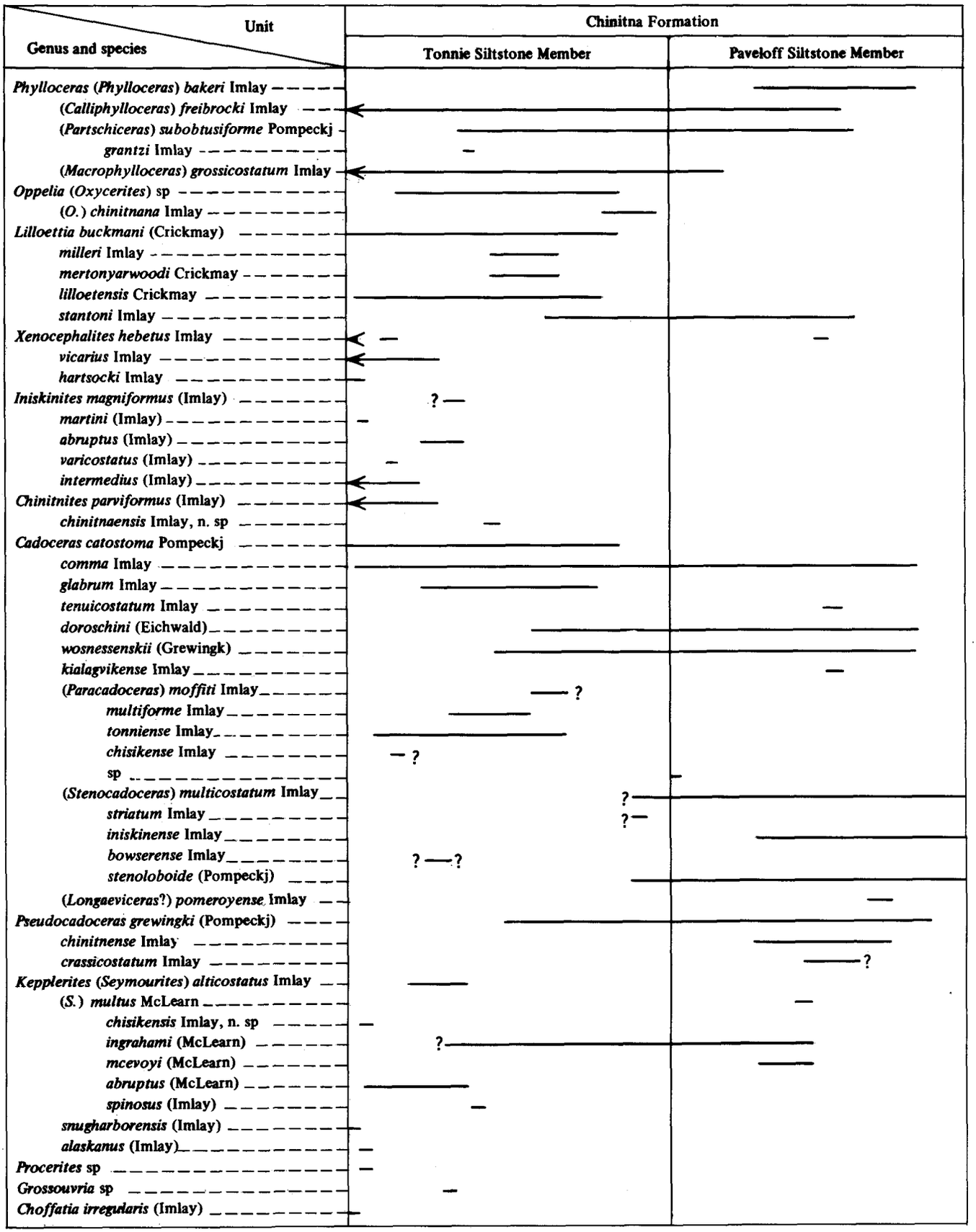


FIGURE 2.—Stratigraphic ranges of ammonites in the Chinitna Formation west of Cook Inlet.

multicostatum Imlay in association with several species of *Pseudocadoceras* and with *Cadoceras tenuicostatum* Imlay. *C.* (*S.*) *stenoloboide* and *C. tenuicostatum* are also recorded from the upper part of the lower member at positions that seem to be lower than the highest occurrences of *Lilloettia*. They have not been found, however, at the same localities as *Lilloettia* or even in the same stratigraphic sequences. The upper member has not furnished ammonites except possibly one occurrence of *Pseudocadoceras grewingki* (Pompeckj) (USGS Mesozoic loc. 10813).

AMMONITE ZONATION

CADOCERAS (*STENOCADOCERAS*) *STENOLOBOIDE* ZONE

This zone is characterized by an abundance of the subgenus *Stenocadoceras* and particularly by the species *Cadoceras* (*Stenocadoceras*) *stenoloboide* Pompeckj and *C.* (*S.*) *multicostatum* Imlay. Most of the associated species of other genera (fig. 2) either range upward from the *C. catostoma* Zone or are represented by so few occurrences that their total ranges are unknown. Some species, however, seem to be restricted to the *C.* (*S.*) *stenoloboide* Zone, including *C.* (*Longaeviceras*?) *pomeroyense* Imlay, *Pseudocadoceras chinitnense* Imlay, and *P. crassicostatum* Imlay. *Stenocadoceras* itself has not been found in association with *C. catostoma* Pompeckj in any collection made since 1921. Older records of such an association at USGS Mesozoic localities 2921, 3028, 3029, and 11052a (Imlay, 1953b, table 6) are questioned because the collection at USGS Mesozoic locality 2921 was made from about 1,200 feet of beds, that at USGS Mesozoic locality 3028 does not now contain any specimen of *Stenocadoceras*, and the collections from USGS Mesozoic localities 3029 and 11052a contain single small immature specimens whose identification with *C. catostoma* Pompeckj (Imlay, 1953b, p. 83) is doubtful.

The characteristic ammonites of the *Cadoceras* (*Stenocadoceras*) *stenoloboide* Zone west of Cook Inlet range through the upper part of the Chinitna Formation (fig. 2), including the upper one-sixth of the Tonnie Siltstone Member. In the Talkeetna Mountains they are represented by only two occurrences (fig. 5), of which at least one is in the upper fifth of the Chinitna Formation (USGS Mesozoic loc. 25308). In the Alaska Peninsula they occur mainly in the middle member of the Shelikof Formation (fig. 6), but the zonal species occurs also in the upper fifth of the lower member, apparently a little higher than *Lilloettia* and *C. catostoma* Pompeckj. This relationship is essentially identical with that in the upper part of the Tonnie Siltstone Member of the Chinitna Formation west of Cook Inlet.

CADOCERAS CATOSTOMA ZONE

This zone is characterized by a fair abundance of *Cadoceras catostoma* Pompeckj and *Lilloettia buckmani* (Crickmay). Associated but less common ammonites include *C. glabrum* Imlay, all species of *C.* (*Paracadoceras*), and all species of *Lilloettia* except *L. stantoni* Imlay. These ammonites range through all or most of the lower five-sixths of the Tonnie Siltstone Member of the Chinitna Formation west of Cook Inlet (fig. 2), apparently range through most of the Chinitna Formation in the Talkeetna Mountains (figs. 4 and 5), and all except *Paracadoceras* occur in the lower member of the Shelikof Formation on the Alaska Peninsula (fig. 6).

INISKINITES INTERMEDIUS SUBZONE

The lower part of the *Cadoceras catostoma* Zone is herein recognized as a subzone characterized by *Iniskinites intermedius* (Imlay). This subzone marks the top of the ranges of *Parareineckeia* and of the new genus *Iniskinites*. It also marks the top of the range of *Xenocephalites*, except for one specimen (USGS Mesozoic loc. 22434) from near the middle of the Paveloff Siltstone Member of the Chinitna Formation. Characteristic species other than those described under *Iniskinites* probably include *Kepplerites* (*Seymourites*) *alticostatus* Imlay, *K.* (*S.*) *chisikensis* Imlay, *K.* (*S.*) *abruptus* (McLearn), *K. snugharborense* (Imlay), *Choffatia irregularis* (Imlay), and *Parareineckeia shelikofana* (Imlay). Most of these species occur in the lower part of the Tonnie Siltstone Member of the Chinitna Formation west of Cook Inlet (fig. 2). Two of the species occur in the lower half of the lower member of the Shelikof Formation on the Alaska Peninsula (fig. 6). *Iniskinites* in the Talkeetna Mountains occurs a little below the middle of the upper member of the Chinitna Formation exposed northwest of Limestone Hills and ranges through the lower member into the basal part of the upper member of the formation exposed between Limestone Hills and Horn Mountains.

AGES AND CORRELATIONS

The only ammonites from the Chinitna and Shelikof Formations that are useful for dating and correlating with faunal sequences in Europe and East Greenland are *Cadoceras*, *C.* (*Paracadoceras*), *C.* (*Stenocadoceras*), *Kepplerites*, and *Pseudocadoceras*. Their ranges in those areas, as shown in figure 7, are based partly on the studies of Callomon (1955,

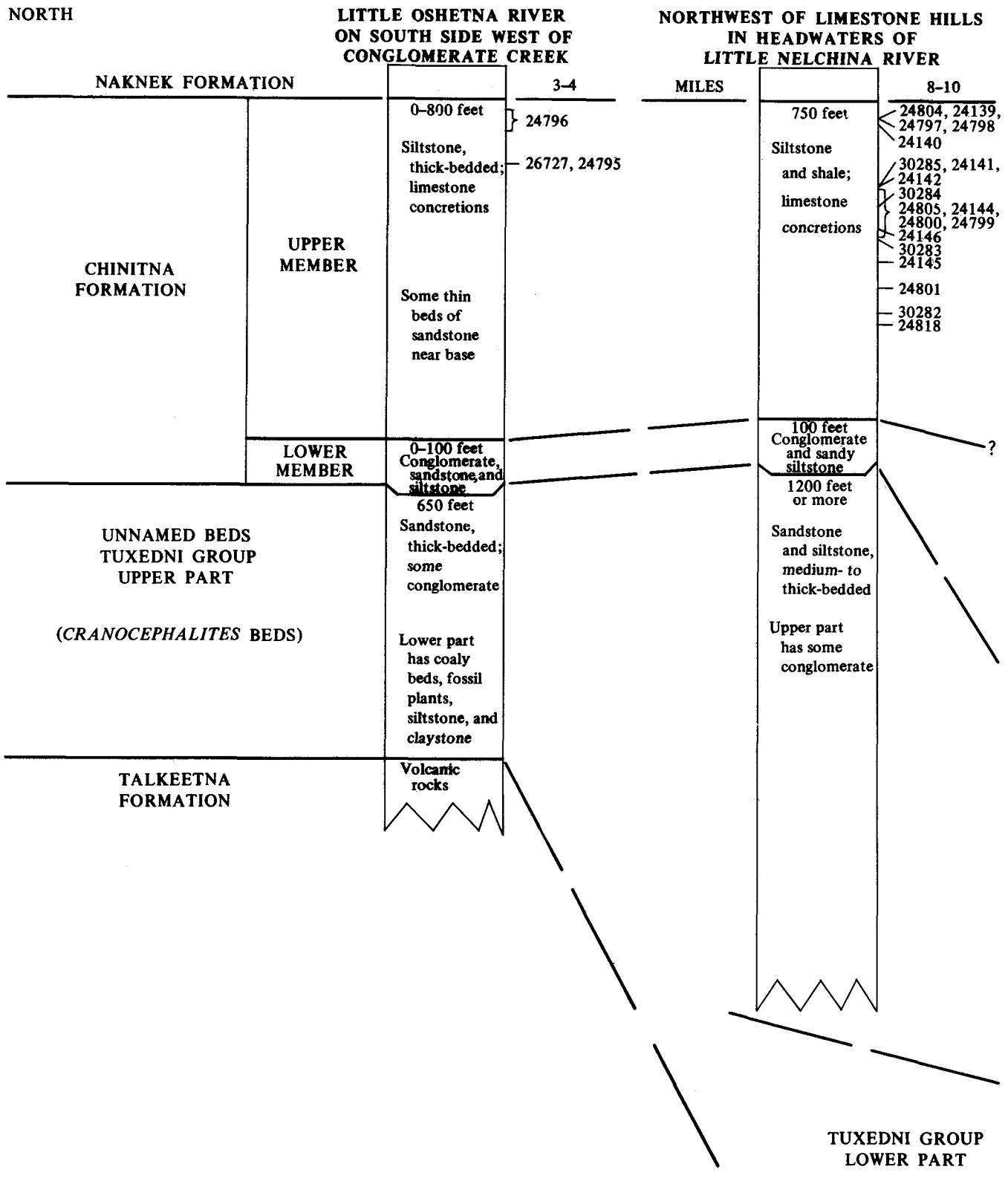
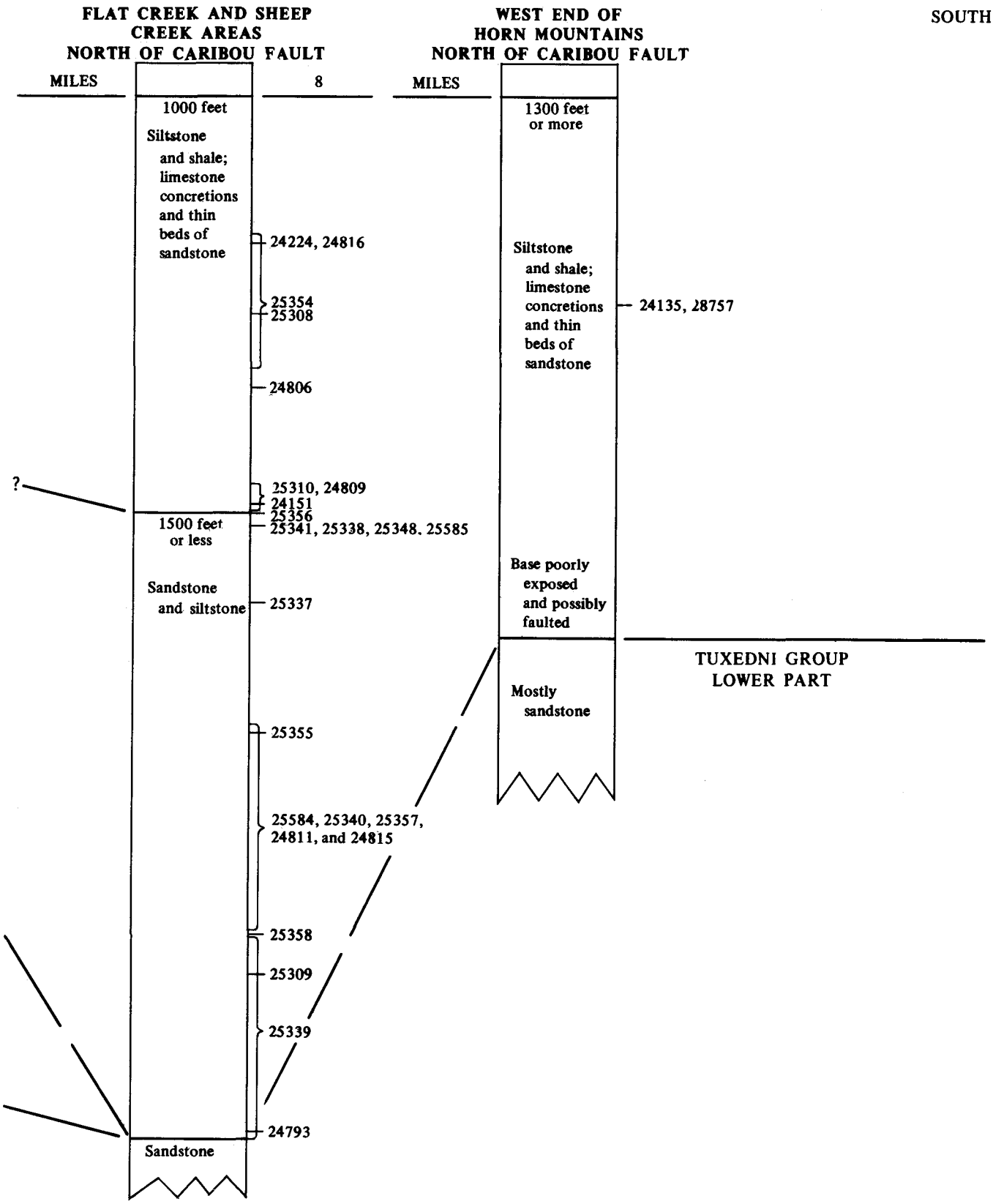


FIGURE 3.—Stratigraphic positions of ammonite localities in the Chinitna Formation of the Nelchina area in the southeastern
many localities are estimations



part of the Talkeetna Mountains. Data furnished by Arthur Grantz (written commun., 1972); stratigraphic positions of because of poor or faulted exposures.

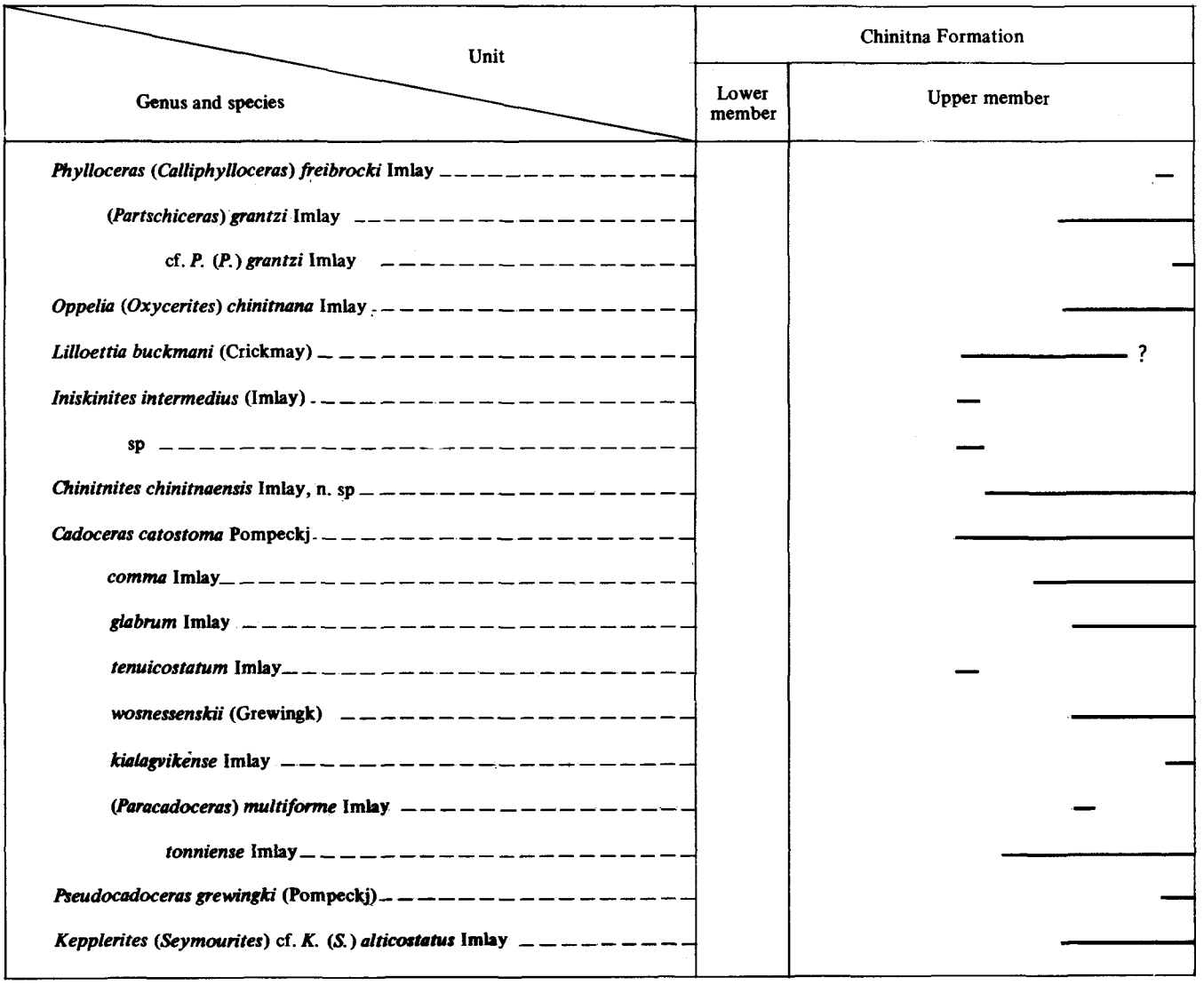


FIGURE 4.—Stratigraphic ranges of ammonites in the Chinitna Formation northwest of Limestone Hills in the Talkeetna Mountains.

p. 255. 1964, p. 274–281). The ranges of the subgenera *Stenocadoceras* and *Paracadoceras* are based, however, on the ranges of species that have been assigned to those subgenera by the writer (Imlay, 1953b, p. 44, 46).

Thus, under *C. (Paracadoceras), C. (P.) elatmae* (Nikitin) (1881b, p. 116, pl. 11, figs. 20, 21, 23) in the U.S.S.R. is associated with *Chamoussetia,* which is characteristic of the lower part of the *calloviense* zone (Sazanov, 1964, p. 797). *C. (P.) breve* Blake (1905–07, p. 48, pl. 5, fig. 1) in England occurs in the *macrocephalus* zone (Callomon, 1964, p. 273; Arkell, 1956, p. 27). *C. (P.) ammon* (Spath) (1932, p. 78, pl. 21, figs. 5a, b) in East Greenland is recorded with other ammonites (Spath, 1932, p. 126) that Callomon (1959, p. 507–511) placed partly in the highest Bathonian and partly in the lowest Callovian.

Callomon's Bathonian assignment of such ammonites as *Cadoceras (P.) variabile* Spath and *C. calyx* Spath is based entirely on their stratigraphic position below beds that he correlated faunally with the basal Callovian of Europe. This assignment seems reasonable but needs to be substantiated by descriptions and illustrations of the Greenland ammonites that represent the basal Callovian.

Under the subgenus *C. (Stenocadoceras), C. (S.) milaschevici* (Nikitin) (1881a, p. 66, pl. 3, fig. 25) in Siberia occurs in beds of middle Callovian Age (Sachs, 1964, p. 770); in the Russian Platform it occurs in beds that are correlated with the *jason* zone (Sazonov, 1964, p. 793); and in western Europe

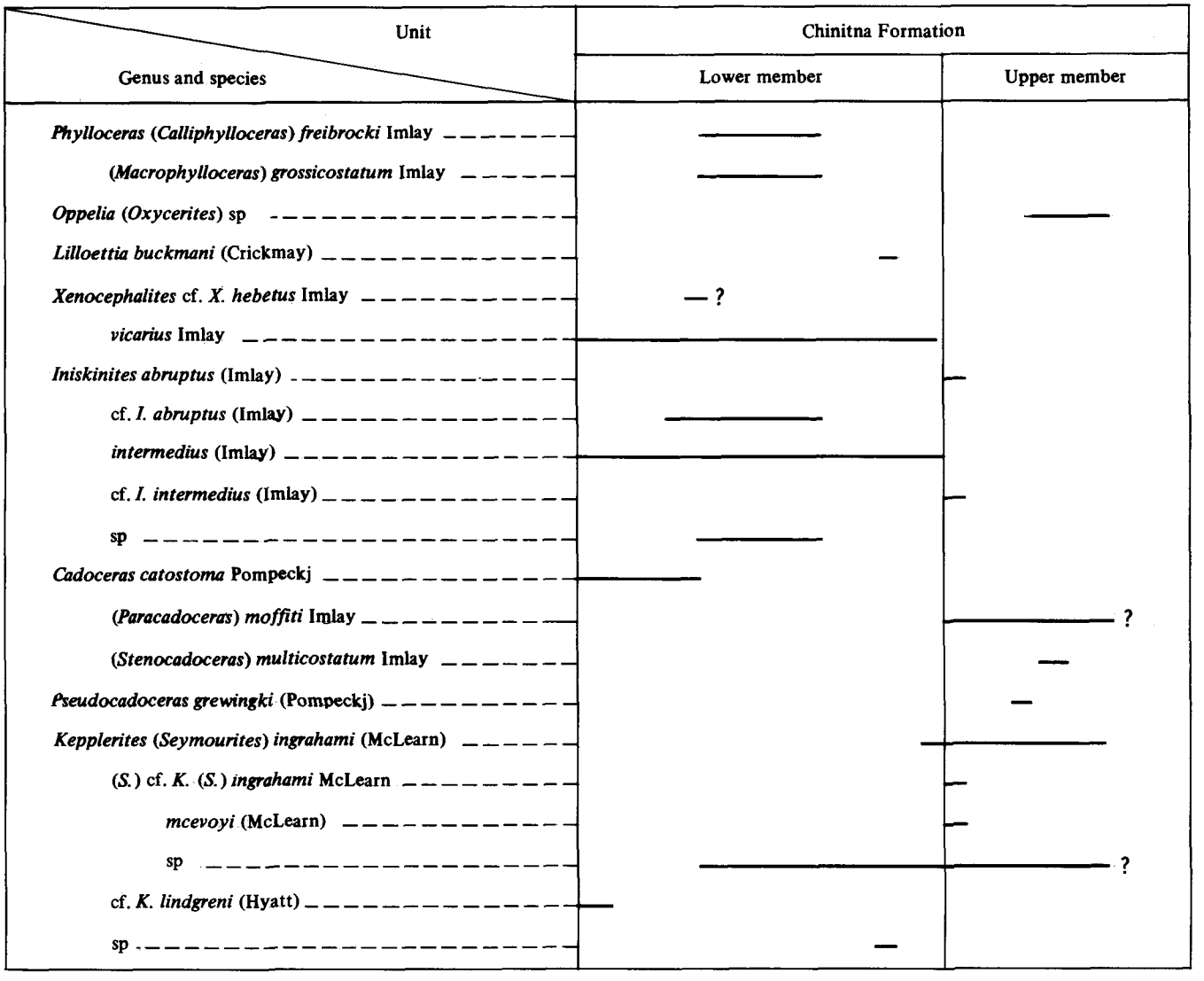


FIGURE 5.—Stratigraphic ranges of ammonites in the Chinitna Formation between Limestone Hills and Horn Mountains in the Talkeetna Mountains.

it occurs in the *coronatum* zone (Callomon, 1964, p. 279). A similar or possibly identical species was reported from the upper part of the *calloviense* zone in Yorkshire (Arkell, 1956, p. 26). In addition, *C.* (*S.*) *stenolobum* (Keyserling) (1846, p. 329, pl. 20, fig. 7, pl. 22, figs. 13, 14) in the Russian Platform occurs in beds that are correlated with the *athleta* zone of western Europe (Sazonov, 1964, p. 793).

Cadoceras (*Cadoceras*) in western Europe ranges from at least the base of the *calloviense* zone through the *jason* zone (Callomon, 1955, p. 255; 1964, p. 273, 275, 278). It is probably represented also in the Russian Platform by *C. tchefkini* (d'Orbigny) (1845, p. 439, pl. 35, figs. 10–15) in association with *Erymnoceras coronatum* and other ammonites of the *coronatum* zone (Sazonov, 1964, p. 797). In Greenland, *C.* (*Cadoceras*) occurs partly in beds that correlate faunally with the basal Callovian of Europe and partly in underlying beds that are tentatively assigned by Callomon (1959, p. 508, 509) to the highest Bathonian on the basis of stratigraphic position.

The genus *Pseudocadoceras* in western Europe is most common in the *calloviense* zone but ranges upward through the remainder of the Callovian (Callomon, 1964, p. 275–281). In the Russian Platform it is reported from beds of early to middle Callovian Age, including the *macrocephalus* zone (Sazanov, 1964, p. 797).

The genus *Kepplerites* in western Europe ranges through the *macrocephalus* and *calloviense* zones (Callomon, 1964, p. 274, 275). In East Greenland

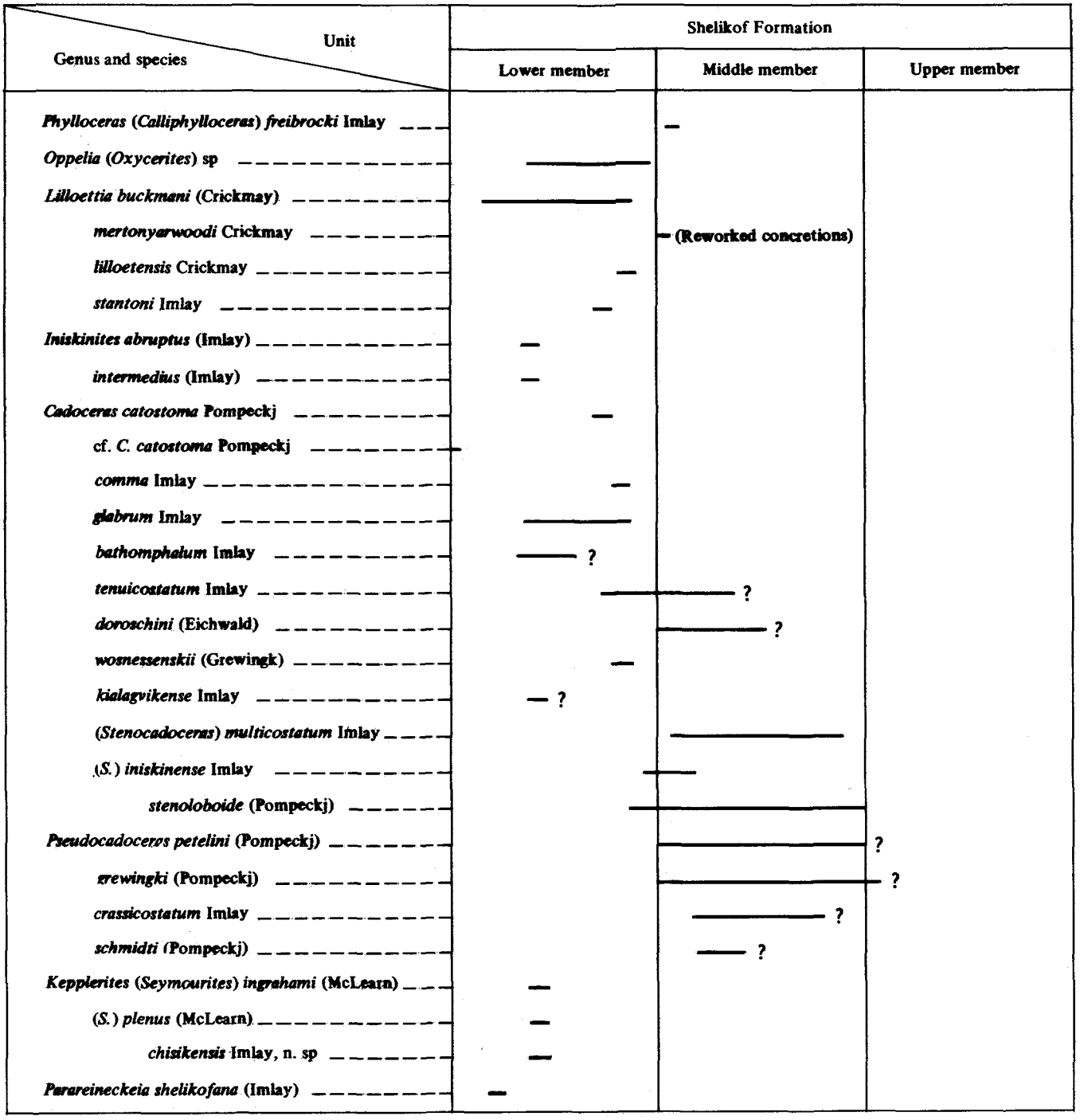


FIGURE 6.—Stratigraphic ranges of ammonites in the Shelikof Formation between Puale Bay and Wide Bay, Alaska Peninsula.

it is recorded from beds that contain ammonites typical of those zones, but it occurs also in underlying beds that are assigned to the upper Bathonian on the basis of stratigraphic position (Callomon, 1959, p. 507–509). The lowest occurrence of *Kepplerites* in East Greenland is in the upper part of the range of *Arcticoceras*, just below the lowest occurrence of *Cadoceras* (J. H. Callomon, oral commun., 1972).

If the ranges of these ammonites in Europe and East Greenland (fig. 7) are approximately the same as in Alaska (figs. 2, 4–6), then the Chinitna and

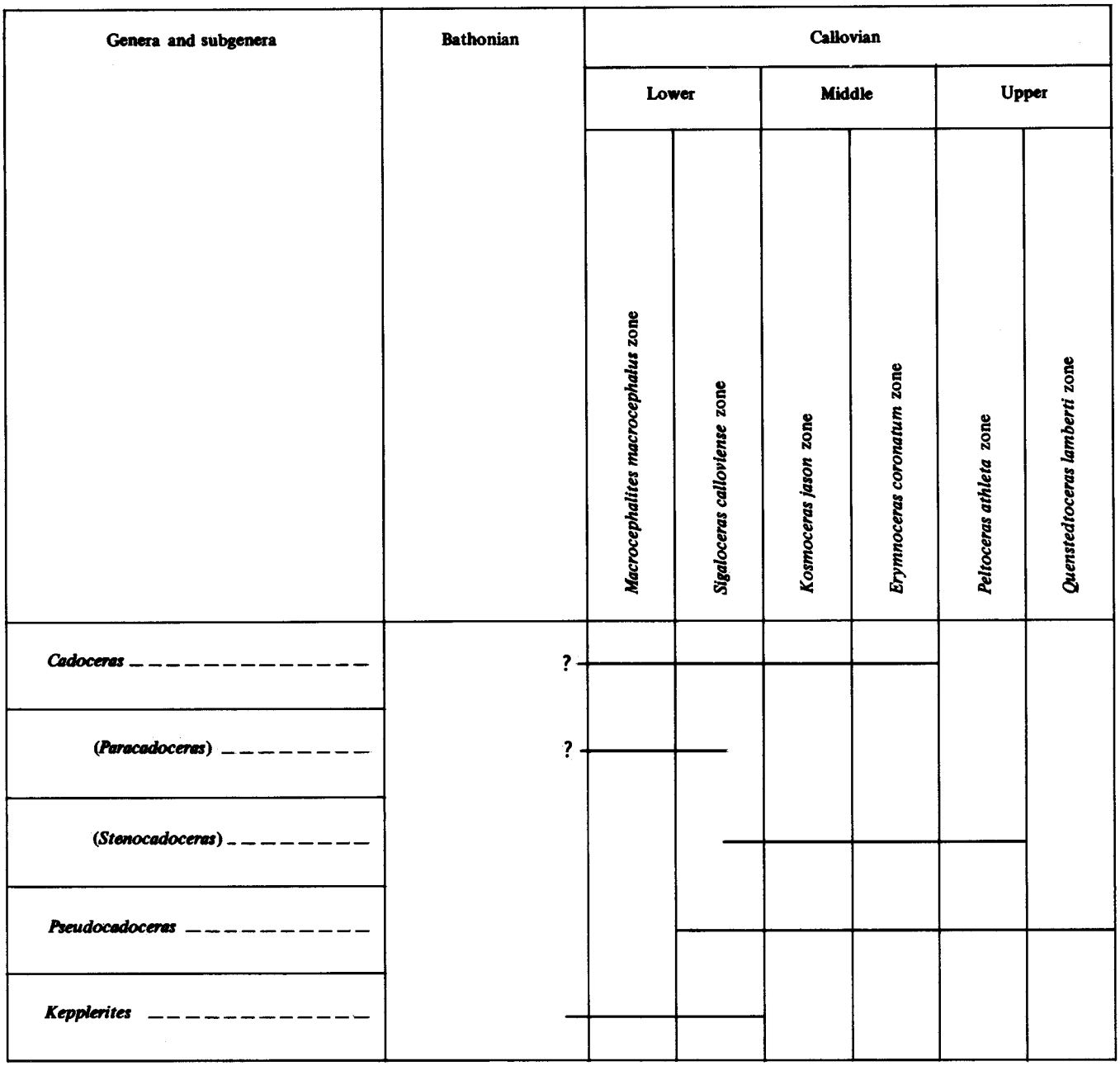


FIGURE 7.—European and East Greenland ranges of certain Jurassic ammonites present, or possibly present, in Alaska.

Shelikof Formations should be equivalent to at least the middle Callovian as well as the upper part of the lower Callovian (fig. 8). The *athleta* zone of the basal upper Callovian might also be represented by the upper 150–200 feet of the Chinitna Formation above the range of *Cadoceras* proper (fig. 2), although positive fossil evidence is lacking. In descending order, the *coronatum* and *jason* zones of the middle Callovian would then be represented by most of the upper half of the Paveloff Siltstone Member of the Chinitna Formation above the range of *Kepplerites* and below the highest occurrence of *Cadoceras*. Likewise, the upper part of the *calloviense* zone would be represented by the lower half of the Paveloff Siltstone Member and by the upper fourth of the Tonnie Siltstone Member above the highest occurrence of *C.* (*Paracadoceras*). Finally, the lower part of the *calloviense* zone would be represented by all or only part of the remainder of the Tonnie Siltstone Member.

Evidently, the exact age of the basal few hundred feet of the Chinitna Formation is not now

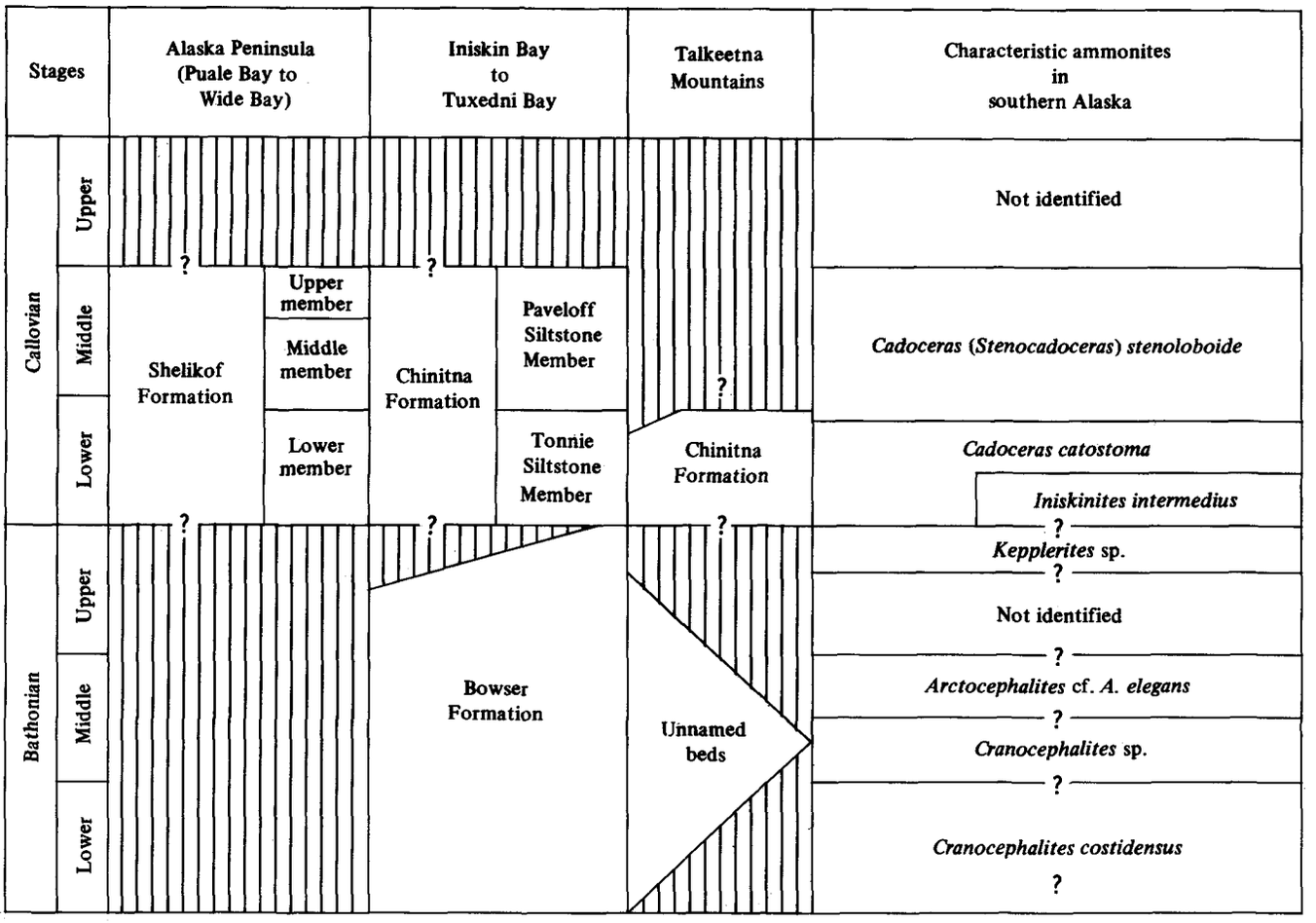


FIGURE 8.—Correlation of Callovian formations and faunas in southern Alaska.

determinable by the fossils found therein. In particular, the specimens formerly assigned to the subgenus *Kepplerites* (*Gowericeras*) by Imlay (1953b, p. 99, 100, pl. 53, figs. 6–11) are of little age significance because they do not show certain features characteristic of that subgenus (Donovan, 1953, p. 132; 1957, p. 135). Nonetheless, the basal beds could be older than the *calloviense* zone and even as old as the latest Bathonian provided that the earliest occurrences of *Cadoceras* and *Paracadoceras* in East Greenland are actually latest Bathonian as proposed by Callomon (1959, p. 507–509).

The basal part of the Chinitna Formation, regardless of its exact age, is probably equivalent to beds in East Greenland that contain the lowest occurrences of *Cadoceras* and *Paracadoceras* because in both areas the underlying beds in the Bowser Formation contain *Kepplerites* without *Cadoceras*. Furthermore, these beds are underlain in turn by *Arctocephalites* and then by *Cranocephalites*. The main difference is the absence to date of any specimens of *Arcticoceras* between *Arctocephalites* and *Cadoceras* in southern Alaska. The *Arcticoceras* beds could, however, be represented in the Red Glacier area west of Cook Inlet by 360–380 feet of beds above an occurrence of *Arctocephalites* (USGS Mesozoic loc. 22699). They could also be represented in part by an erosional unconformity between the Bowser and Chinitna Formations in that area (Detterman and Hartsock, 1966, p. 40, 42, pl. 5).

None of the age assignments made in the preceding discussion is based on the presence of *Cosmoceras*. For example, the specimen formerly described as *C.* (*C.*) cf. *C.* (*C.*) *spinosum* (Sowerby) (Imlay, 1953b, p. 100, pl. 53, figs. 4, 5), obtained as float near the middle of the Paveloff Siltstone Member, probably represents an immature form of *Kepplerites gitinsi* McLearn. Donovan (1957, p. 136) assigned it to *Torricelliceras*, which Callomon (1955, p. 235, 238) considered to be a microconch of *Kep-*

plerites. Similarly, the type specimens of *C. (Gulielmiceras) alaskanum* Imlay (1953b, p. 100, pl. 49, figs. 13–19) are identical in shape and ribbing with the inner whorls of *K. ingrahami* (McLearn), and the holotype is evidently a microconch of that species.

AMMONITE FAUNAL SETTING

The Callovian ammonites of southern Alaska (Imlay, 1953b, p. 54–57; 1965, p. 1031) are dominated by genera characteristic of the Boreal realm, such as *Kepplerites, Cadoceras,* and *Pseudocadoceras,* but include several genera characteristic of the Pacific realm, such as *Xenocephalites, Lilloettia,* and *Parareineckia.* They also include two new genera, *Iniskinites* and *Chinitnites,* which to date are known only from southern Alaska. On the specific level, the Callovian ammonites of southern Alaska have a great deal in common with ammonites of that age in British Columbia (McLearn, 1929, p. 4–12), Oregon (Imlay, 1964, p. D10–D15), and northern California (Imlay, 1961, p. D9–D11, D19–D21), and nothing in common specifically with the western interior of North America (Imlay, 1953a; Frebold, 1957, p. 19, 56–65) and Arctic Canada (Frebold, 1961, p. 17–22, 28–29; 1964, p. 6–18, 22–24). In contrast, some of the Callovian species of *Cadoceras* from Arctic Canada are closely similar to, or possibly identical with species in East Greenland (Frebold, 1964, p. 24). Evidently, southern Alaska during Callovian time was part of a Pacific Coast faunal province, and that province had some marine connections with Canada and northern Alaska through Yukon Territory and British Columbia, as discussed by Imlay and Detterman (1937, p. 18, fig. 5).

GEOGRAPHIC DISTRIBUTION

Nearly all the ammonite localities described or mentioned herein from the Chinitna Formation west of Cook Inlet and from the Shelikof Formation on the Alaska Peninsula have been previously published in three U.S. Geological Survey professional papers (Imlay, 1953b, p. 65–71, figs. 4–9; 1962, p. C3, C16, C17; Detterman and Hartsock, 1966, p. 44–46, pl. 3). The exception is USGS Mesozoic locality 3027, which is at the same spot as USGS Mesozoic localities 2920 and 20755 (Imlay, 1953b, p. 68, fig. 7). The species occurrences from the Chinitna Formation in the Talkeetna Mountains are listed in table 2. The position of the fossil localities are shown in figure 9 and are described in detail in table 3.

SYSTEMATIC DESCRIPTIONS

Family Kosmoceratidae
Genus KEPPLERITES Neumayr and Uhlig, 1892
Subgenus SEYMOURITES Kilian and Reboul, 1909

Kepplerites (Seymourites) chisikensis Imlay, n. sp.

Plate 1, figures 1–5

Kepplerites (Seymourites) tychonis (Ravn.) Imlay, 1953b, U.S. Geol. Survey Prof. Paper 249–B, p. 96, pl. 48, figs. 14, 17.

This species is represented in available collections by two specimens which show the body whorl and parts of the outer two septate whorls. The largest specimen has been crushed laterally on its right side.

Shell moderately compressed. Whorls subquadrate, higher than wide, widest at about one-third of height. Flanks flattened below, converging gently above to a moderately rounded venter, rounding rather abruptly into umbilicus on septate whorls. Umbilicus very small on septate whorls, but enlarging markedly on body chamber. Umbilical wall vertical on septate whorls, becoming gently inclined adorally on adult whorl. Body chamber occupies slightly more than half a whorl and becomes contracted adorally. Aperture marked on internal mold by a forwardly inclined constriction that is followed by a low swelling.

The ribs on the next-to-the-largest septate whorl, partially exposed on the broken right-hand side of the holotype (pl. 1, fig. 1), are fine, closely spaced, and incline gently forward on the flanks. Secondary ribs outnumber primary ribs about three to one and arise mostly from the swollen to weakly tuberculate ventral ends of the primary ribs.

The ribs on the outermost septate whorl remain fine and closely spaced but become higher and sharper adorally. They incline forward rather strongly on the flanks and cross the venter transversely. Primary ribs are slightly swollen ventrally but do not bear tubercles. On the outermost septate whorl, secondary ribs outnumber the primary ribs nearly four to one.

Similar ribbing persists adorally on the body chamber except near the aperture, where secondary ribs outnumber primary ribs only about three to one. On the holotype, the ribbing does not appear to be so sharp on the body chamber as on the septate whorls owing to corrosion of shell material. On the paratype, by contrast, the few fragments of body whorl that are preserved bear sharp primary ribs.

The suture line is not well preserved.

The paratype near the adoral end of its outer

TABLE 2.—*Geographic distribution of ammonites in the*

[Numbers 1–40 are keyed to locality numbers in figure 9.

Species	1	2		3						4	5	6	7	8		9			10			11		12	13	
	24796	24795	26727	24804	24805	30282	30283	30284	30285	24144	24139	24143	24818	3700	24800	24145	24146	24801	24140	24141	24142	24802	24803	24799	24797	24798
Phylloceras (Calliphylloceras) freibrocki Imlay.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	×	--	--	--	--	--	--	--
(Partschiceras) grantzi Imlay	--	--	--	--	×	--	--	--	--	--	--	--	--	--	--	--	--	--	×	--	--	--	--	--	--	--
cf. *P. (P.) grantzi* Imlay	--	--	--	×	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
(Macrophylloceras) grossicostatum Imlay.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Oppelia (Oxycerites) chinitnana Imlay	--	--	--	--	×	--	×	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
(Oxycerites) sp	--	--	--	--	--	--	--	×	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lilloettia buckmani (Crickmay)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	×	--	--	--	--
Xenocephalites cf. *X. hebetus* Imlay	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
vicarius Imlay	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
X? sp	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iniskinites magniformus (Imlay)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
abruptus (Imlay)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cf. *I. abruptus* (Imlay)	--	--	--	--	--	×	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
intermedius (Imlay)	--	--	--	--	--	×	--	--	--	--	--	--	×	--	--	--	--	--	--	--	--	--	--	--	--	--
cf. *I. intermedius* (Imlay)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
sp	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	×	--	--	--	--	--	--	--	--
Chinitnites chinitanensis Imlay, n. sp	--	--	--	--	×	--	×	×	×	--	×	×	--	--	--	--	--	--	--	--	--	--	×	--	--	--
Cadoceras catostoma Pompeckj	--	--	--	--	--	×	--	--	--	--	--	--	×	--	--	--	--	--	--	--	--	--	--	×	--	--
comma Imlay	--	--	--	--	--	--	--	--	--	×	×	--	--	--	--	--	×	--	--	--	--	--	--	--	--	--
glabrum Imlay	--	--	--	--	--	--	--	--	--	×	×	--	--	--	--	--	--	--	×	--	--	--	--	--	--	--
cf. *C. glabrum* Imlay	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	×
tenuicostatum Imlay	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	×	--	--	--	--	--	--	--
doroschini (Eichwald)	--	--	--	--	--	--	--	--	--	--	--	--	--	×	--	--	--	--	--	--	--	--	--	--	--	--
wosnessenskii (Grewingk)	--	--	--	--	--	--	--	--	--	×	--	--	--	--	×	--	--	--	×	--	--	--	--	--	--	--
kialagvikense Imlay	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	×	--	--	--	--	--	--	--
(Paracadoceras) moffiti Imlay	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
multiforme Imlay	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	×	×	--	--	--	--	--
tonniense Imlay	×	×	×	--	--	--	--	--	--	--	--	--	--	--	--	×	--	--	--	×	--	--	--	--	--	--
(Stenocadoceras) multicostatum Imlay	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pseudocadoceras grewingki (Pompeckj)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	×	--	--	--	--	--	×	--
Kepplerites (Seymourites) cf. *K. (S.) alticostatus* Imlay.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	×	--	--
(S.) ingrahami (McLearn)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cf. *K. (S.) ingrahami* (McLearn)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
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spinosus (Imlay)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
snugharborensis (Imlay)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cf. *K. lindgreni* (Hyatt)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
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Parareineckeia shelikofana (Imlay)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

septate whorl has a diameter of 96 mm (millimeters), a whorl height of 51 mm, a whorl thickness of 43 mm, and an umbilical width of 12 mm. Adorally, the umbilicus widens rapidly and is 14 mm in width at a diameter of only 100 mm.

This species is characterized by a moderately compressed shell, by an umbilicus that is small on the septate whorls but enlarges markedly on the body chamber, by fine dense ribbing, and by the ventral ends of its primary ribs being swollen to weakly tuberculate on its inner whorls and only swollen on its outer whorls.

Kepplerites chisikensis Imlay, n. sp., was previously identified (Imlay, 1953b, p. 96) with *K. tychonis Ravn* (1911, p. 490, pl. 37, figs. 1a, b) from East Greenland because of resemblances in form, coiling, and ribbing. The holotype of *K. tychonis* Ravn (see pl. 5, fig. 4 and pl. 6, fig. 6, of this report) differs, however, by having a wider umbilicus on its septate whorls, a less eccentric body chamber, a stouter whorl section, and shorter primary ribs that become weaker instead of stronger on the adult body chamber. Another specimen from Greenland, described as *K. tychonis* Ravn var. *fasciculata* Spath (1932, p. 86, pl. 26, fig. 6), resembles the Alaskan species more closely in coiling and whorl shape but differs by having shorter and weaker primary ribs that bear weak but distinct tubercles on the body chamber.

The Alaskan species does not include a small specimen from USGS Mesozoic loc. 20755, as previously suggested (Imlay, 1953b, p. 96). That specimen has sparser primary ribs that terminate in weak tubercles and shows considerable resemblance to the inner whorls of *K. ingrahami* (McLearn). It also resembles *Cosmoceras (Gulielmiceras) alaskanum* Imlay (1953b, p. 100, pl. 49, figs. 13–16), which is probably the microconch of *K. ingrahami (McLearn)*.

Types.—Holotype, USNM 180717; paratype, USNM 108125.

Occurrences.—Shelikof Formation at USGS Mesozoic loc. 19793 northwest of Wide Bay on the Alaska

Chinitna Formation of the Talkeetna Mountains, Alaska

Higher numbers are USGS Mesozoic locality numbers]

14	15	16			17	18	19			20	21	22	23	24	25	26	27	28	29	30	31		32		33		34	35	36		37	38	39	40
24184	24151	25337	25354	25355	25341	25310	24806	24809	25308	25309	25338	25356	25584	25340	25348	25357	25358	25585	25339	24811	24793	24815	8584	24147	24224	24816	24119	24789	24135	28757	26951	8576	8571	26950
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Peninsula; Chinitna Formation at USGS Mesozoic loc. 21287 on Chisik Island in Cook Inlet region.

The holotype from the Wide Bay area was collected 500 feet above the base and 2,400 feet below the top of the Shelikof Formation in association with *K. ingrahami* (McLearn), *K. plenus* (McLearn), *Iniskinites abruptus* (Imlay), *I. intermedius* (Imlay), and *Cadoceras glabrum* Imlay.

The paratype from Chisik Island was collected about 80 feet above the base and 850 feet below the top of the Tonnie Siltstone Member of the Chinitna Formation. This occurrence is a little above the middle of the range of *Iniskinites intermedius* (Imlay) and 100 feet or less, stratigraphically, above *K. snugharborensis* (Imlay), *Xenocephalites hebetus* Imlay, and *Choffatia irregularis* (Imlay) at USGS Mesozoic loc. 3015. Its occurrence in or near the lower part of the range of *K. ingrahami* (McLearn) is shown by the presence of that species (USGS Mesozoic loc. 12074) in the lower third of the Chinitna Formation on Chisik Island. It is shown, also, by some small ammonites (USGS Mesozoic locs. 2920 and 20755), probably representing the inner whorls of *K. ingrahami* (McLearn), which were obtained 50 to 100 feet above the base of the formation on the east shore of Iniskin Bay.

Family CARDIOCERATIDAE Siemiradzki, 1891
Subfamily CADOCERATINAE Hyatt, 1900

Genus CHINITNITES Imlay, n. gen.

Chinitnites is characterized by small compressed to stout shells; a very small umbilicus on septate whorls; a contracted adult body chamber that occupies about half a whorl; an apertural constriction that is conspicuous only low on the flanks; and sharp flexous ribs that arch gently forward on the venter. Some ribs fork fairly low on the flanks, and others remain simple or alternate with short ribs. All ribs become stronger and more widely spaced ventrally and adorally except for one or two ribs next to the adult aperture. The suture line bears lobes and saddles of nearly equal width and a fairly long first

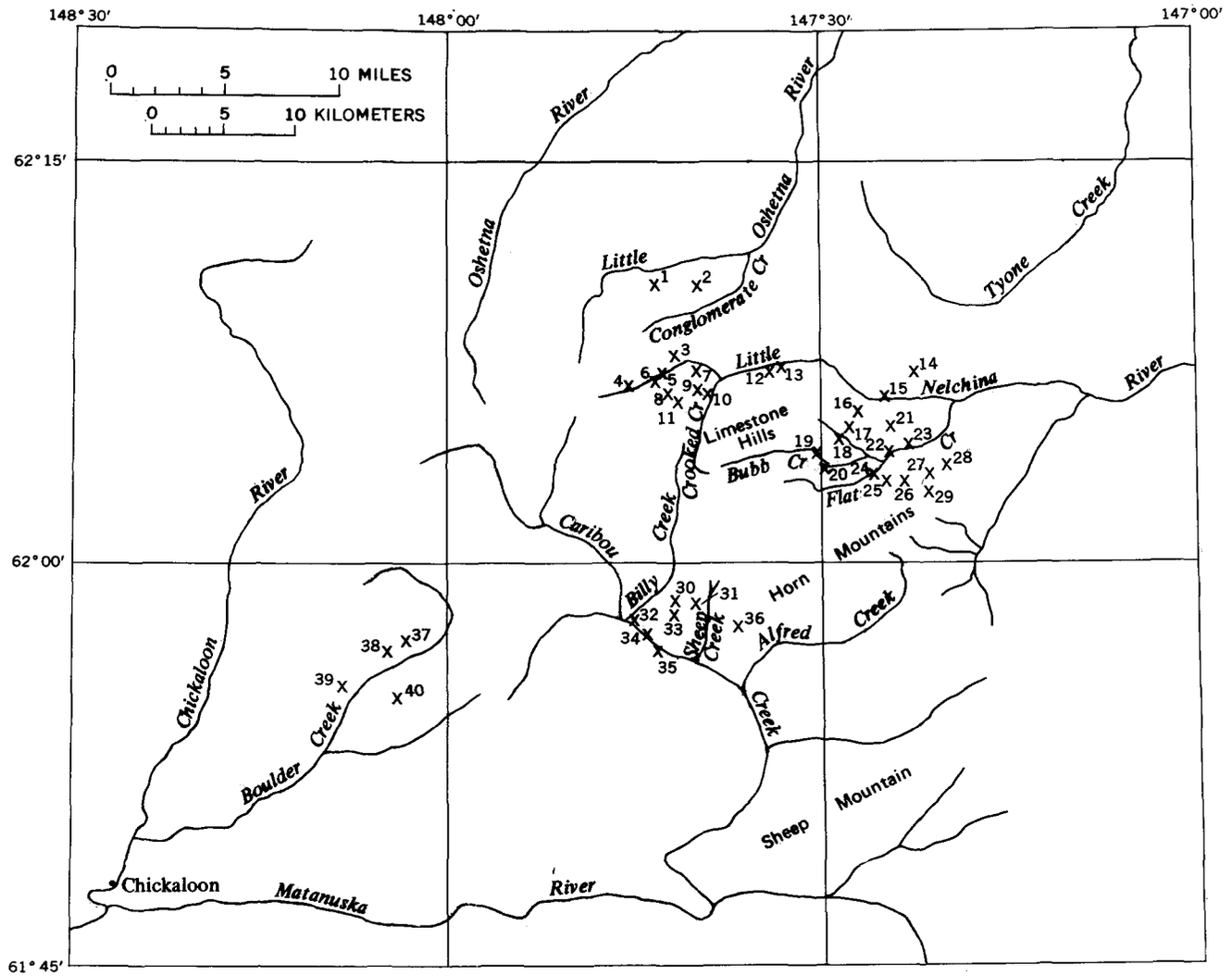

FIGURE 9.—Index map of listed fossil localities in the Chinitna Formation in the Talkeetna Mountains. Detailed descriptions of localities are given in table 3.

lateral lobe that is nearly as long as the ventral lobe. Its overall plan is similar to that on some specimens of *Cranocephalites* (Spath, 1932, pl. 3, fig. 5, pl. 5, fig. 8) but shows no simplification such as occurs in adults of that genus (Spath, 1932, pl. 1, fig. 6, pl. 4, fig. 8). The suture line is likewise similar to but less complicated that that of *Arctocephalites* (Spath, 1932, pl. 11, fig. 7b). *Chinitnites chinitnaensis* (Imlay), described herein, is designated as the type species.

Chinitnites differs from *Xenocephalites* by having a wider umbilicus on its septate whorls, an apertural constriction, lower and less widely spaced ribs on its body chamber, and a smaller adult size. It shows much more resemblance to *Cranocephalites* (Spath, 1932, p. 14–16; Donovan, 1953, p. 78, 130, 133) but differs by being much smaller, by its apertural constriction being more conspicuous low on the flanks, and by its ribs on the venter of the adult body whorl becoming high and sharp instead of low or slightly reduced in strength along the midline of the venter. *Arctocephalites? alticostatus* Imlay (1962, p. C22, pl. 2, figs. 1–8) is not assigned to *Chinitnites* because the ribs on its inner septate whorls are higher and sharper, and its adult body chamber does not contract from the inner whorls.

Chinitnites occurs north of Cook Inlet in the upper part of the Bowser Formation and in the lower part of the Chinitna Formation. Its highest occurrences are of early Callovian Age. Its lowest occurrences could be of late Bathonian Age.

TABLE 3.—*Descriptions of Jurassic ammonite localities in the Chinitna Formation in the Talkeetna Mountains, Alaska*

Loc. No. (fig. 9)	USGS Mesozoic loc. No.	Collector's field No.	Collector, year of collection, description of locality, and stratigraphic assignment (VABM indicates vertical angle elevation bench mark)
1	24796	53AGz217	Arthur Grantz and L. F. Fay, 1953. Talkeetna Mountains (A–2) quad. Lat 62°10′23″ N., long 147°43′15″ W. Chinitna Formation, in siltstone near top of upper member.
2	24795	53AGz209	Arthur Grantz and L. F. Fay, 1953. Talkeetna Mountains (A–2) quad. Lat 62°10′00″ N., long 147°40′ W. Chinitina Formation, float from near top of upper member which is about 800 ft thick.
2	26727	57AGz11W	Arthur Grantz, 1957. Talkeetna Mountains (A–2) quad. Bedrock at same place as USGS Mesozoic loc. 24795. Chinitna Formation, in siltstone 650 ft above base of upper member which is about 800 ft thick.
3	24804	53AGz262	Arthur Grantz and L. F. Fay, 1953. Talkeetna Mountains (A–2) quad. Lat 62°07′43″ N., long 147°41′56″ W. Chinitna Formation, near top of upper member.
3	24805	53AGz263	Arthur Grantz and L. F. Fay, 1953. Talkeetna Mountains (A–2) quad. From lat 62°07′33″ N., long 147°42′03″ W. to a point 550 ft upstream. Probably equivalent to USGS Mesozoic locs. 30283–30285. Chinitna Formation, upper third of upper member.
3	30282	72ADt14#1	R. W. Imlay and R. L. Detterman, 1972. Talkeetna Mountains (A–2) quad. In same gulch as USGS Mesozoic loc. 24805, but probably lower; 2.3 miles N. 47° W. of junction of Cadoceras Creek and Little Nelchina River. Lat 62°07′45″ N., long 147°42′ W. SW¼ sec. 31, T. 24 N., R. 10 E. Chinitna Formation, upper member, about 500 ft stratigraphically below faulted top in interbedded sandstone and siltstone.
3	30283	72ADt14#2	R. W. Imlay and R. L. Detterman, 1972. Talkeetna Mountains (A–2) quad. In same gulch as USGS Mesozoic loc. 30282. Chinitna Formation, upper member about 325 ft stratigraphically below top.
3	30284	72ADt14#3	R. W. Imlay and R. L. Detterman, 1972. Talkeetna Mountains (A–2) quad. In same gulch as USGS Mesozoic loc. 30282. Chinitna Formation, upper member, about 250 ft stratigraphically below top.
3	30285	72ADt14#4	R. W. Imlay and R. L. Detterman, 1972. Talkeetna Mountains (A–2) quad. In same gulch as USGS Mesozoic loc. 30282. Chinitna Formation, upper member about 200 ft below top.
4	24144	52AGz164	Arthur Grantz, R. D. Hoare, and R. W. Imlay, 1952. Talkeetna Mountains (A–2) quad. North Branch of Little Nelchina River, 3.96 miles west of main headwater fork. Chinitna Formation, upper third of upper member.
5	24139	52AGz157	Arthur Grantz, R. D. Hoare, and R. W. Imlay, 1952. Talkeetna Mountains (A–2) quad. North branch Little Nelchina River, 2.53 miles west of main headwater fork. Chinitna Formation, near top of upper member.
6	24143	52AGz161	Arthur Grantz, R. D. Hoare, and R. W. Imlay, 1952. Talkeetna Mountains (A–2) quad. North branch of Little Nelchina River, 2.74 miles west of main headwater fork. Chinitna Formation, upper half or perhaps middle third of upper member.
7	24818	53AGz260A	Arthur Grantz and L. F. Fay, 1953. Talkeetna Mountains (A–2) quad. Lat 62°07′15″ N., long 147°40′00″ W. Chinitna Formation, 325 ft above base of upper member which is here about 750 ft thick.
8	3700	6AK156	Adolf Knopf, 1906. Talkeetna Mountains (A–2) quad. Near headwaters of Little Nelchina River, about 10 miles N. 10° E. of mouth of Billy Creek at altitude of 5,000 ft. Float from Chinitna Formation.
8	24800	53AGz255	Arthur Grantz, 1953. Talkeetna Mountains (A–2). quad. Lat 62°06′32″ N., long 147°40′01″ W. Chinitna Formation, upper third of upper member.
9	24145	52AGz166	Arthur Grantz, R. D. Hoare, and R. W. Imlay, 1952. Talkeetna Mountains (A–2) quad. On small tributary of Little Nelchina River, 0.99 mile S. 65½° W. of main headwater fork. Chinitna Formation, 380 ft above base of upper member which is about 750 ft thick.
9	24146	52AGz167	Arthur Grantz, R. D. Hoare, and R. W. Imlay, 1952. Talkeetna Mountains (A–2) quad. On small tributary of Little Nelchina River, 0.93 mile S. 62½° W. of main headwater fork. Chinitna Formation, 450 ft above base of upper member which is about 750 ft thick.

TABLE 3.—*Description of Jurassic ammonite localities in the Chinitna Formation in the Talkeetna Mountains, Alaska*—Continued

Loc. No. (fig. 9)	USGS Mesozoic loc. No.	Collector's field No.	Collector, year of collection, description of locality, and stratigraphic assignment
9	24801	53AGz256	Arthur Grantz and L. F. Fay, 1953. Talkeetna Mountains (A–2) quad. Lat 62°06′32″ N., long 147°40′01″ W. Chinitna Formation, 325 ft above base of upper member which is about 750 ft thick.
10	24140	52AGz158	Arthur Grantz, R. D. Hoare, and R. W. Imlay, 1952. Talkeetna Mountains (A–2) quad. On small tributary of Little Nelchina River, 0.74 mile S. 53° W. of main headwater fork. Chinitna Formation, 700 ft above base of upper member which is about 750 ft thick.
10	24141	52AGz159	Arthur Grantz, R. D. Hoare, and R. W. Imlay, 1952. Talkeetna Mountains (A–2) quad. On small tributary of Little Nelchina River, 0.83 mile S. 58½° W. of main headwater fork. Chinitna Formation, 550 ft above base of upper member which is about 750 ft thick.
10	24142	52AGz160	Arthur Grantz, R. D. Hoare, and R. W. Imlay, 1952. Talkeetna Mountains (A–2) quad. On small tributary of Little Nelchina River, 0.81 mile S. 56° W. of main headwater fork. Chinitna Formation, 550 ft above base of upper member which is about 750 ft thick.
11	24802	53AGz257	Arthur Grantz and L. F. Fay, 1953. Talkeetna Mountains (A–2) quad. On small tributary of Little Nelchina River. Lat 62°06′13″ N., long 147°41′39½″ W. Chinitna Formation, middle or upper third of upper member.
11	24803	53AGz258	Arthur Grantz and L. F. Fay, 1953. Talkeetna Mountains (A–2) quad. On small tributary of Little Nelchina River. Lat 62°06′15″ N., long 147°42′10″ W. Chinitna Formation, upper half of upper member.
12	24799	53AGz251	Arthur Grantz and L. F. Fay, 1953. Talkeetna Mountains (A–2). About ⅛ mile south of Little Nelchina River and 2 miles east of main headwater fork. Lat 62°07′23½″ N., long 147°34′24″ W. Chinitna Formation, upper member.
13	24797	53AGz248	Arthur Grantz and L. F. Fay, 1953. Talkeetna Mountains (A–2) quad. On south side of Little Nelchina River. Lat 62°07′24½″ N., long 147°33′22″½ W. Chinitna Formation, near top of upper member.
13	24798	53AGz249	Arthur Grantz and L. F. Fay, 1952. Talkeetna Mountains (A–2) quad. On south side of Little Nelchina River. Lat 62°07′26½″ N., long 147°33′16″ W. Chinitna Formation, near top of upper member.
14	24184	52AGz105	Arthur Grantz, R. D. Hoare, and R. W. Imlay, 1952. Talkeetna Mountains (A–1) quad. On north tributary that enters Little Nelchina River 1 mile west of mouth of Flat Creek, 1.08 miles S. 10° E. of VABM[1] Wal (4,610 ft). From reworked concretions in basal part of Cretaceous shales overlying the Nelchina Limestone. Concretions derived partly from the Chinitna Formation and partly from the Naknek Formation.
15	24151	52AHr22	R. D. Hoare, 1952. Talkeetna Mountains (A–1) quad. North bank of Little Nelchina River, 2.47 miles S. 27° W. of VABM Wal (4,610 ft). Chinitna Formation, near base of upper member.
16	25337	54AGz156	Arthur Grantz,, 1954, Talkeetna Mountains (A–1) quad. On small tributary about 0.75 mile south of Little Nelchina River. Lat 62°05′37″ N., long 147°26′57½″ W. Chinitna Formation, 1,300 ft above base of lower member which is here about 1,500 ft thick.
16	25354	54AFy87	L. F. Fay, 1954. Talkeetna Mountains (A–1) quad. About 1/5 mile southwest of USGS Mesozoic loc. 25337. Lat 62°05′35″ N., long 147°27′20½″ W. Chinitna Formation, middle third of upper member.
16	25355	54AFy88	L. F. Fay, 1954. Talkeetna Mountains (A–1) quad. Near USGS Mesozoic loc. 25337. Lat 62°05′35″ N., long 147°27′03½″ W. Chinitna Formation, top of middle third of lower member.
17	25341	54Fy22	L. F. Fay, 1954. Talkeetna Mountains (A–1) quad. Lat 62°05′04″ N., long 147°27′41″ W. Chinitna Formation, near top of lower member.
18	25310	54AGz34	Arthur Grantz, 1954. Talkeetna Mountains (A–1) quad. About 2¼ miles west of Flat Creek on southeast-flowing tributary. Lat 62°04′39″ N., long 147°28′42″ W. Chinitna Formation, in lower 70 ft of upper member, which is here about 1,000 ft thick.
19	24806	53AGz275	Arthur Grantz and L. F. Fay, 1953. Talkeetna Mountains (A–2) quad. On Bubb Creek about 3.25 miles west of junction with Flat Creek. Lat 62°03′59″ N., long 147°30′24″ W. Chinitna Formation, 300 ft above base of upper member, which is here about 1,000 ft thick.

TABLE 3.—*Description of Jurassic ammonite localities in the Chinitna Formation in the Talkeetna Mountains, Alaska*—Continued

Loc. No. (fig. 9)	USGS Mesozoic loc. No.	Collector's field No.	Collector, year of collection, description of locality, and stratigraphic assignment
19	24809	53AGz283	Arthur Grantz and L. F. Fay, 1953. Talkeetna Mountains (A–2) quad. About 900 ft southwest of USGS Mesozoic loc. 24806. Lat 62°03′54½″ N., long 147°30′12″ W. Chinitna Formation, 0 to 70 ft above base of upper member, which is here about 1,000 ft thick.
19	25308	54AGz25	Arthur Grantz, 1954. Talkeetna Mountains (A–2) quad. About 700 ft northwest of USGS Mesozoic loc. 24806. Lat 62°04′02″ N., long 147°30′37″ W. Chinitna Formation, 450 to 500 ft above base of upper member, which is here about 1,000 ft thick.
20	25309	54AGz31	Arthur Grantz, 1954. Talkeetna Mountains (A–1) quad. Lat 62°03′31½″ N., long 147°29′54″ W. Chinitna Formation, 400 ft above base of lower member, which is here about 1,500 ft thick.
21	25338	54AGz157	Arthur Grantz, 1954. Talkeetna Mountains (A–1) quad. About 2 miles west of Flat Creek near head of southeast-flowing tributary. Lat 62°05′08″ N., long 147°24′29½″ W. Chinitna Formation, near top of lower member.
22	25356	54AFy122	L. F. Fay, 1954. Talkeetna Mountains (A–1) quad. On west side of Flat Creek. Lat 62°04′04″ N., long 147°24′49″ W. Chinitna Formation, from top of lower member.
23	25584	54AFy89A	L. F. Fay, 1954. Talkeetna Mountains (A–1) quad. On west side of Flat Creek about 2.75 miles above junction with Little Nelchina River. Lat 62°04′22½″ N., long 147°23′06″ W. Chinitna Formation, middle third of lower member.
24	25340	54AFy21	L. F. Fay, 1954. Talkeetna Mountains (A–1) quad. On Flat Creek about 4.5 miles above its mouth. Lat 62°03′22½″ N., long 147°25′53″ W. Chinitna Formation, middle third of lower member.
25	25348	54AFy37	L. F. Fay, 1954. Talkeetna Mountains (A–1) quad. About ½ mile south of Flat Creek on north-flowing Shovel Creek. Lat 62°03′09″ N., long 147°24′54½″ W. Chinitna Formation, near top of lower member.
26	25357	54AFy123	L. F. Fay, 1954. Talkeetna Mountains (A–1) quad. About 1.5 miles south of Flat Creek on unnamed north-flowing tributary. Lat 62°03′05″ N., long 147°23′08½″ W. Chinitna Formation, middle third of lower member.
27	25358	54AFy127	L. F. Fay, 1954. Talkeetna Mountains (A–1) quad. About 1.25 miles south of Flat Creek on north-flowing Placer Creek. Lat 62°03′20″ N., long 147°21′25″ W. Chinitna Formation, probably from top of lower third of lower member.
28	25585	54AFy106	L. F. Fay, 1954. Talkeetna Mountains (A–1) quad. About 1.20 miles from Flat Creek on northwest-flowing Meyer Creek. Lat 62°03′43½″ N., long 147°19′49″ W. Chinitna Formation, near top of lower member.
29	25339	54AGz200	Arthur Grantz, 1954. Talkeetna Mountains (A–1) quad. About 2 miles south of Flat Creek and 0.75 mile south of USGS Mesozoic loc. 25358. Lat 62°02′49″ N., long 147°22′09½″. Chinitna Formation, lower third of lower member.
30	24811	53AFy2	L. F. Fay, 1953. Anchorage (D–2) quad. About 0.4 mile due north of VABM Sheep (5,462 ft) lat 61°58′34½″ N., long 147°42′05″ W. Chinitna Formation, middle third of lower member.
31	24793	53AGz156	Arthur Grantz, 1953. Anchorage (D–2) quad. On a northeast-trending fork of Sheep Creek, 0.4 mile above junction. Lat 61°58′35½″ N., long 147°40′15″ W. Chinitna Formation, near base of lower member.
31	24815	53AGz158	Arthur Grantz and L. F. Fay, 1953. Anchorage (D–2) quad. About 0.2 mile south-southwest of USGS Mesozoic loc. 24793. Lat 61°58′27″ N., long 147°40′25″ W. Chinitna Formation, middle third of lower member.
32	8584	35	G. C. Martin, 1913. Anchorage (D–3) quad. North bank of Caribou Creek., 0.1 mile west of east boundary of quadrangle. Chinitna Formation, undivided, probably from lower third.
32	24147	52AGz197	Arthur Grantz, R. D. Hoare, and R. W. Imlay, 1952. Anchorage (D–3) quad. North side of Caribou Creek from 200 to 600 yds east of mouth of Billy Creek. Chinitna Formation undivided, probably from lower third.
33	24224	52AGz224	Arthur Grantz, R. D. Hoare, and R. W. Imlay, 1952. Anchorage (D–2) quad. On ridge between Billy Creek and Sheep Creek, 1,500 ft N. 72° W. of VABM Sheep (5,462 ft). Chinitna Formation, probably upper part of middle third of upper member.

TABLE 3.—*Description of Jurassic ammonite localities in the Chinitna Formation in the Talkeetna Mountains, Alaska*—Continued

Loc. No. (fig. 9)	USGS Mesozoic loc. No.	Collector's field No.	Collector, year of collection, description of locality, and stratigraphic assignment
33	24816	53AGz224	Arthur Grantz and L. F. Fay, 1953. Anchorage (D–2) quad. From same spot as USGS Mesozoic loc. 24224. Chinitna Formation, probably upper part of middle third of upper member.
34	24119	52AGz185	Arthur Grantz, R. D. Hoare, and R. W. Imlay, 1952. Anchorage (D–2) quad. On Caribou Creek about 2.5 miles west of mouth of Sheep Creek. Chinitna Formation, about 200 ft above base of upper member, which is locally more than 450 ft thick.
35	24789	53AGz58	Arthur Grantz and L. R. Fay, 1953. Anchorage (D–2) quad. On south side of Caribou Creek 1.75 miles west of mouth of Sheep Creek. Lat 61°56′44″ N., long 147°43′28″ W. Chinitna Formation, undivided lower half south of Caribou fault.
36	24135	52AGz276	Arthur Grantz, R. D. Hoare, and R. W. Imlay, 1952. Anchorage (D–2) quad. 2.56 miles N. 49° E. of mouth of Sheep Creek. Chinitna Formation, about 750 ft above base where formation is 1,300 ft thick and where lower 800 ft may represent a distal facies of the lower member.
36	28757	63AGz127	Arthur Grantz, 1963. Anchorage (D–2) quad. About 800 ft northwest of USGS Mesozoic loc. 24135. Lat 61°57.7′ N., long 147°37′ W. Chinitna Formation, same stratigraphic data as USGS Mesozoic loc. 24135.
37	26951	9–17–0B2	E. R. Orwig, 1957. Anchorage (D–3) quad. 15,700 ft north and 3,100 ft east of VABM Boulder (6,318 ft). Coordinates 2.63, 13.94 in. Chinitna Formation.
38	8576	25	R. M. Overbeck, 1913. Anchorage (D–3) quad. 3,000 ft up creek which enters Boulder Creek from north at point 5.5 miles above junction of Boulder Creek with East Fork, about 3,000 ft upcreek and at altitude of 3,300 ft. Chinitna Formation.
39	8571	20	G. C. Martin, 1913. Anchorage (D–4) quad. Tributary to Boulder Creek from north, 3 miles above junction of Boulder Creek with East Fork. Float from Chinitna Formation.
40	26950	9–17–0B1	E. R. Orwig, 1957. Anchorage (D–3) quad 1,830 ft north and 1,500 ft west of VABM Boulder (6,318 ft). Coordinates 1.76, 11.3 in. Chinitna Formation.

Chinitnites chinitnaensis Imlay, n. sp.

Plate 2, figures 1–31

This species is represented by 102 specimens of which 10 have complete body chambers. Shell small, moderately compressed. Whorls depressed ovate, much wider than high, widest a little below the middle of the flanks, embracing about two-thirds of previous whorls except for the body chamber which adorally becomes slightly less involute. Flanks evenly convex, merging gradually into broadly rounded venter. Umbilicus very small but enlarging somewhat on body chamber; wall fairly low, vertical at base, rounding evenly into flanks. Body chamber represented by slightly more than half a whorl. Aperture marked by a forwardly inclined constriction that is fairly pronounced on the lower part of the flanks and disappears on the venter.

Ribs are flexuous, vary considerably in density and coarseness, are highest and sharpest on the flanks, and adorally gradually become stronger and more widely spaced. They curve forward on the umbilical wall and on the lower part of the flanks, recurve slightly on the upper part of the flanks, and are transverse or arch gently forward on the venter. Some primary ribs remain simple. Others bifurcate or are indistinctly connected with secondary ribs at about two-fifths of the height of the flanks. In places, alternation of simple and short intercalary ribs occurs along the zone of furcation. Secondary ribs outnumber the primary ribs about 2 to 1. Among the specimens in hand, 17 represent a finely ribbed variant, 14 a coarsely ribbed variant, and the other specimens are of intermediate coarseness.

The suture line has a moderately slender first lateral lobe that is essentially as long as the ventral lobe. The second lateral lobe is much shorter.

Specimens (pl. 2)	Diameter	Whorl height	Whorl thickness	Umbilical width
Paratype (figs. 19–21)	24	9 (0.37)	12.5 (0.52)	6.7 (0.27)
Paratype (figs. 10–12)	20	9.5 (.47)	12.2 (.61)	5 (.25)
Paratype (figs. 13,14)	16.3	7 (.43)	10 (.61)	4.2 (.26)
Paratype (figs. 5–7)	16.4	6.5 (.40)	9 (.55)	4 (.24)
Paratype (figs. 2, 3)	13	5.5 (.42)	7.8 (.60)	3.2 (.25)
Holotype (figs. 27, 29–31)	30	12 (.40)	17 (.57)	8 (.27)

This species differs from *Chinitnites parviformus* (Imlay) by having a depressed ovate instead of a subquadrate whorl section, fewer secondary ribs

per primary rib, and slightly to much coarser ribbing.

Types.—Holotype, USNM 180725; paratypes, USNM 180718–180724 and 180726–180729.

Occurrences.—Chinitna Formation at USGS Mesozoic locs. 21348, 22432, 24139, 24143, 24803, 24805, and 30283–30285. The fossils at USGS Mesozoic locs. 21348 and 22432 are from 450–500 feet above the base of the Tonnie Siltstone Member on the Iniskin Peninsula (Detterman and Hartsock, 1966, p. 45). The other localities are in the upper half of the upper member of the Chinitna Formation in the Talkeetna Mountains northwest of Limestone Hills. Associated fossils show that the species occurs in the middle part of the range of *Cadoceras catostoma* Pompeckj and *C.* (*Paracadoceras*) *tonniense* Imlay. The occurrences on the Iniskin Peninsula are 150–200 feet higher than the highest occurrences of *Chinitnites parviformus* (Imlay, 1953b, p. 82, pl. 33, figs. 3, 6, 8–10, 12) and are above the range of *Iniskinites.*

Chinitnites parviformus (Imlay)

Plate 3, figures 1, 2, 5–7

Kheraiceras? *parviforme* Imlay, 1953b, U.S. Geol. Survey Prof. Paper 249–B, p. 82, pl. 33, figs. 3, 6, 8–10, 12.

This species is characterized by a subquadrate whorl section that is nearly as high as wide; a very small umbilicus that enlarges appreciably on the adoral part of the adult body chamber; an apertural constriction; and sharp flexuous ribs, of which some bifurcate fairly low on the flanks and others remain simple but may alternate with short ribs along the zone of furcation. Body chamber occupies about half a whorl instead of five-sixths as stated in the original description. Minor variations in coarseness and density of ribbing occur among specimens from the same locality.

The suture line, partly exposed on one specimen, is similar to that on *Cranocephalites vulgaris* Spath (1932, pl. 3, fig. 5).

In addition to the occurrences previously recorded, the species is represented by five specimens from the upper part of the Bowser Formation. One of these (pl. 3, figs, 1, 2), bears ribbing that is a little finer than on the holotype but is comparable with that on one paratype (Imlay, 1953b, pl. 33, fig. 6). The species does not include one small ammonite illustrated by Imlay (1962, pl. 1, fig. 7) as *Arctocephalites* (*Cranocephalites*) *pompeckj* (Madsen). That ammonite has a somewhat wider umbilicus that does not enlarge on the body whorl, and its primary ribs, as exposed in the umbilicus, are considerably stronger.

Types.—Holotype, USNM 108052; paratypes USNM 108053a–c; hypotypes, USNM 180734 and 180735.

Occurrences.—Chinitna Formation, west of Cook Inlet near Oil Bay, at USGS Mesozoic locs. 21334 and 22427; Bowser Formation at USGS Mesozoic locs. 11038 and 11042. The species ranges upward from about 750 feet below the top of the Bowser Formation to 300 feet above the base of the Chinitna Formation.

Genus INISKINITES Imlay, n. gen.

Iniskinites is characterized by medium to large, fairly stout to globose shells; an extremely small umbilicus on septate whorls; an eccentric to hook-shaped body chamber that occupies about three-fourths of a whorl and becomes depressed near the aperture; a deep apertural constriction that becomes shallower ventrally; and low to high, sharp to rounded, nearly radial to gently flexuous ribs that cross the venter transversely. During growth, the ribs become stronger ventrally and adorally, on some species become markedly stronger on the adult body chamber, and on most species persist to the aperture without any reduction in strength. Most primary ribs branch into two to four slightly weaker secondary ribs at about the top of the lower third of the flanks, but some remain simple or are indistinctly connected with secondary ribs. Short ribs occur commonly between pairs or bundles of branched ribs. The suture line has very broad saddles and moderately stocky lobes.

Iniskinites magniformus (Imlay) (1953b, p. 79, pl. 31, figs. 5–8) is designated as the type species.

Iniskinites differs from the genotypes of *Kheraiceras* (Arkell, 1952, p. 89; Arkell and others, 1957, p. L292, L293) by its inner whorls being less depressed and less spindle shaped, by its body whorl being less eccentric or contracted, by its aperture being marked by a constriction, by its ribs remaining strong or becoming stronger adorally on the adult body chamber instead of fading, and by its second lateral lobe being stocky and trifid instead of broad and bifid.

It differs from *Cranocephalites* Spath by having a smaller umbilicus on its septate whorls, by the adult body chamber becoming depressed near the aperture, by the ribs on the venter of the body whorl tending to become stronger adorally instead of weaker, and by its suture line being more complex.

Iniskinites magniformus (Imlay)

Plate 3, figures 8, 9; plate 4, figures 2, 7, 8

Kheraiceras magniforme Imlay, 1953b, U.S. Geol. Survey Prof. Paper 249–B, p. 79, 80, pl. 31, figs. 5–8.

This species has stout inner whorls, globose penultimate and body whorls, an extremely small umbilicus, a hook-shaped adult body chamber that becomes depressed toward the aperture, and a constricted inclined aperture. Its ribs are very fine, sharp, and closely spaced on the adapical part of the outermost septate whorl (pl. 4, fig. 7). Adorally on that whorl and on the body chamber, the ribs gradually become broader, more widely spaced, indistinct near the umbilicus, and stronger on the venter except near the aperture. The suture line has broad saddles, fairly broad lobes, and is finely subdivided. The first and second lateral lobes are nearly the same length as the ventral lobe.

Types.—Holotype, USNM 108047; hypotypes, USNM 180736 and 180737.

Occurrences.—Chinitna Formation. The holotype is from an unknown locality on the east shore of Iniskin Bay. The hypotypes, herein figured, are from USGS Mesozoic loc. 22431 near Iniskin Bay west of Cook Inlet and from USGS Mesozoic loc. 24147 in the Talkeetna Mountains. Near Iniskin Bay, the species occurs about 400 feet above the base of the Chinitna Formation. Associated ammonites show that *Iniskinites magniformus* (Imlay) occurs in the middle part of the range of *Cadoceras catastoma* Pompeckj. Some previous records of the species (Imlay, 1953b, p. 80) from USGS Mesozoic locs. 22427 and 22448, based on small individuals, are probably erroneous.

Iniskinites abruptus (Imlay)

Plate 5, figures 1–3

Kheraiceras abruptum Imlay, 1953b, U.S. Geol. Survey Prof. Paper 249–B, p. 80, 81, pl. 33, figs. 1, 7, 11, 13.

This species has fine dense ribbing on its inner whorls as on *Iniskinites magniformus* (Imlay). It differs by having a stout instead of a globose shell, by the ribs on the body chamber being much coarser, and by the ribbing changing abruptly from fine to coarse near the beginning of the body chamber.

Types.—Holotype, USNM 108049; hypotypes, USNM 180738 and 180739.

Occurrences.—Chinitna Formation on the Iniskin Peninsula west of Cook Inlet at USGS Mesozoic locs. 22412, 22428, 22431, and 22433 (holotype). Chinitna Formation in Talkeetna Mountains at USGS Mesozoic locs. 24119, 24135, 24147, and 25310. Shelikof Formation near Wide Bay, Alaska Peninsula, at USGS Mesozoic loc. 19793. On the Iniskin Peninsula, the species occurs 350–475 feet above the base of the Chinitna Formation.

Iniskinites martini (Imlay)

Plate 4, figures 1, 3–6

Kheraiceras martini Imlay, 1953B, U.S. Geol. Survey Prof. Paper 249–B, p. 80, pl. 32, figs. 1, 4, 6.

Several ammonites closely resemble *I. martini* (Imlay) in whorl shape and ribbing, occur at least in part at the same stratigraphic position, and are considered to be immature forms of that species. At a comparable size, *I. intermedius* Imlay (1953b, p. 81, pl. 31, figs. 1–4, pl. 32, figs. 2, 3, 5, 7, 8) is much more compressed.

Types.—Holotype, USNM 108048; hyptoypes, USNM 180740 and 180741.

Occurrences.—Chinitna Formation in basal 50–100 feet at USGS Mesozoic locs. 3027 and 22448 near Iniskin Bay. These localities are near USGS Mesozoic loc. 22446 from which the holotype of *I. martini* (Imlay) was obtained.

Iniskinites intermedius (Imlay)

Plate 3, figures 3, 4

Kheraiceras intermedium Imlay, 1953b, U.S. Geol. Survey Prof. Paper 249–B, p. 81, pl. 31, figs. 1–4, pl. 32, figs. 2, 3, 5, 7, 8.

This species is most similar to *I. martini* (Imlay) (1953b, p. 80, pl. 32, figs. 1, 4, 6) but differs by being appreciably smaller and more compressed and by its ribbing being higher and sparser, particularly on the adult body whorl.

Types.—Holotype, USNM 108223; paratypes, USNM 108051, 108224, and 108225; hypotype, USNM 180742.

Occurrences.—Chinitna Formation in Talkeetna Mountains at USGS Mesozoic locs. 24151, 24184, 24793, 24818, 25341, and 30282; west of Cook Inlet at USGS Mesozoic locs. 21273, 21334, 22427, and 22690. Topmost foot of the Bowser Formation USGS at Mesozoic loc. 21272 (=3014). On Chisik Island the species ranges from the very top of the Bowser Formation (USGS Mesozoic loc. 21272) to 125 feet above the base of the Chinitna Formation (USGS Mesozoic loc. 22690). Assignment of the lowest occurrence to the Bowser Formation is based on its position 1 foot below a channel conglomerate which is mapped as the basal unit of the Chinitna Formation.

Family REINECKEIIDAE Hyatt, 1900
Genus PARAREINECKEIA Imlay, 1962

Parareineckeia shelikofana (Imlay)

Plate 6, figures 1–5, 7

Reineckeia (Kellawaysites) shelikofana Imlay, 1953b, U.S. Geol. Survey Prof. Paper 249–B, p. 101, pl. 55, figs. 1, 2, 5–8.

Parareineckeia shelikofana (Imlay), 1962, U.S. Geol. Survey Prof. Paper 374–C, p. 25, 26.

This species is represented by two specimens in addition to the holotype. One of these shows the smallest septate whorls. The other shows most of the remainder of the shell, including the adoral part of the adult body chamber, a feature not preserved on the holotype.

The small specimen, which is slightly depressed, at a diameter of 35 mm, has a whorl height of 13.5 mm, a whorl thickness of 19.2 mm, and an umbilical width of 12.8 mm. It differs from the inner whorls of the holotype by having somewhat finer and denser ribbing.

On the large specimen the septate whorls are identical in shape and ribbing with comparable septate whorls on the holotype. On the body chamber the ribs become much stronger, broader, and more widely spaced adorally than on the septate whorls. Primary ribs become fairly prominent, incline adorally on the flanks, and pass into two or three lower and broader secondary ribs along an irregular zone below the middle of the flanks. A few secondary ribs arise freely or are indistinctly connected with the primary ribs. All secondary ribs arch gently forward on the venter. The aperture terminates simply.

Types.—Holotype, USNM 108143; hypotypes, USNM 180744 and 180745.

Occurrences.—Shelikof Formation, 350 feet above base on north side of Wide Bay, Alaska Peninsula, at USGS Mesozoic loc. 21355 (holotype). Hypotypes from USGS Mesozoic loc. 24184 in the Talkeetna Mountains were obtained from reworked concretions in basal part of Cretaceous shales. The holotype should be from slightly older beds than those containing *Kepplerites chisikensis* Imlay, n. sp., at USGS Mesozoic loc. 19793 (Imlay, 1953b, p. 70).

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[Italic page numbers indicate major references and descriptions]

*U.S. GOVERNMENT PRINTING OFFICE: 1975 O—585—476/110

PLATES 1-6

[Contact photographs of the plates in this report are available, at cost, from U.S. Geological Survey Library, Federal Center, Denver, Colorado 80225.]

PLATE 1

[All figures are natural size]

FIGURES 1–5. *Kepplerites (Seymourites) chisikensis* Imlay, *n. sp.* (*p. 15*).

1, 5. Holotype, USNM 108717, from USGS Mesozoic loc. 19793. Figure 1 shows fine ribs and weak tubercles exposed on inner whorls of broken right-hand side. Figure 5 shows nearly complete body chamber.

2–4. Septate paratype, USNM 108125, from USGS Mesozoic loc. 21287. Note imprint of contracted body chamber. For other views, see Imlay (1953b, pl. 48, figs. 14, 17).

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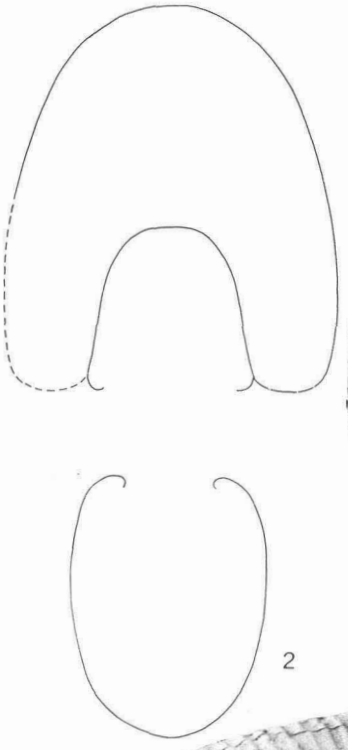

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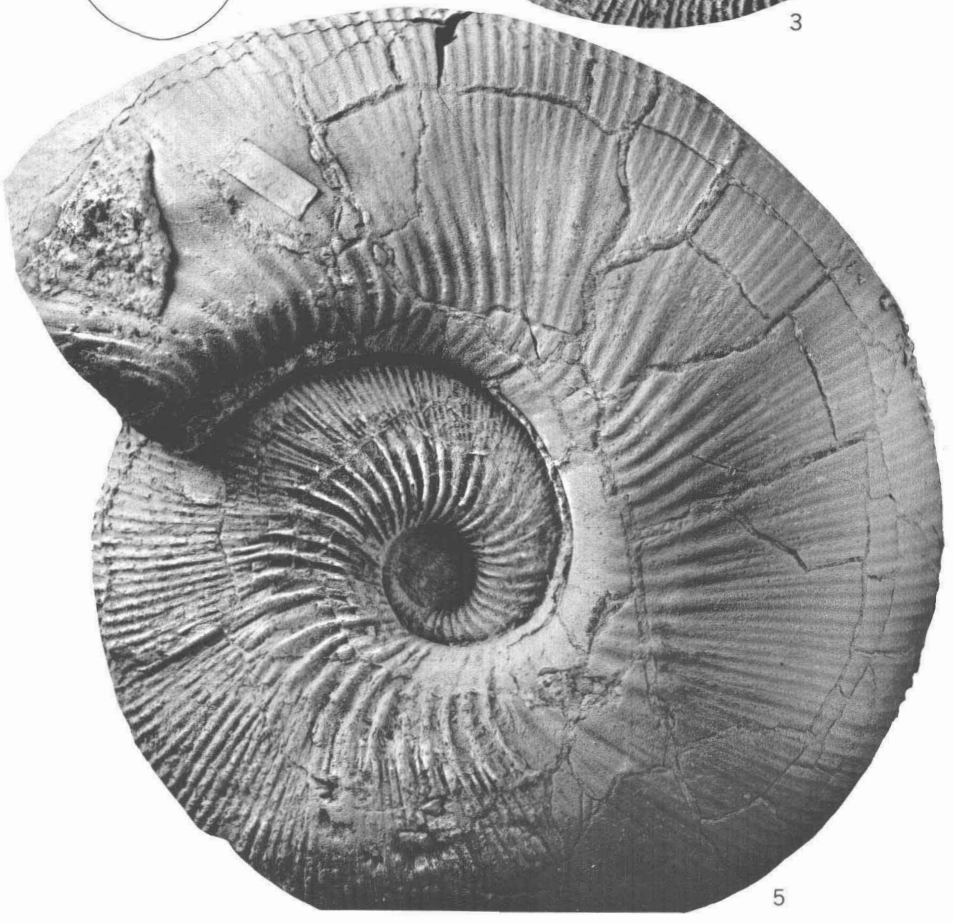


5

KEPPLERITES

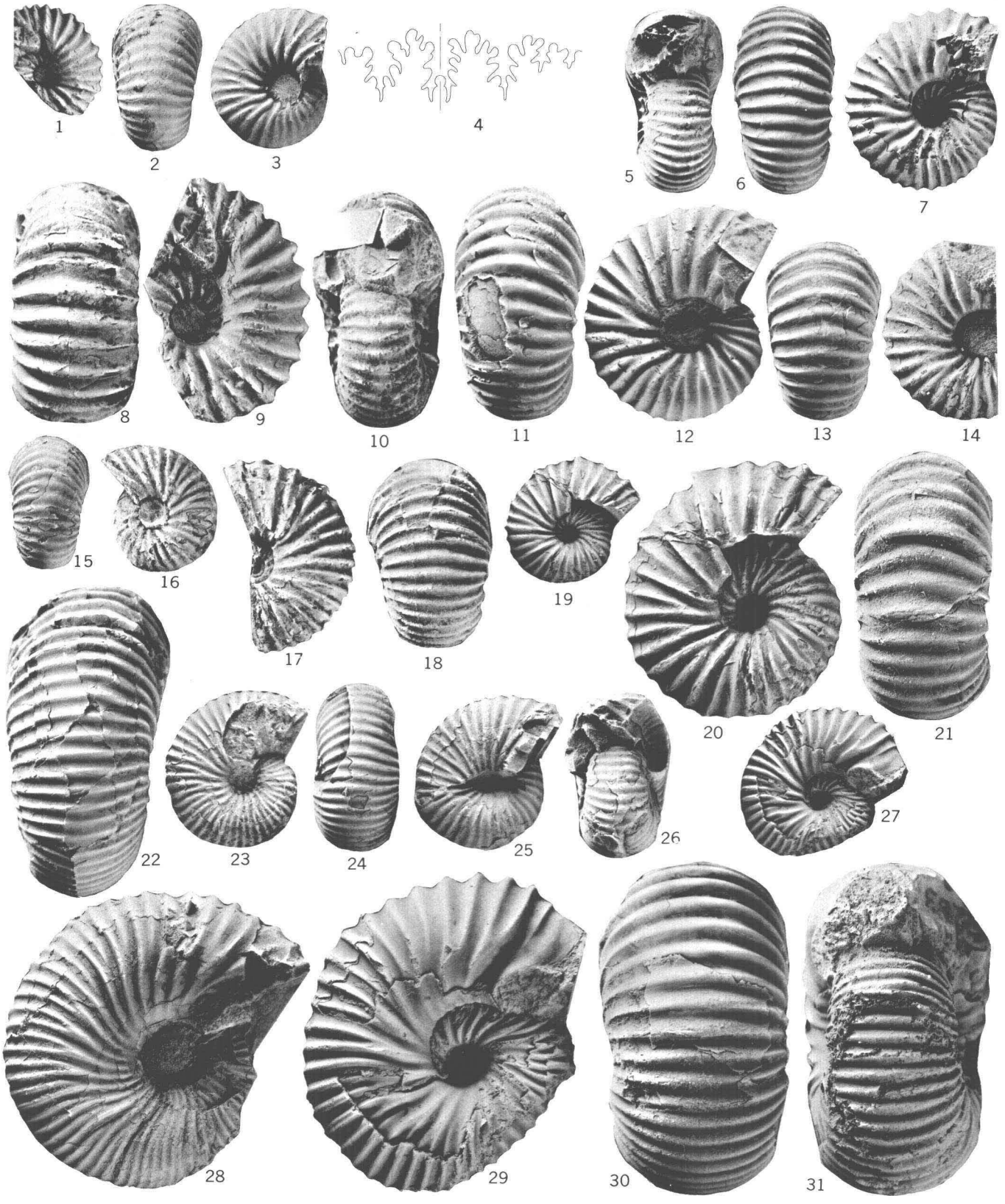
PLATE 2

[Figures 1, 19, and 27 are × 1. Figure 4 is × 3. All others are × 2]

FIGURES 1–31. *Chinitnites chinitnaensis* Imlay, n. sp. (p. 22).

1, 8, 9. Paratype, USNM 180723, from USGS Mesozoic loc. 24803.
2–4. Paratype, USNM 180722, from USGS Mesozoic loc. 24803. Suture line drawn at whorl height of 6 mm.
5–7. Paratype, USNM 180721, from USGS Mesozoic loc. 24143.
10–12. Paratype, USNM 180719, from USGS Mesozoic loc. 24803.
13, 14. Paratype, USNM 180720, from USGS Mesozoic loc. 24803.
15, 16. Paratype, USNM 180729, from USGS Mesozoic loc. 24139.
17, 18. Paratype, USNM 180724, from USGS Mesozoic loc. 24139.
19–21. Paratype, USNM 180718, from USGS Mesozoic loc. 21348.
22, 28. Paratype, USNM 180727, from USGS Mesozoic loc. 22432.
23, 24. Paratype, USNM 180728, from USGS Mesozoic loc. 24143.
25, 26. Paratype, USNM 180726, from USGS Mesozoic loc. 24805.
27, 29–31. Holotype, USNM 180725, from USGS Mesozoic loc. 24805.

Specimens shown in figures 1–14 represent a coarsely ribbed variant; in figures 15–21, a moderately ribbed variant; and in figures 22–26 and 28, a finely ribbed variant. The holotype shown in figures 27 and 29–31 has fairly fine ribbing on its outermost septate whorl and moderate ribbing on its body chamber.



CHINITNITES

PLATE 3

[All figures natural size unless otherwise indicated]

FIGURES 1, 2, 5–7. *Chinitnites parviformus* (Imlay) (p. 23).

1, 2. Hypotype, USNM 180735 (× 2), from USGS Mesozoic loc. 11042.

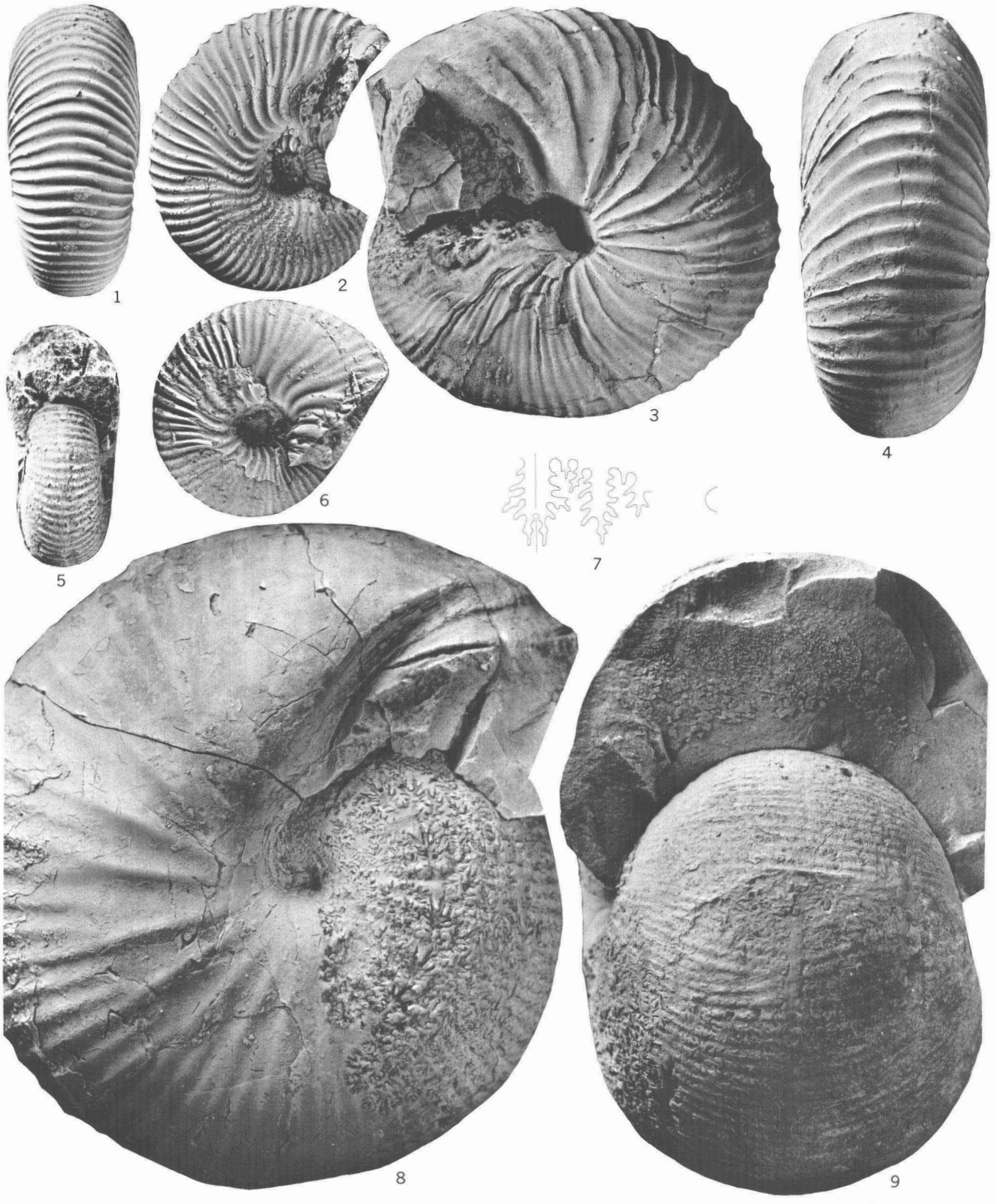
5–7. Apertural and lateral views (× 2) and suture line (× 3) of hypotype, USNM 180734, from USGS Mesozoic loc. 21334.

3, 4. *Iniskinites intermedius* (Imlay) (p. 24).

Hypotype, USNM 180742, from USGS Mesozoic loc. 25341. Shows adult body whorl and apertural construction.

8, 9. *Iniskinites magniformus* (Imlay) (p. 24).

Hypotype, USNM 180736, from USGS Mesozoic loc. 24147. In figure 9 the adoral third of the body chamber has been removed along crack shown in figure 8.



CHINITNITES AND *INISKINITES*

PLATE 4

[All figures are natural size]

FIGURES 1, 3–6. *Iniskinites martini* (Imlay) (p. 24).

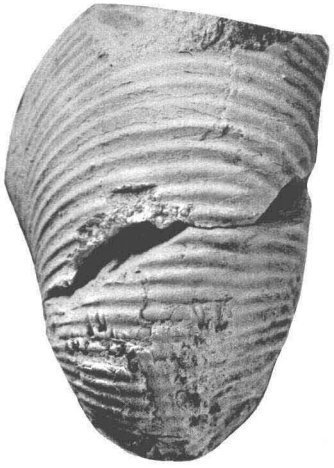
1, 3. Laterally compressed specimen, USNM 180740, from USGS Mesozoic loc. 3027.

4, 5. Slightly distorted specimen, USNM 180741, from USGS Mesozoic loc. 22448.

6. Partly diagrammatic suture line from adapical end of adult body chamber at whorl height of 50 mm. Holotype, USNM 108048, from USGS Mesozoic loc. 22446.

2, 7, 8. *Iniskinites magniformus* (Imlay) (p. 24).

Inner septate whorls and nearly complete body whorl of hypotype, USNM 180737, from USGS Mesozoic loc. 22431. Position of cross-sectional view shown in figure 2 corresponds to crack in figure 7.



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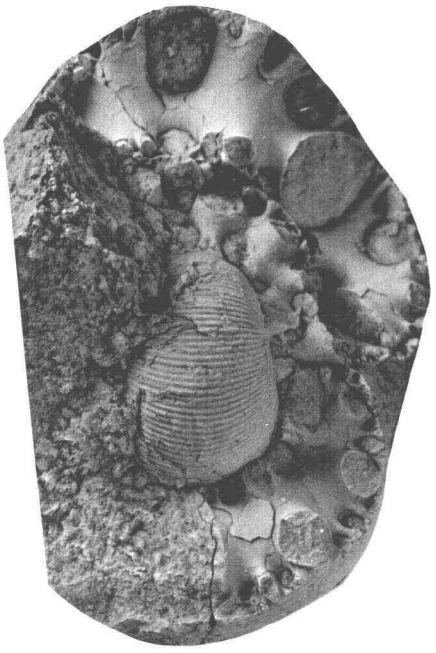

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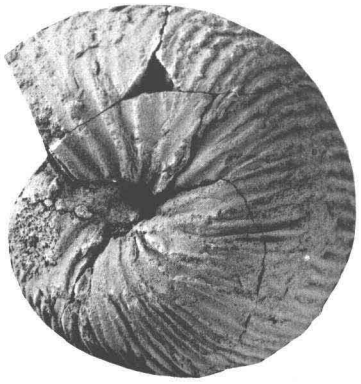

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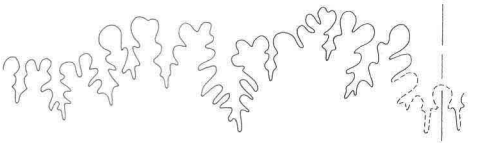

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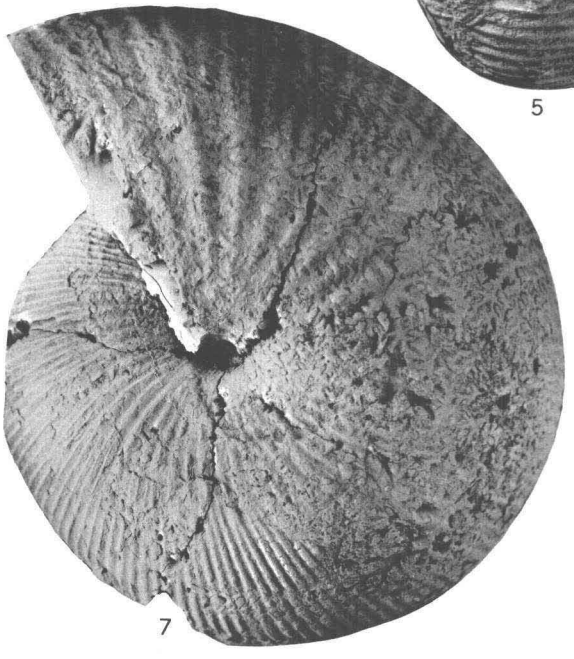

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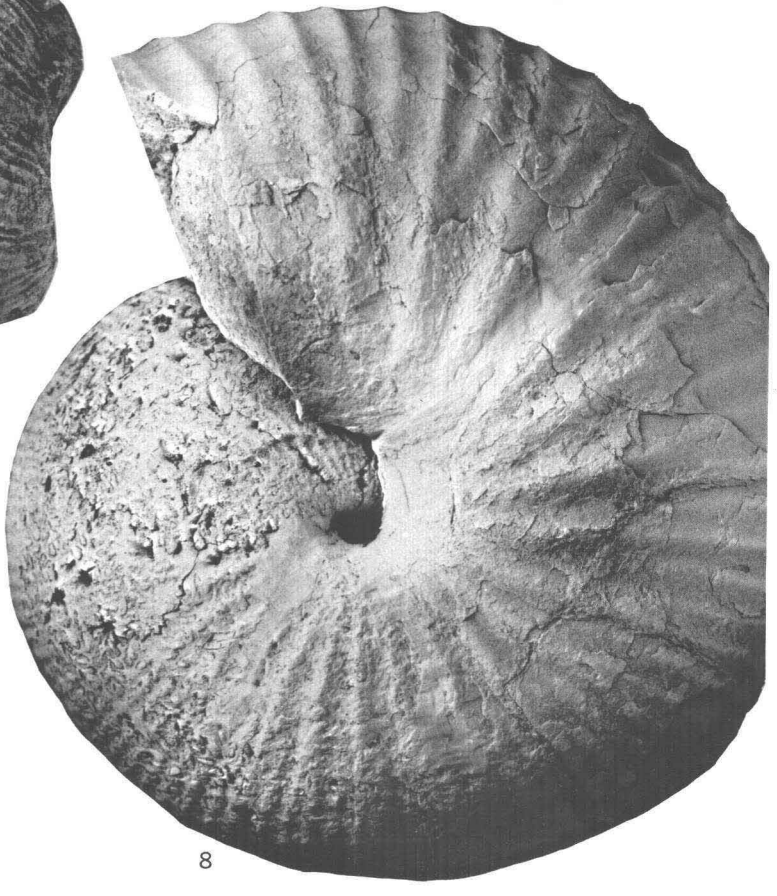


8

INISKINITES

PLATE 5

[All figures are natural size]

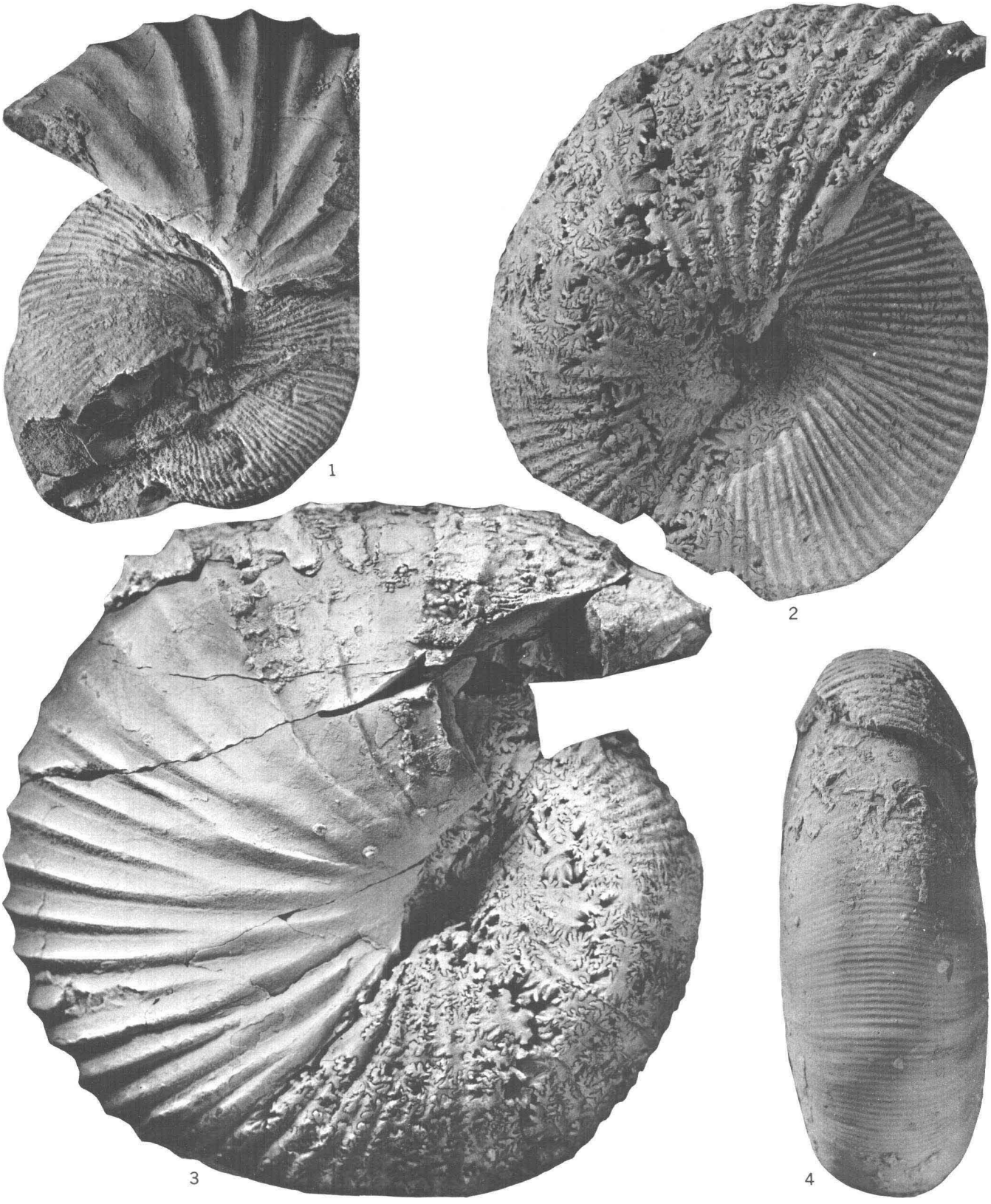
FIGURES 1–3. *Iniskinites abruptus* (Imlay) (p. 24).

1. Laterally crushed hypotype, USNM 180739, from USGS Mesozoic loc. 24147. Note that ribs are much coarser on body chamber than on septate whorl.

2, 3. Outermost septate whorl (fig. 2) and nearly complete body chamber of hypotype, USNM 180738, from USGS Mesozoic loc. 25310.

4. *Kepplerites tychonis* Ravn (p. 16).

Ventral view of plaster cast of holotype from East Greenland, University of Copenhagen collection, for comparison with *Kepplerites chisikensis* Imlay, n. sp. See pl. 6, fig. 6, for lateral view.



INISKINITES AND *KEPPLERITES*

PLATE 6

[All figures are natural size]

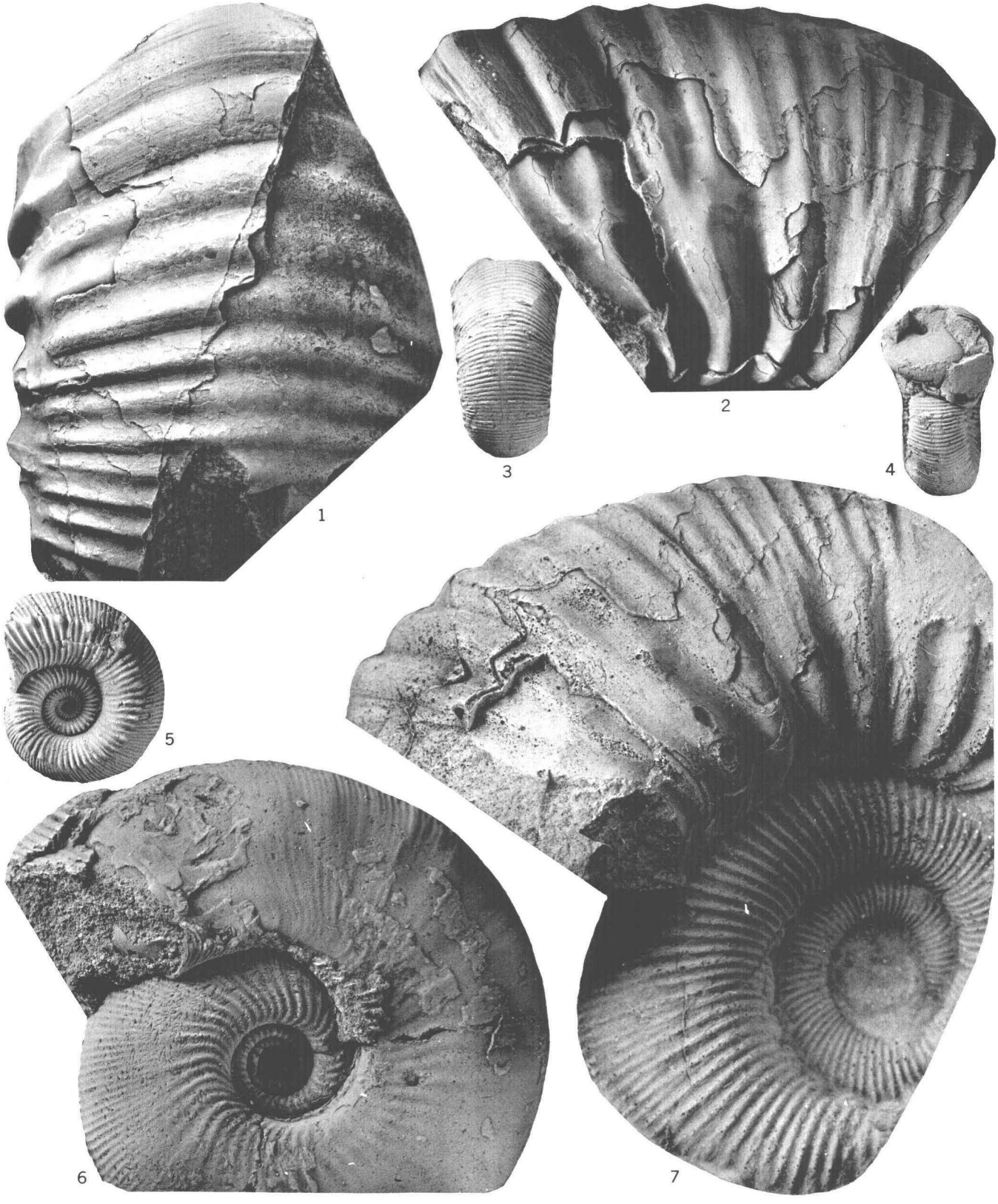
FIGURES 1–5, 7. *Parareineckeia shelikofana* (Imlay) (p. 25).

1, 2, 7. Ventral and lateral views of adoral part of body chamber (figs. 1, 2) and lateral view of rubber imprint of external mold (fig. 7) of hypotype, USNM 180744, from USGS Mesozoic loc. 24184.

3–5. Small septate whorl of hypotype, USNM 187045, from USGS Mesozoic loc. 24184.

6. *Kepplerites tychonis* Ravn (p. 16).

Lateral view of plaster cast of holotype from East Greenland, University of Copenhagen collection, for comparison with *Kepplerites chisikensis* Imlay, n. sp. See pl. 5, fig. 4, for ventral view.



PARAREINECKEIA AND *KEPPLERITES*