A NEW CHELYDRID TURTLE
PROTOCHELYDRA ZANGERLI
FROM THE LATE PALEOCENE OF NORTH DAKOTA

by
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The Science Museum of Minnesota

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Investigation of late Paleocene deposits in western North Dakota over the last 3 years by the Paleontology Department of The Science Museum of Minnesota has resulted in the discovery of an interesting fauna. One locality in particular, designated as Wannagan Creek quarry, has produced a number of extraordinary vertebrate remains. This locality and its fauna are currently the basis of a paleoecological study that will therefore be of a rather lengthy projected duration. In light of this, preliminary reports on some of the more important forms seem appropriate. The present paper is intended as the first in a series to describe parts of this fauna.

Of the materials thus far prepared, the most exciting is a skull and partial postcranial skeleton of a primitive chelydrid turtle, which clearly represents a new genus.

The new fossil is remarkable in that it is the earliest record of a snapping turtle. It also provides us with an early Tertiary member of the most primitive subfamily of chelydrids — the chelydrinae. I take pleasure in naming it for Dr. Rainer Zangerl of the Field Museum of Natural History. Its description follows.

<div align="center">

Order Chelonia
Family Chelydridae
Subfamily Chelydrinae
Genus Protochelydra, new genus

</div>

Diagnosis — A primitive chelydrine turtle, allied to *Chelydra,* orbits of skull smaller and unelevated, roof of skull deeply emarginated, postorbital bar wide, alveolar surface wide, plastron as wide as long and primitive in having elements joined medially.

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Protochelydra zangerli, new species.

Holotype — SMM P72.34.20. A nearly intact skull.

Horizon and Locality — SMM Wannagan Cr. quarry, lower level, Tongue
 River Formation (late Paleocene) NW¼ sec. 18, T. 141 N., R.
 102 W. Billings Co., North Dakota, U.S. National Grasslands.

Referred Specimens — SMM P70.20.430, hypo- and xiphiplastra;
 P70.20.441, partial hyoplastron; P72.34.21, epiplastron; P72.34.22,
 epiplastron; P72.34.18, peripheral; P71.16.255, ilium; P72.34.15,
 humerus; P72.34.16, scapula; P72.34.17, ilium.
 All Wannagan Cr. quarry, lower level.

Diagnosis — As this is the only species representing the genus, its char-
 acterization must agree with that of the genus.

DESCRIPTION OF SKULL

The holotype is a nearly complete skull (Fig. 1) lacking most of the right
prefrontal, maxilla, postorbital, and jugal. Although somewhat crushed,
all remaining elements are well preserved and present an exceedingly good
habitus of the entire skull. Its dorsal shape is triangular, nearly as wide as
long (measured from the occipital condyle to the tip of the snout). Its
lateral silhouette is low and the orbits are directed laterad. It is unmis-
takably chelydrine in possessing a premaxillary beak ''tooth,'' a wide
postorbital bar, a well-developed proötic foramen, and in having the
stapes (columella) inclosed by the quadrate. Furthermore, although not
preserved in its entirety, the palatal region does not indicate the develop-
ment of a secondary palate nor does the temporal emargination have the
expression of either a staurotypine or kinosternine.

Conformance between the new fossil and the common snapping turtle
Chelydra serpentina indicates a close alliance and points up the primitive
nature of the latter. Outstanding differences between the two are reflected
in the degree of emargination of the roof of the skull, the unelevated orbit,
lack of rugosity of the dorsal surface, the longer pterygoids, and the wide
alveolar surface in the fossil. In addition the alveolar edge has pronounced
festooning, and the ventral emargination of the temporal bar surpasses
that of the living genus by a considerable amount.
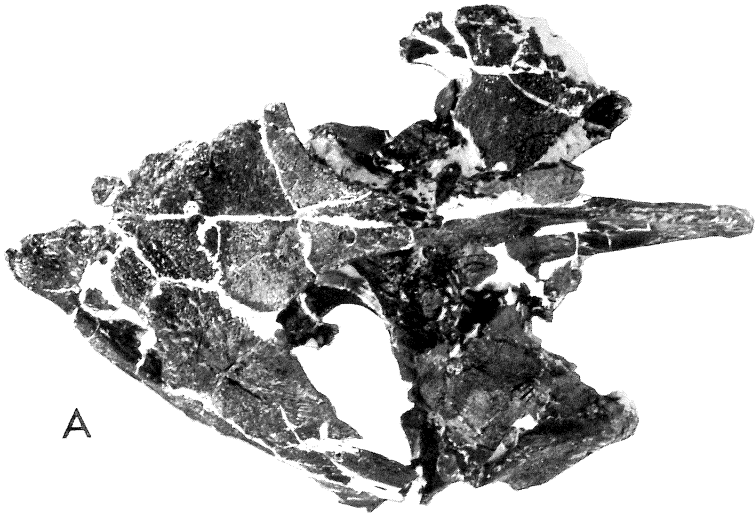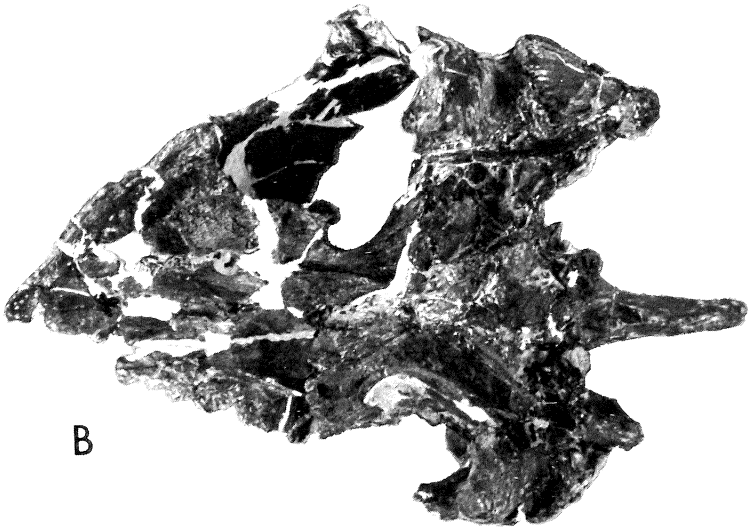
Figure 1
Protochelydra zangerli, type specimen SMM P72.34.20.
A. Dorsal, B. ventral views of skull. X 1.

Openings of the skull — On the exterior surface a few differences in the skull openings between the new form and *Chelydra* can be seen. Only in the living form is the orbital rim sharply elevated along its superior and posterior margins, thereby appreciably increasing the size of the opening and making it prominent when viewed from above.

The temporal emargination contrasts markedly with that of the living form in that in the fossil it extends fully half the length of the skull as measured from the condyle to the tip of the snout; whereas in all other chelydrines this excavation is considerably less, a condition that is emphasized by the relative shortness of the anterior part of the skull in the fossil. The emargination, however, is still greater, with the temporal region fully exposed and the postorbital bar greatly reduced in other subfamilies. No significant differences in the typically small nostril or the otic opening are apparent. The proötic foramen is present and located as it is in other chelydrines.

Vacuities on the ventral side of the skull are small by comparison. The posterior palatine vacuity is only one-third that of *Chelydra*. The anterior palatal foramen is preserved only in part, but its general outline is smaller also.

Bones of the skull — Most sutures are distinguishable as is the fine sculpturing of the roofing bones. The texture is due to an intertwining of miniature depressions and pits. The depression lines on the posterior halves of the postorbital and jugal present a striated appearance with the lines diverging rearward. The only notable difference in the course or degree of suturing is found in the shortened parietal — postorbital contact attributable to the deep temporal emargination. The frontals are excluded from the orbits in usual chelydrid fashion. The supraoccipital crest is stout and expanded along its basal edge not unlike *Staurotypus,* and has the chelydrid arch.

In ventral aspect (Fig. 2C), the alveolar surface is quite wide and stands in contrast to the relatively narrow area displayed by other chelydrines. The palate, however, does not show the modification of the sort found in more advanced chelydrids wherein a secondary palate is developed. The pterygoids are unusual in that they extend quite far posteriorly.

The new form is characterized by two distinct, posteriorly converging ridges on the pterygoids that meet near the anterior tip of the wedge-shaped basisphenoid. The basioccipital is strongly depressed centrally. As in *Macroclemys* especially, this depression is carried forward onto the
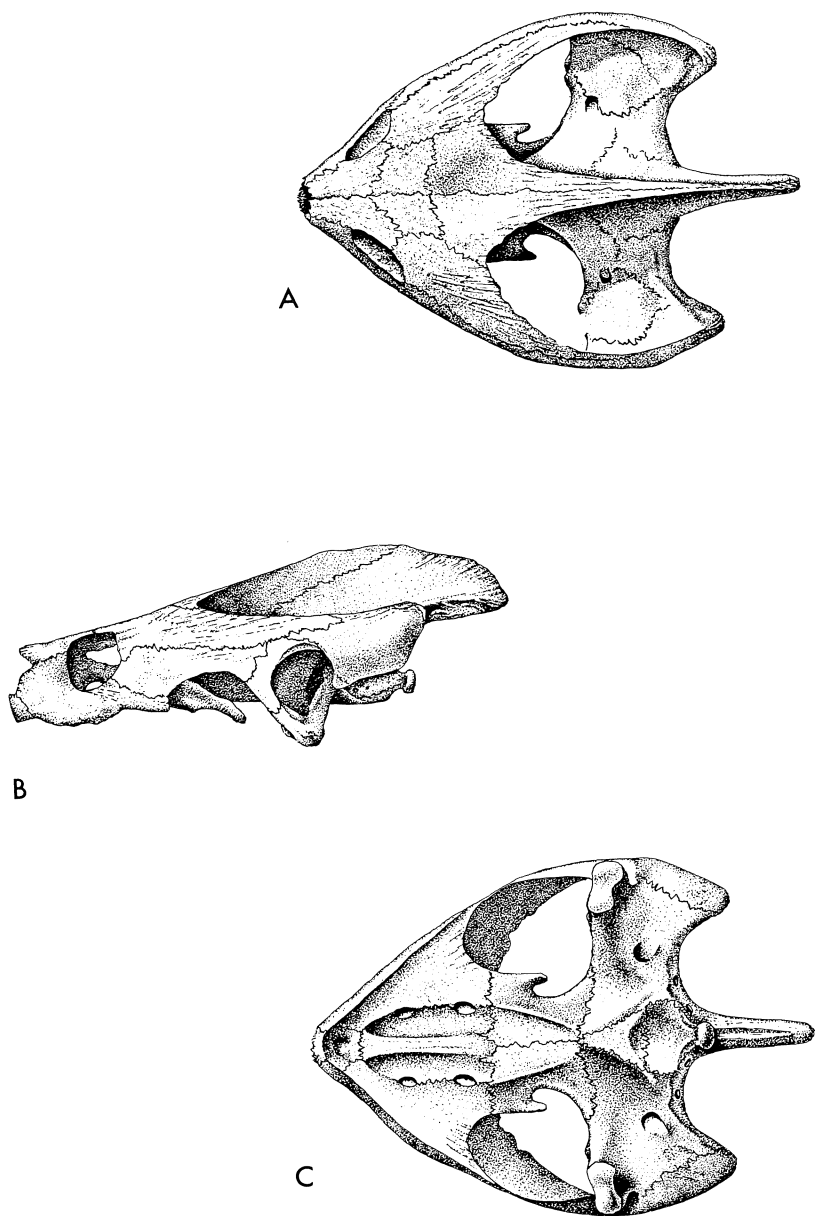
Figure 2
Restoration of the skull, *Protochelydra zangerli*.
A. Dorsal, B. lateral, C. ventral views.

posterior part of the basisphenoid, whereas in *Chelydra* this region is flatter. A further similarity to the former is found in the rather shortened base of the quadrate as measured from the articular area to the bottom of the otic opening.

Within the right otic opening of the fossil, the stapes (columella) may be observed more or less in place in the fenestra ovalis (Fig. 3). The shaft has been broken at about midlength, but its form and position are clear. As in other chelydrines, the stapes is characteristically inclosed by the quadrate.
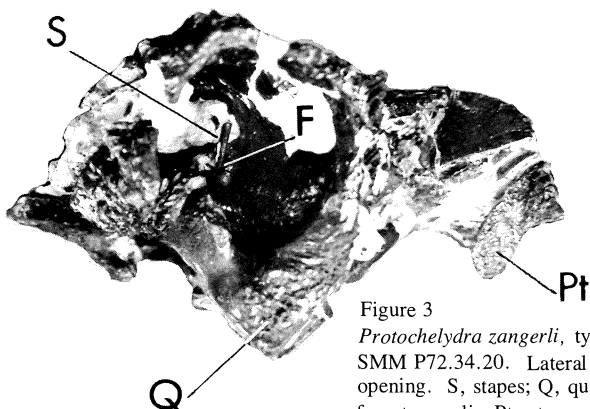

Figure 3
Protochelydra zangerli, type specimen SMM P72.34.20. Lateral view of otic opening. S, stapes; Q, quadrate; F, fenestra ovalis; Pt, pterygoid process. Approx. X 2.

MEASUREMENTS OF THE SKULL
mm.

Total length (occipital condyle to tip of snout) 77.8
Greatest width (est.) 69.8
Width of snout (ant. to orbit, est.) 20
Width of snout (post. to orbit, est.) 38.2
Width across quadrates 68
Width across pterygoids 27.2
Width of alveolar surface posteriorly 16.5
Height of skull (ant. to orbit) 17
Height of skull (post. to orbit) 19
Height of snout (ant. tip) 14
Height of orbit 12.8
Length of orbit 15
Width of suborbital bar 7.5
Distance between nasal notch and anterior rim of orbit 6.2
Distance between posterior rim of orbit and anteriormost point
    of temporal emargination 15.7

DESCRIPTION OF THE SHELL

Justification for the restoration of the plastron (Fig. 4) rests with several extremely well-preserved elements. These components comprising epi-, hypo-, and xiphiplastra, as well as a portion of the hyoplastron, show definite chelydrid affinities.

The plastron is cruciform and approximately as wide as long. It is primitive in design having as its most distinguishing feature its two halves united by heavy interfingering sutures. Along the medial border the hyo- and hypoplastra are on the order of 10-12 mm. thick. The hyo-hypoplastral suture is long and continuous; hence a solid ventral plate is formed that has neither a central fontanelle nor any intervening cartileges as in other chelydrines, except for that which may have been associated with the entoplastron.

The epiplastron (Fig. 8) is small and similar to that of *Chelydra*. Its anterior end is expanded into a flange horizontally where it meets its counterpart. The area of contact shows only slight grooving. About one-third of the way down on the medial border, rugosities begin for attachment of the entoplastron and continue for another third of the length of the bone. Along the superior side of most of this contact area, a deep sulcus is developed to receive the angled front edge of the entoplastron. Below this the bone narrows rapidly and becomes grooved to accommodate the antero-lateral border of the hyoplastron. The lateral edge of the epiplastron below its anterior flange is sharp and tuberculate to midlength. Beyond this it is laterally compressed. Both dorsal and ventral surfaces are smooth. The latter shows no shield furrows. The former possesses a wide, flat ridge that is actually the full thickness of the bone between two thinned edges. It begins near the anterior tip on the flange and extends caudad to about midlength.

The entoplastron is unknown; yet its form was surely rather typically chelydrine. The area of junction with the epiplastron is visible below the anterior end on the inner edge of this bone. The distance of union between the two is about one-third the length of the outer element. The wedge-shaped entoplastron fits intimately between the epiplastra into the groove provided in the latter. Its posterior edge and caudal process, as well as the nature of any fontanelle that may have existed below, cannot be determined as the anterior end of the hyoplastron is also missing.

The xiphiplastron is stout and adheres to the hypoplastron by a strong suture. Antero-laterally a prominent spur is developed to fit a matching
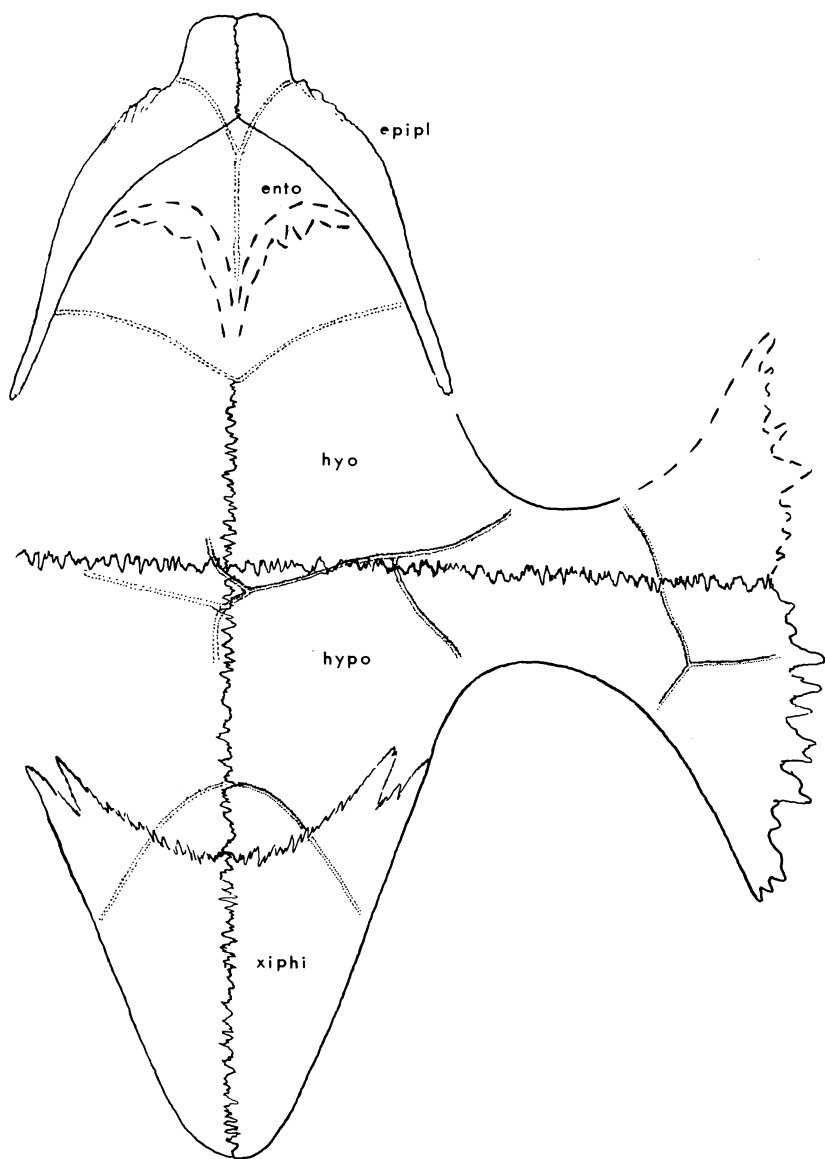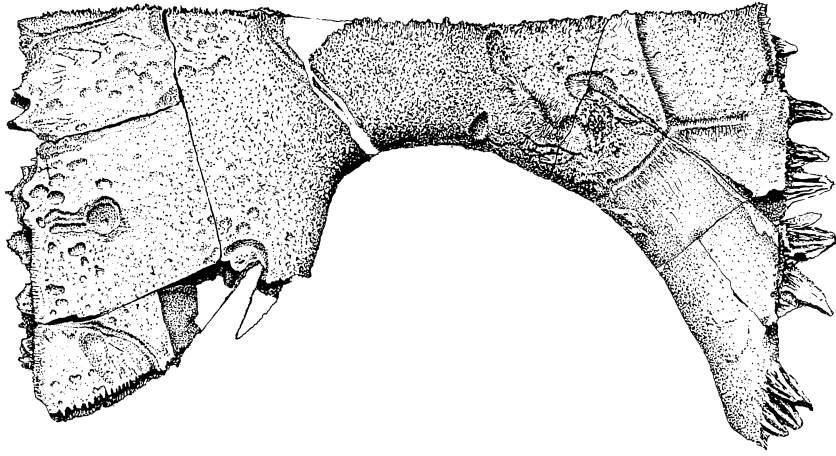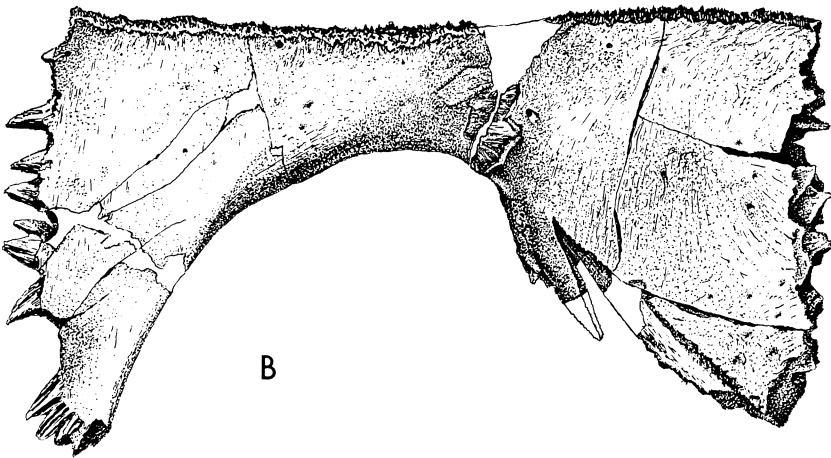
Figure 4
Restoration of plastron of *Protochelydra zangerli*. Dotted
lines indicate unknown areas.

3 cm

A

B

Figure 5
Protochelydra zangerli, P70.20.430 hypoplastron. A.
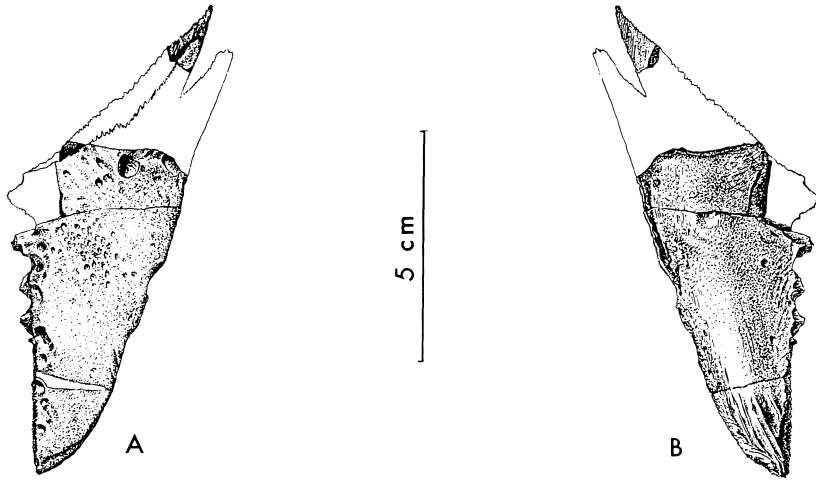Ventral, B. dorsal views.

Figure 6
Protochelydra zangerli, P70.20.430 xiphiplastron. A.
Ventral, B. dorsal views.

V-shaped cleft in the hypoplastron (Figs. 5, 6). Posteriorly it is striated on its dorsal side. The xiphiplastra are joined tightly along their inner margins by sutures to form the rather short posterior lobe of the plastron.

The shield pattern of the lower shell can be determined except for the anterior lobe (Fig. 4).

A single carapacial bone is available (Fig. 7). This is considered as the tenth right peripheral of an adult individual. It is about as wide as long and has a deep pit for reception of a rib end about midway on its inner edge. From this and the plastron, the following can be stated regarding the upper shell:

(1) The carapace is broad, overhangs posteriorly, and is somewhat scalloped as suggested by figure 7. (2) It is typically chelydrid in construction where it meets the plastron. This is evident in the outer extremities of the hyo-hypoplastra (Fig. 4). (3) Some posterior peripherals at least have no sutural adherence to costal elements; therefore, a fontanelle is present. The degree of fontanellization is uncertain, but one would expect it to be notable as judged from the present adult-sized peripheral. (4) The posterior marginal shields are arranged in a pattern wherein the medial furrow for the marginal scute is located on the peripheral

near its inner edge. This is at least true of the tenth and at least partially for the nineth and eleventh. It further determines that the costal scute spans the fontanelle to reach the marginal scute. (5) The present tenth peripheral, as noted, has a deep pit to accommodate the distal end of the eighth costal. Since the eleventh peripheral would be without such a pit and rib association, the full chelÿdrine complement of eleven peripherals was present. This is in contrast to the full complement of only ten peripherals in other chelydrid subfamilies.
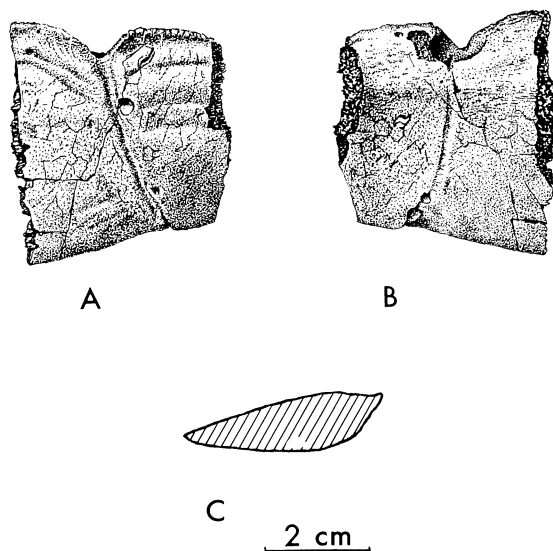

Figure 7
Protochelydra zangerli, P72.34.18, tenth right peripheral.
A. Dorsal, B. ventral views, C. sectional view at midlength.

DESCRIPTION OF OTHER ASSOCIATED ELEMENTS

A humerus, scapula, and unpaired ilia, are among the other postcranials associated with the holotype. It is quite likely that the first two and ilium, P72.24.17, belong to the type specimen. This cannot be established beyond doubt; thus, separate catalogue numbers have been allocated. The epiplastron, P72.34.21, (Fig. 8) should be cited here again as it may also represent the holotype. All are characteristically chelydrid in form.
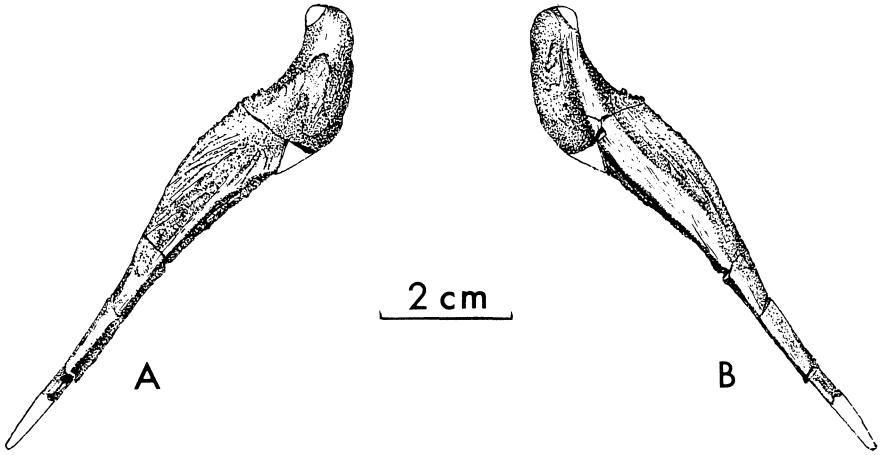
Figure 8
Protochelydra zangerli, P72.34.21 epiplastron. A. Ventral,
B. dorsal views. Restored portion in outline.

The humerus (Fig. 9) is small and retains its original shape and matches *Chelydra* except in one minor feature. The only peculiar aspect of this bone is a wide, flat area on the lateral tubercle that is defined by a sharp ridge on its inner side.
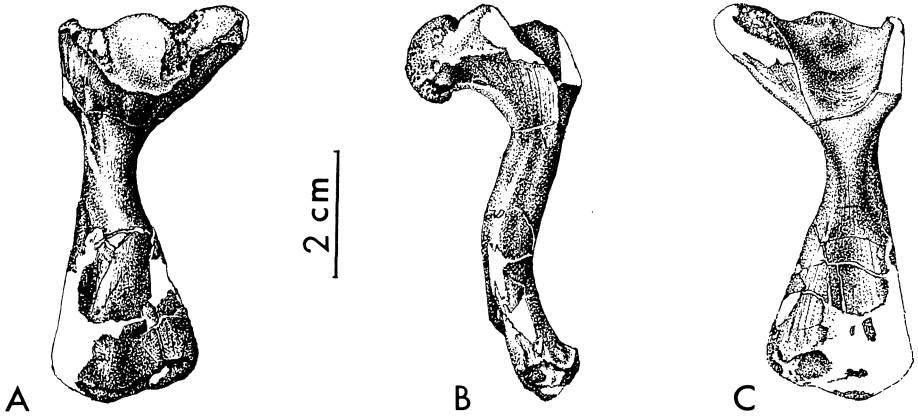

Figure 9
Protochelydra zangerli, P72.34.15, left humerus. A.
Dorsal, B. lateral, C. ventral views. Restored part
shown in outline.

The scapula (Fig. 10) lacks its extremities but is otherwise unaltered and remarkably similar to the extant form. Again only minor distinction is detected. The anterior side of the dorsal process is tapered into a ridge for the lower one-third of its length.

The unpaired ilia are uncrushed. The larger specimen (Fig. 11) is about twice the size of the other bone. It is nearly an exact copy of the ilium of *Macroclemys* with the addition of a small prominence situated on the anterior border just below the striated upper surface. This occurs on both specimens.

Figure 10
Protochelydra zangerli, P72.34.16, left scapula.
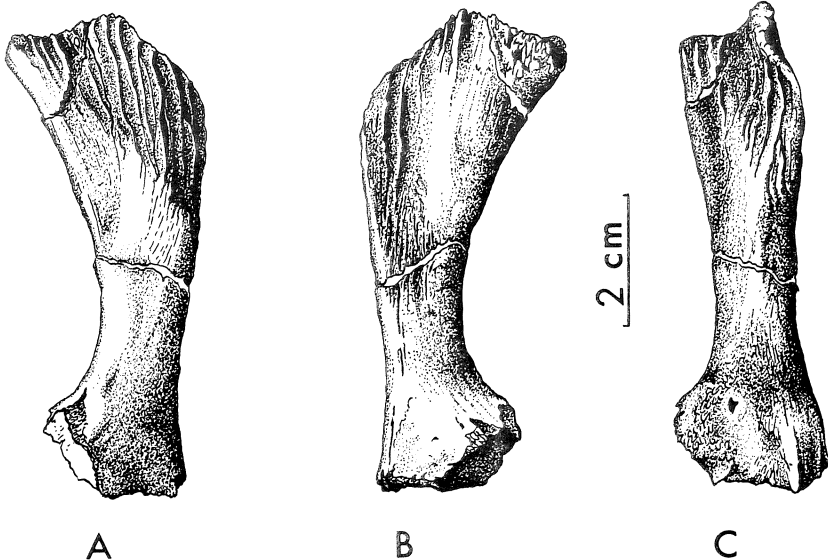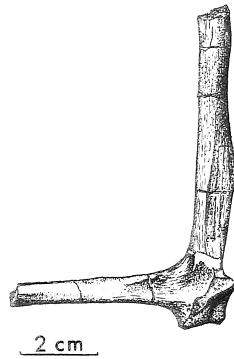Anterior view, extremities not restored.

2 cm

2 cm

A   B   C

Figure 11
Protochelydra zangerli, P71.16.255, right ilium.
A. Lateral, B. medial, C. anterior views.

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DISCUSSION

It is not altogether unexpected to discover a chelydrid so early in the North American Tertiary, especially a member of the chelydrinae, which is generally accepted as the most primitive of the three subfamilies of chelydridae. It is enlightening, however, because of the lack of a previous chelydrid record older than the Oligocene.

Chelydrines today occupy a considerable range in North America. *Chelydra* itself, to which the fossil is closely allied, roughly inhabits the eastern half of the continent and extends southward into Central and South America. In the late Tertiary (Pliocene) and Pleistocene, its range was evidently wide as well in spite of the relative paucity of fossils to record it. Hibbard (1963), Galbreath (1948), and Hay (1916) have reported various occurrences.

The highly specialized alligator snapping turtle *Macroclemys* is today confined to the lower half of the Mississippi drainage. In the Miocene and Pliocene its distribution included the great plains. Zangerl (1945) described *M. schmidti,* new species, and *M. temminckii* from the middle Miocene of Nebraska and early Pliocene of South Dakota respectively. Others, viz., Hay (1908) and (1911), Hibbard (1963), and Dobie (1968), reported later occurrences from the plains as well as the Florida region. Apparent European chelydrines are well known from certain deposits of Oligocene and younger Tertiary (Meyer, 1852) and others. Williams (1952) states, "In the Miocene of both Europe and North America there is a flowering-out — real or apparent — of chelydrine types."

From the present material one cannot definitely conclude that North America was the center of chelydrid evolution. Yet in considering the probable relationship of the new form to the North American chelydrines, it does show a very early development of the group and a most plausible center of radiation — a radiation that surely was taking place during Cretaceous times. In the new specimen one might also logically find a generalized ancestral type or something close to it from which even the later, more advanced chelydrid subfamilies were derived. The complete temporal emargination, development of a secondary palate, reduction of postorbital bar, and quadrate-stapes relationship found in advanced chelydrids could all have evolved from such a type.

Williams (ibid) comments on the possible special relationship of *Hoplochelys* (Paleocene) and *Baptemys* (Eocene) to the chelydridae. Unfortunately the skull of the former is unknown; yet, it is otherwise in general agreement with *Baptemys,* whose skull is un-chelydrid in character. The carapace and plastron of these genera are also not like that of the new form. Similarity of age would further rule out an ancestral tie for either but not the possibility of chelydrid kinship.

Although the families chelydridae and testudinidae show significant morphological distinctions, their alliance should be mentioned. Williams (ibid.), in suggesting a possible Cretaceous separation point for the two families, was not far off. In comparing it to testudinids, the most primitive of chelydrids is shown to be as distinctive as later genera and would support the notion of at least a late Cretaceous cleavage of families.

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