BIOLOGY 622 – FALL 2014
BASAL AMNIOTA - STRUCTURE AND PHYLOGENY

WEEK – 3
EUPELYCOSAURIA

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INTRODUCTION

Recall the Synapsida is one of the two great groups of the Amniota *sensu stricto* (the other being Reptilia). Within Synapsida, two subgroups are known, the Caseasauria and the Eupelycosauria.

The term "Eupelycosauria" has been adopted in part as a reaction to the realization that "Pelycosauria" is technically a polyphyletic group, as it does not include all members of the group derived from it. So, notably, Eupelycosauria technically includes all therapsids and mammals as well.

We are focusing only the basal-most members.

As stated earlier, the familial designations of Romer and Price (1940) have in many cases held up, however, the interrelationships of those families have been subject to some change.

MODERN INTERPRETATIONS OF PHYLOGENETIC RELATIONSHIPS OF BASAL SYNAPSIDS (I.E "PELYCOSAURS")

The work of Reisz (1980, 1986), Reisz et al (1992), and Berman et al (1995) have confirmed the validity pelycosaurian families, and placed them in two distinct groups:

SYNAPSIDA

- Caseasauria
  - Family Eothyrididae
  - Family Caseidae
- Eupelycosauria
  - Family Varanopseidae
  - Family Ophiacodontidae
  - Family Edaphosauridae
  - Sphenacodontia
    - *Haptodus*
    - *Palaeohatteria*

Pantelosaurus
Cutleria
Sphenacodontoidea
Family Sphenacodontidae
Therpasida (leading to mammals)

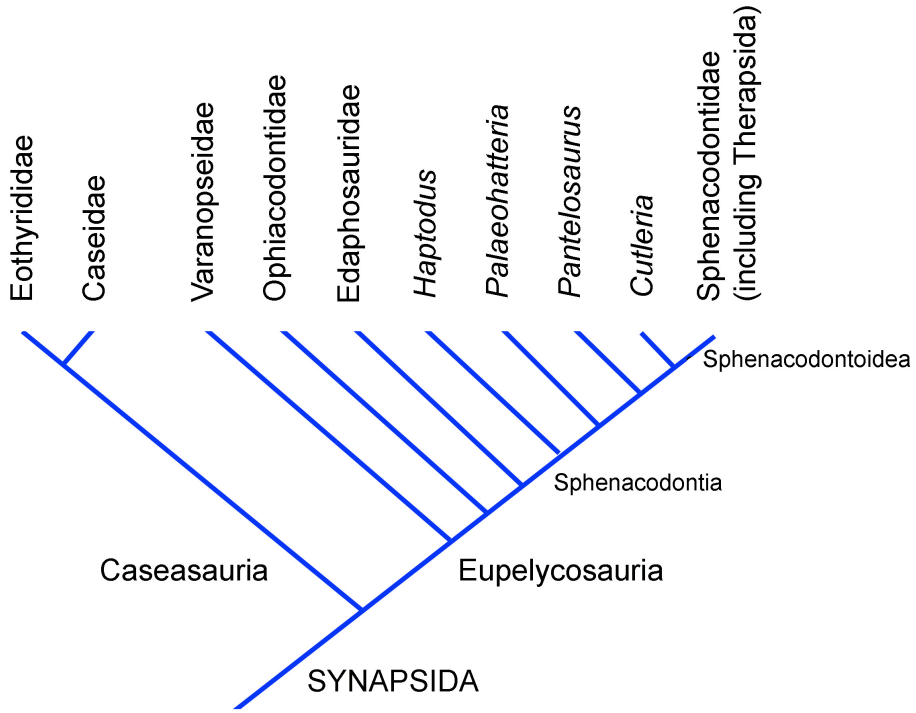
EUPLEYCOSAURIA: DEFINITION

Eupelycosauria is defined as those taxa bearing all basal synapsid synapomorphies with the following unique features: (1) a long, narrow supratemporal. (2) The frontal contributes to at least one third of the dorsal orbital margin.

Haptodus, Palaeohatteria, Pantelosaurus, and *Cutleria* are all genera that used to be placed in a distinct group known as the "Haptodontidae" or Haptodontinae"; but that has been shown to be a structural grade as opposed to a monophyletic family or subfamily.

THE MAJOR GROUPS OF EUPELYCOSAURIA

OVERVIEW: What seems clear is that a few features are common to all eupelycosaurs, but as Romer determined as far back as 1940, there are certain families that have been robust in terms of their stability over many years.

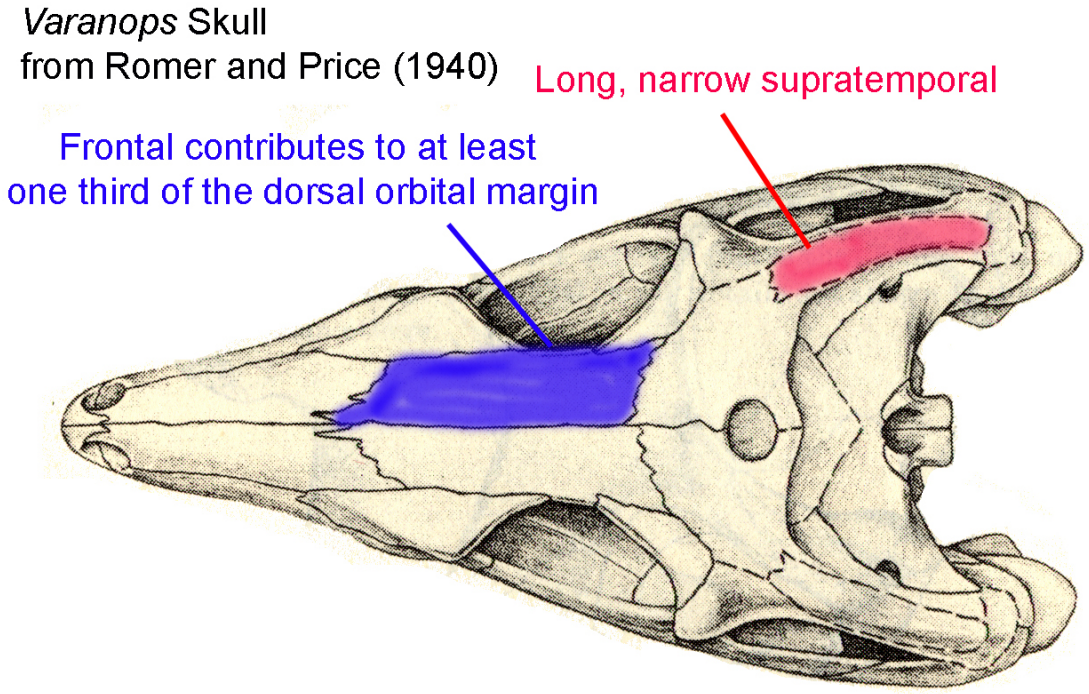


Following are features that define major subdivisions of the Eupelycosauria. I will address them only briefly, as the major groups will be covered by the class presenters for the day.

Defining Features of EUPELYCOSAURIA

1. A long, narrow supratemporal. The supratemporal of caseasaurs is almost as wide as long (length to width ratio less than two).
2. The frontal contributes to at least one third of the dorsal orbital margin (the orbital contribution of the frontal is narrower in caseasaurs).

In this case a varanopid skull provides a basal example of a eupleycosaur to show these features.

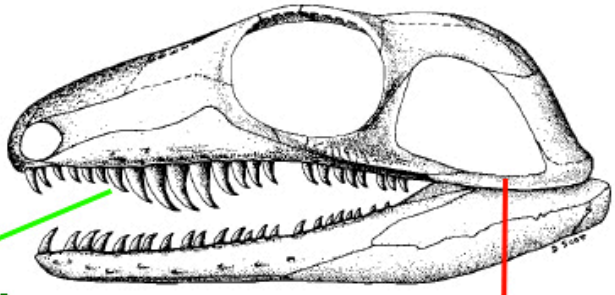


Defining Features of VARANOPSEIDAE

1. Marginal dentition composed of strongly curved, mediolaterally flattened teeth.
2. Occipital flange of squamosal reduced.
3. Narrow zygomatic arch.

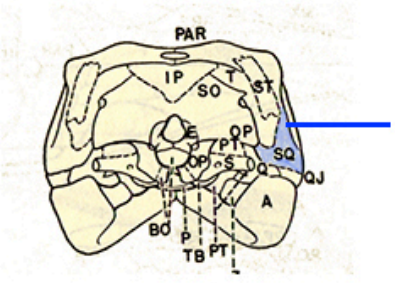
Following is one of the most famous specimens of a varanopid, *Aerosaurus* from the Early Permian of northern New Mexico.

Aerosaurus
Left lateral view
From Langston and Reisz (1981)



Marginal dentition composed of strongly curved, mediolaterally flattened teeth.

Narrow zygomatic arch

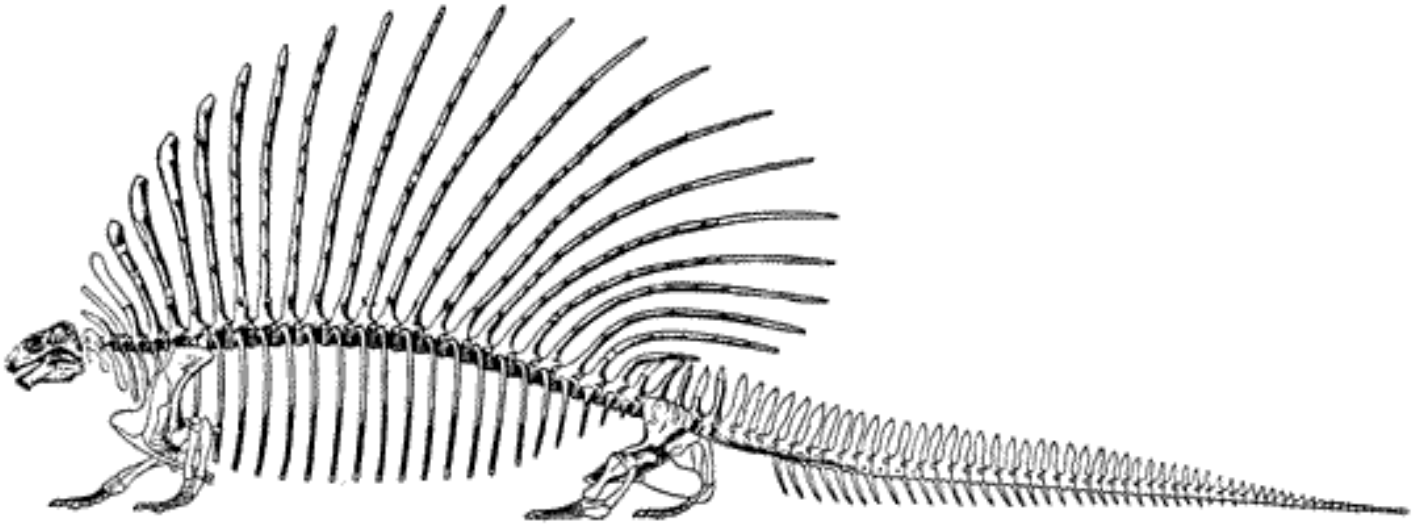


Occipital flange of squamosal reduced

Varanops
Occipital view from
Romer and Price (1940)

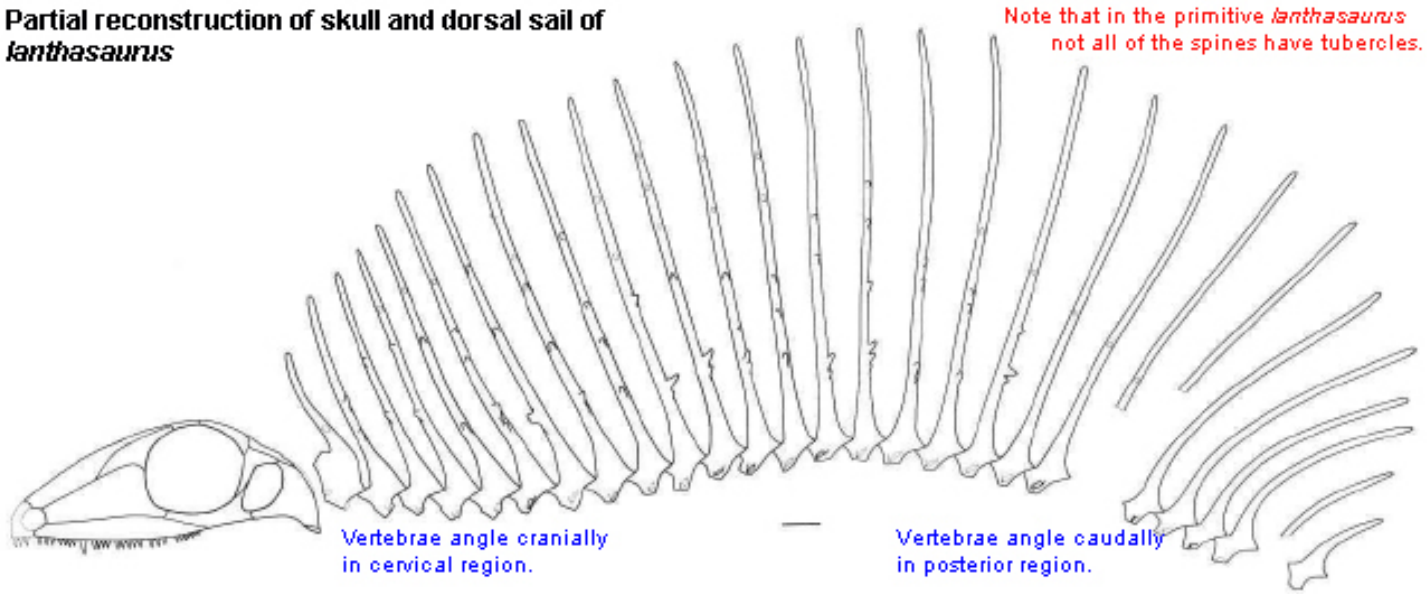
Defining Features of EDAPHOSAURIDAE

The Edaphosauridae are the other pelycosaurian group to (independently) develop a dorsal sail. However it is quite different from that of sphenacodontids. They are also well known as one of the early amniote experiments in herbivory.



The defining features of the family contribute to the peculiar morphology of the sail of edaphosaurs.

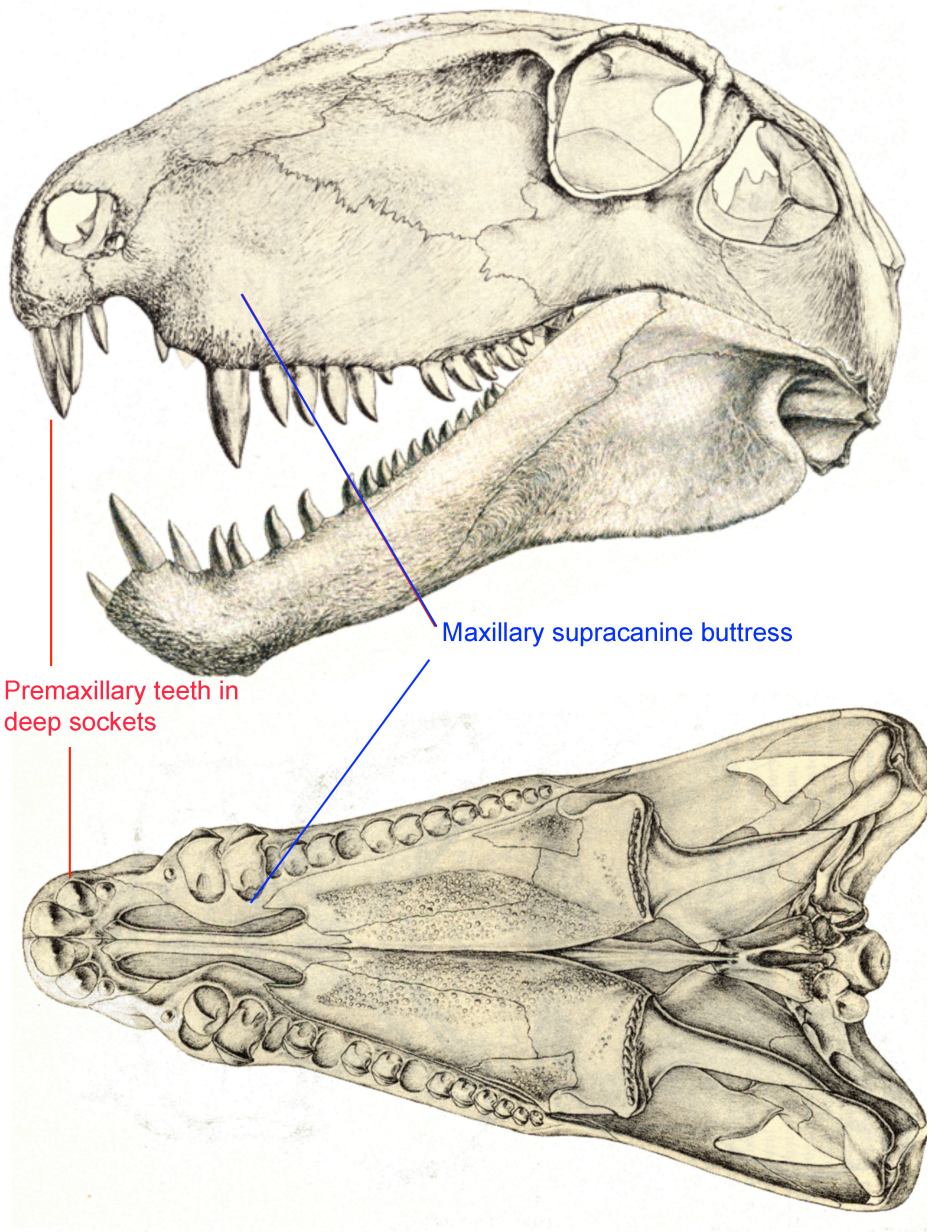
1. Presence of lateral tubercles on (at least some) of the neural spines.
2. Neural spines long and circular in cross-section distal to a laterally compressed proximal section.
3. Cervical neural spines lean anteriorly, whereas posterior spines lean posteriorly.



Defining Features of SPHENACODONTIA

1. Maxillary supracanine buttress present (this structure is a thickening of the maxilla visible on its internal surface, dorsal to the caniniform teeth).
2. Premaxillary teeth in deep sockets. The teeth of other synapsids are implanted in shallow sockets.

Example following is from *Dimetrodon*.



The "Haptodontine Grade" of Organization

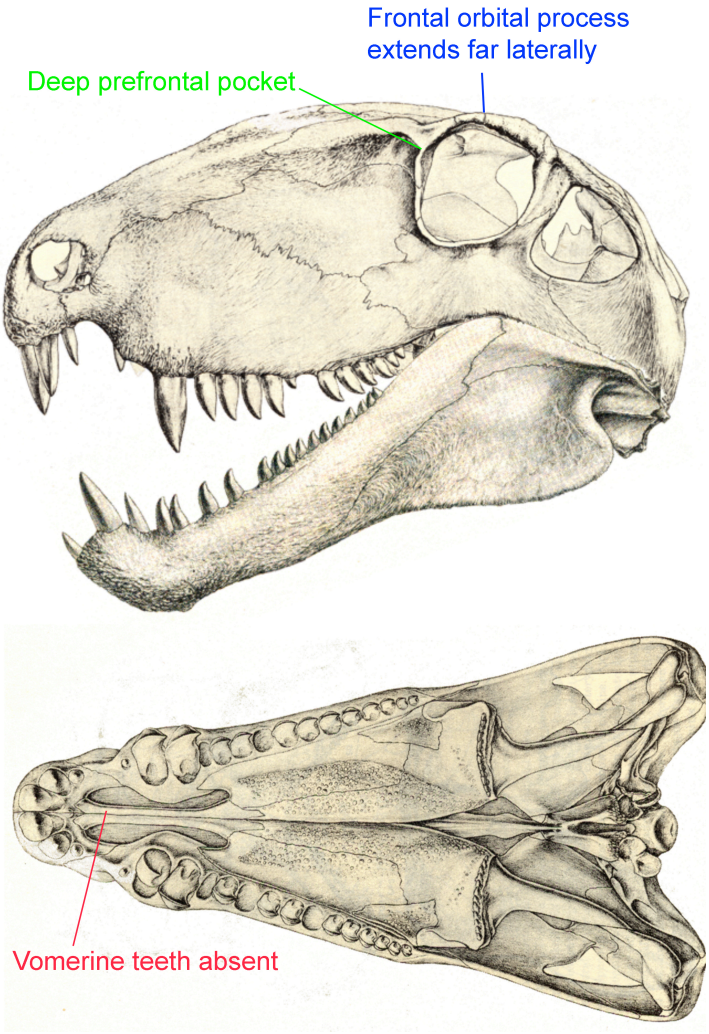
Haptodus and the genera usually considered to be closely related to it have traditionally been lumped together in the family Haptodontidae or subfamily Haptodontinae. However, recent work has suggested they instead represent a series of small transitional genera between Sphenacodontines and more basal eupelycosaurs.

I will leave the survey of this non-formal grouping to the presenters.

Defining Features of SPHENACODONTOIDEA

1. Frontal orbital process extends far laterally (it is poorly developed, if present, in other synapsids).
2. Deep prefrontal pocket (a concavity near the anterodorsal edge of the orbit).
3. Vomerine teeth absent (the vomer bears a shagreen of denticles in other synapsids).

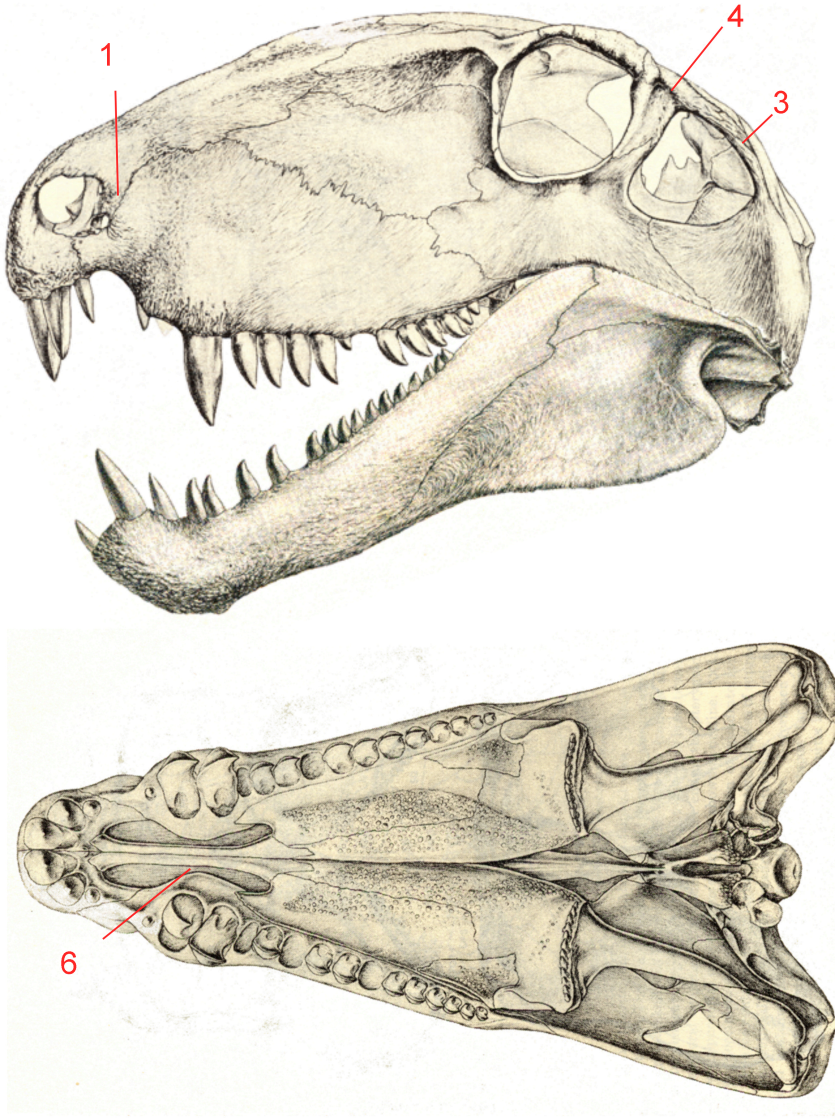
Example following is from *Dimetrodon*.

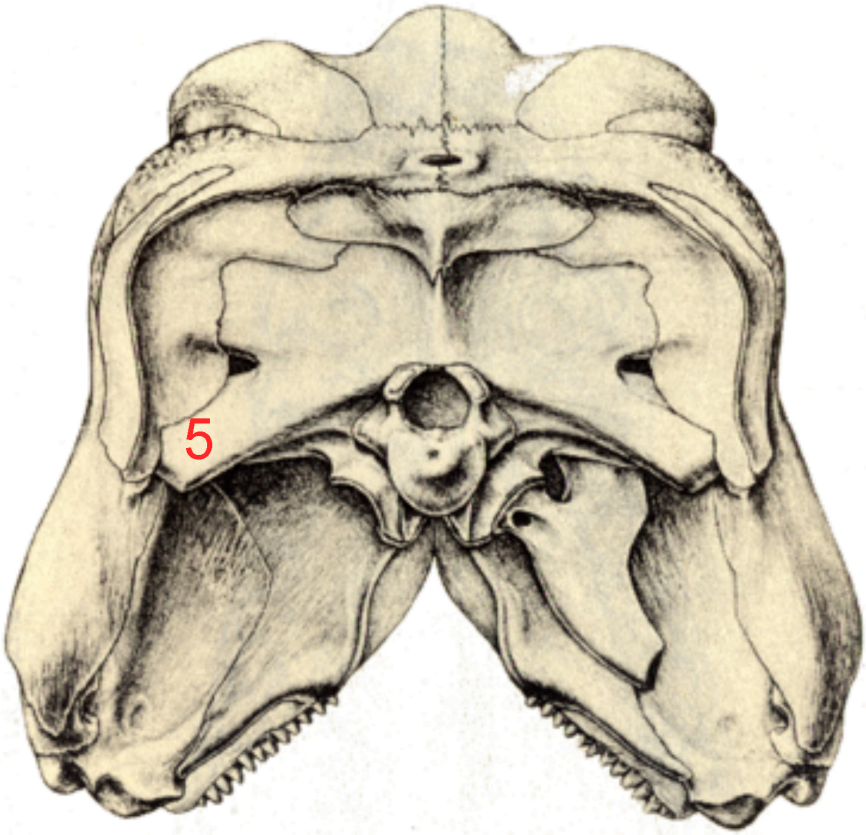


Defining Features of SPHENACODONTIDAE

1. Presence of a ventral narial process of the nasal (just posterior to the external naris)
2. Frontal anterior process narrower than its posterior process (these two processes are equally wide in other synapsids).
3. Postorbital-squamosal contact extensive (this contact is narrow in other synapsids, when present) .
4. Supratemporal contacting postorbital (this contact is absent in most other eupelycosaurs).
5. Paroccipital process extends ventrolaterally and posteriorly (it extends laterally in most other synapsids).
6. Caniniform root bulges into choana (in other synapsids, the caniniform tooth does not constrict the choana).

Example following is from *Dimetrodon*.

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EUPELYCOSAURIAN GENERA

FAMILY	SUBFAMILY	GENUS	AGE	LOCALITY
VARANOPSEIDAE	Varanodontinae	*Aerosaurus*	Early Permian	New Mexico
		Varanops	Early Permian	Teas, Oklahoma
		Varanodon	Early Permian	Oklahoma
		Elliotsmithia	Late Permian	South Africa
		Ruthromia	Late Pennsylvanian	New Mexico
		Tambacarnifex	Early Permian	Germany
		Watongia	"Middle" Permian	Oklahoma
	Mycterosaurinae	*Heleosaurus*	Late Permian	South Africa
		Mesenosaurus	Late Permian	Russia
		Mycterosaurus	Early Permian	Oklahoma
		Pyozia	Middle Permian	Russia
OPHIACODONTIDAE		*Archaeothyris*	Late Pennsylvanian	Nova Scotia
		Clepsydrops	Late Pennsylvanian	Illinois
		Ophiacodon	Late Pennsylvanian, Early Permian	Kansas, Texas, New Mexico, Colorado, England
		Varanosaurus	Early Permian	Texas, Oklahoma
EDAPHOSAURIDAE		*Ianthasaurus*	Late Pennsylvanian	Kansas
		Xyrospondylus	Late Pennsylvanian	Colorado
		Edaphosaurus	Early Permian	Texas, West Virginia, Pennsylvania
		Lupeosaurus	Early Permian	Texas
		Glaucasaurus	Early Permian	Texas
(Unassigned)		*Haptodus*	Late Pennsylvanian	France, England
		Paleohatteria	Early Permian	Germany
		Pantelosaurus	Early Permian	Germany
		Cutleria	Early Permian	Colorado
SPHENACODONTIDAE		*Sphenacodon*	Late Pennsylvanian, Early Permian	Utah, Arizona
		Ctenorhachis	Early Permian	Texas
		Ctenospondylus	Early Permian	Utah
		Dimetrodon	Early Permian	Germany, Texas, New Mexico
		Secodontosaurus	Early Permian	Texas
		Cryptovenator		