= Struthiosaurinae =

Struthiosaurinae is a subfamily of ankylosaurian dinosaurs from the Cretaceous of Europe . It is defined as " the most inclusive clade containing Europelta but not Cedarpelta , Peloroplites , Sauropelta or Edmontonia " while being reinstated for a newly recognized clade of basal nodosaurids . Struthiosaurinae appeared at about exactly the same time as the North American subfamily Nodosaurinae . Struthiosaurines range all across the Cretaceous , the oldest genus being Europelta at an age of 112 Ma and the youngest being Struthiosaurus at about 85 ? 66 Ma .

It was originally mentioned by Franz Nopcsa in 1923 as a subfamily of Acanthopholidae , along with the previously defined Acanthopholinae . The family has gone through many taxonomic revisions since it was defined by Nopcsa in 1902 . It is now recognized as a junior synonym of the family Nodosauridae . The subfamily now includes the genera Anoplosaurus , Europelta , Hungarosaurus , and Struthiosaurus , designated as the type genus . Because of the instability of Acanthopholis , the generic namesake of Acanthopholinae , and its current identification as a nomen dubium , Struthiosaurinae , the next named group , was decidedly used over the older one .

A review of ankylosaur osteoderms was published in 2000 , and reviewed the armour of Struthiosaurinae . The group was represented by the single genus Struthiosaurus , known from head , cervical , dorsal , sacral , and caudal scutes . Only a few head osteoderms were identified , so it is unknown how much of the skull was armoured . Many cervical and dorsal scutes have been preserved alongside species of Struthiosaurus . They include cervical bands , which are groups of osteoderms fused together and attached to the vertebrae , and large spines found on the shoulders of nodosaurids like Sauropelta and Edmontonia , although it is not known if the spines were fused like the later of separate like the former . It is quite possible that small ovoid scutes found on Struthiosaurus could have formed a pelvic shield like polacanthids . The caudal scutes of struthiosaurines are small and rough . Even though osteoderms are well @-@ known , it is not certain where they were positioned on the body .

= = Classification = =

Struthiosaurinae is a group named by Franz Nopcsa , that was reinstated by James Kirkland for a group of just @-@ european nodosaurids .

= = = History = = =

Baron Franz Nopcsa , in 1902 , proposed a new grouping of dinosaurs , Acanthopholididae , a clade of lightly @-@ built thyreophorans . He included in it the genera Acanthopholis , Polacanthus , Syngonosaurus , Struthiosaurus , and possibly Nodosaurus . Soon after , he also added Priodontognathus and Palaeoscincus . He considered Acanthopholididae to be the sister clade to Stegosauridae , and also stated that it might include Hylaeosaurus , which he found had most of the characteristics of the family . Later , in 1915 , he rearranged the species included in it . The genera that were later included were Acanthopholis (= Anoplosaurus) , Polacanthus , Stegopelta , Stegoceras , and Struthiosaurus . Along with Ankylosaurus , Acanthopholididae was defined to form a subfamily of Nodosauridae . In 1923 he divided up the family into two subfamilies without comment . These two subfamilies were named Acanthopholinae and Struthiosaurinae .

In the same year , he corrected the subgroups of Thyreophora . He placed Acanthopholididae , Stegosauridae and Ceratopsidae together inside the group . Five years later , he corrected the name of the family to Acanthopholidae , which is now the correct spelling . In the same publication , he also changed the genera included . He assigned Hylaeosaurus , Stegoceras , Struthiosaurus , and Troodon inside it but moved Stegopelta and Ankylosaurus into the family Ankylosauridae . Nopcsa then downgraded the phylogenetic rank of Acanthopholidae to make it a subfamily inside Nodosauridae . The clade was defined to include Ankylosaurus and Acanthopholinae . Inside Acanthopholinae he placed Acanthopholis , Hylaeosaurus , Rhodanosaurus , Struthiosaurus , and Troodon . Now considered as an artificial grouping , it was defined to include dinosaur taxa now

considered to be polacanthids , a pachycephalosaur and Acanthopholis , a genus that is widely considered to be dubious . Acanthopholidae and Acanthopholinae are now dubious groups since the validity of Acanthopholis has changed .

= = = Phylogeny = = =

Historically , Struthiosaurinae has been considered a junior synonym of the family Nodosauridae by Walter P. Coombs in 1978 and Tatyana Tumanova in 1987 , or a sister clade to Edmontoniinae , Panoplosaurinae , Stegopeltinae , and Sauropeltinae by Tracy L. Ford in 2000 . Kirkland and his colleagues followed Ford in using Struthiosaurinae as a clade of basal nodosaurids , but concluded that the only other subfamily of Nodosauridae was Nodosaurinae . According to Kirkland et al . , Acanthopholinae was not an acceptable classification for the new clade of previously unrecognized nodosaurids because of the instability of Acanthopholis . Struthiosaurinae was decided on as the name of the clade , as it was the next published term after Acanthopholinae . To ensure the group was rendered valid , Kirkland et al. redefined Struthiosaurinae as the most inclusive clade containing Europelta but not Cedarpelta , Peloroplites , Sauropelta , or Edmontonia . This definition includes the genera Anoplosaurus , Europelta , Hungarosaurus and Struthiosaurus inside the newly defined group . Below is a cladogram from before the recognition of the clade Struthiosaurinae .

= = Description = =

Struthiosaurines are well @-@ known , and include one of the best @-@ preserved species of ankylosaur , Europelta carbonensis .

= = = Osteoderms = = =

In 2000 , Ford published a complete description of ankylosaurian osteoderms , in which he recognized the group Struthiosaurinae . Ford 's description of Struthiosaurinae was based on the genus Struthiosaurus . Ford found that Struthiosaurus transylvanicus lacked any remains of the jugal , which makes a jugal scute unknown . The skull roof of T. transylvanicus is large and bulbous , preserving a large , flat scute on top , and no osteoderms behind the orbits . Another species , S. austriacus , is known from two incomplete skulls , which preserved irregular scutes parallel to the orbits along the cranium .

Scutes from the postcranial region of the skeleton are also known from struthiosaurines . Cervical bands have been found on S. austriacus , as well as S. sp .. The cervical bands are preserved as a groups of two or three osteoderms that are fused with a large neural spine on the medial edge , and attached to each other through small ovular scutes with short rounded peaks . The scute attaching to the neural spine has a round ridge with a shallow depression ovular in shape . One band was preserved with a primary osteoderm that was angled across the neck from side @-@ to @-@ side and was as long as the whole band itself . The base of the scute is rounded and ends with a tapered point , and the upper side of the scute has a smooth , lightly arching shape . Other bands are preserved with a triangular osteoderms with flat tops and rounded bottoms . The exact placement of cervical bands is not known . In 1995 , Pereda @-@ Suberbiola et al. suggested that in a more traditional placement , the bands would have been horizontal along the body , with the neural spine in the middle of the back . That positioning would mean that the medial scute would be next to another osteoderm of equal size , and together they would either fuse , like in Edmontonia , or touch , as in Sauropelta . Another possibility , suggested by Ford , was that the bands were along the side of the neck , pointing dorsally . If oriented along the side , the primary scutes would have pointed up and down , like in polacanthids , and the medial scutes would , by definition , become secondary osteoderms . The set of medial scutes (or secondary) would be possibly oval in shape .

Thoratic scutes on struthiosaurines are oval to teardrop shaped , and possess sharp ridges that rise distally . Some scutes were long and had small domes on them . The first primary osteoderms on the pelvis are large , compressed from the sides , and have a sharp , short point . S. sp. was

preserved with five fragmentary scutes from the pelvis . One fragment includes two small scutes with a ridge down the middle , joining the two together , and a compressed osteoderm with a small spike . It is thought that the fragment was from the edge of the pelvic region . Another fragment includes two oval osteoderms with small ossicles fused between them . Pelvic shields were probably formed on struthiosaurines by these scutes .

Caudal scutes have been preserved on struthiosaurines . The osteoderms are compressed inwards from the side , have a slope positioned anteriorly , and a square @-@ shaped posterior edge .

= = = Distinguishing anatomical features = = =

All ankylosaurs that possess these characteristics - a narrow predentary ; a nearly horizontal quadrate that is not fused and is oriented 30 degrees from the skull roof ; the presence of mandibular condyles that are three times wider than long ; premaxillary and dentary teeth that are near a symphysis with the front of the lower jaw (the predentary) ; a sacrum arched on top ; an acromion process above the midpoint of the scapula to coracoid attachment ; a straight ischium with a straight dorsal margin ; relatively long , slender limbs ; sacral shield armour ; and the presence of erect pelvic osteoderms with flat bases - form a clade of basal nodosaurids , the Struthiosaurinae . That set of cranial and postcranial features are only present on genera considered to be in the clade . The features above distinguish Struthiosaurinae from other clades and genera found by other analysis ' .

= = Biogeography = =

The near simultaneous appearance of nodosaurids in both North America and Europe is worthy of consideration , because at the time , they were separated from each other by a huge body of water . Europelta is the oldest nodosaurid from Europe ; it is derived from the lower Albian Escucha Formation . The oldest western North American nodosaurid is Sauropelta , from the lower Albian Little Sheep Mudstone Member of the Cloverly Formation , at an age of 108 @.@ 5 ± 0 @.@ 2 million years . Eastern North American fossils seem older . Teeth of Priconodon crassus have been derived from the Arundel Clay of the Potomac Group of Maryland , which dates near the Aptian ? Albian boundary . A Propanoplosaurus hatchling was uncovered from the base of the underlying Patuxent Formation , dated to the upper Aptian , making Propanoplosaurus the oldest nodosaurid .

Polacanthids are known from pre @-@ Aptian fauna from both Europe and North America . The timing of the appearance of nodosaurids on both continents indicates the origins of the clade preceded the isolation of North America and Europe , thereby pushing the group 's date of evolution back to at least the middle Aptian . The separation of Nodosauridae into European Struthiosaurinae and North American Nodosaurinae by the end of the Aptian provides a revised date for the isolation of the continents from each other with rising sealevel .

Struthiosaurinae is one of the longest @-@ lasting groups of ankylosaurians . They range from Europelta at 112 Ma to Struthiosaurus , which lived until the uppermost Cretaceous , or 66 Ma . In between those two early and late struthiosaurines are the genera Anoplosaurus and Hungarosaurus . Hungarosaurus is younger , at about 85 Ma , from the late Santonian of the Csehbánya Formation . Anoplosaurus is a fair amount older , at about 100 Ma , from the late Albian Cambridge Greensand .