

SUPPLEMENTARY INFORMATION

S1 Distal humerus morphology in Thyreophora

Methods

As in most dinosaurs, the morphology of the distal part of the humerus is variable among taxa (and, to a lesser degree between individuals, e.g. Penkalski [S1]), especially with respect to the relative size and morphology of the distal condyli. However, the systematic distribution of these differences has not been considered yet for the purpose of assigning distal humeri of thyreophorans to distinct subclades of the group.

Data mining across a wide range of thyreophorans shows that the relative **proximodistal** position of the distal condyli is promising for a systematic distribution. We used references for humeri of all available stegosaurian and ankylosaurian taxa from the literature. To establish and qualify the position of the distal condyli, we compared (in anterior aspect of the humerus) the distance between the points, where a horizontal line, tangential to the distalmost point of each condylus intersect a line parallel to the diaphysis in a **right** angle (Fig. S1-1). If these lines meet in the same location, the condyli are considered equal in **proximodistal** expansion (Fig. S1-1A); if the line tangentially to the condylus ulnaris intersects above that one tangentially to the condylus radialis, the latter is considered to protrude (**antero**)distally (Fig. S1-1B) and vice versa (Fig. S1-1C). In fact, the protrusion of the condyli **has** also an anterior component, which is obscured when seen from the posterior side of the humerus, which then results in an underestimation of the condylar inequality. Due to the variability of source quality we choose to present the results in a qualitative form (Tab. S1-1).

Results

A comparison of the distal humerus morphology shows clear differences between stegosaurs and ankylosaurs. In stegosaurs uniformly the condylus ulnaris is anterodistally protruding. The protrusion is generally well marked, at least in adult specimens.

Contrary, most ankylosaurian taxa share a condition where both condyli are located at the same plane, only in *Cedarpelta bilbeyhallorum*, „*Crichtonsaurus*“ *benxiensis*, and *Peloroplites cedrimontanus* the condylus radialis is protruding anterodistally. Among the surveyed taxa only two exceptions were **recognized**: In *Hungarosaurus tormai* the condylus ulnaris is more protruding distally than the condylus radialis, though the latter is larger in overall size (Ösi & Makádi [S2]). In *Saichania chulsanensis* the condylus ulnaris is more massive and protruding **distally** than the condylus radialis (Maryanska [S3]: pl. 35, fig. 1b). In the latter taxon, as well as in an indetermined ankylosaurine humerus (possibly belonging to *Scolosaurus cutleri* Nopcsa, 1928 [S4], see Penkalski & Blows [S5]: fig. 6a), the condylus radialis is reduced in size and prominence but the laterodistal margin of the humerus is formed by a flange-like, large ectepicondylus.

In the few instances where a series of individuals of the same species is described (*Euoplocephalus tutus*: Penkalski [S1]; *Ankylosaurus magniventris*: Carpenter [S6]; *Stegosaurus armatus*: Gilmore [S7], Galton [S8]), the inequality in condylar protrusion can vary between individuals. However, the current record indicates that if a protrusion is recognizable, within the same species, always the same condylus protrudes. The morphology of the distal condyles may be strongly influenced by the ontogenetic stage of the individual due to increasing ossification of the epiphyseal cartilage with increasing individual age (**e. g. Holliday et al. [S9]**).

According to this dataset, an anterodistally protruding condylus ulnaris is the common condition in Stegosauria and occurs very rarely in Ankylosauria. **An equality of** distal protrusion of **both condyli** is the common condition in Ankylosauria with some taxa showing an anterodistal protrusion of the condylus radialis. The latter conditions are entirely unknown in Stegosauria, though the inequality in **distal** condylar protrusion **is less pronounced in some juvenile individuals of *Stegosaurus armatus* (see Galton [S8])**.

Based upon these results, we feel it justified to use the orientation of the distal condyli in thyreophorans to assign distal humeri to either of the subclades, further supporting a referral of GPM A3D.3 to the Ankylosauria.

References for Supporting Information Text and Table S1

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