Comments on the juvenile *Megaraptor* specimen and systematic positions of megaraptoran theropods

In this paper, I comment on Porfiri *et al.* (2014), "*Juvenile specimen of Megaraptor (Dinosauria, Theropoda) sheds light about tyrannosauroid radiation*". Though Porfiri *et al.* provided numerous coelurosaurian characters on the *Megaraptor* specimen, their referral of the taxon to tyrannosauroidea is based on some problematic characters. Also, the specimen bears a feature which does not correspond to tyrannosauroidea. All things considered, the suggested evidences supporting the position of Megaraptora within tyrannosauroidea are weak.

Comments on juvenile *Megaraptor* specimen and systematic positions of megaraptoran theropods

(Response to Porfiri et al., 2014)

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ABSTRACTS

In this paper, I comment on Porfiri et al. (2014), "Juvenile specimen of *Megaraptor*(Dinosauria, Theropoda) sheds light about tyrannosauroid radiation". Though Porfiri et al. (2014) provided a numerus coelurosaurian characters on *Megaraptor* specimen, their referral the taxon to tyrannosauroidea is based on some problematic characters. Also, the specimen bears a feature which does not correspond to tyrannosauroidea. All things considered, the suggested evidences supporting the position of Megaraptora within tyrannosauroidea are weak.

Recently, Porfiri et al. (2014) reported a partial skeleton of a juvenile *Megaraptor*, including a partial skull. Based on its close resemblance to basal tyrannosauroids, such as features like D-shaped premaxillary teeth, large foramens on premaxilla, small first dentary alveolar compared to more posterior alveolus, the authors assigned *Megaraptor* and its close relatives to tyrannosauroids. Since the currently known megaraptorans, including *Megaraptor* clearly have numerous basal coelurosaurian features in cranial and postcranial bones(Novas et al., 2013; Porfiri et al., 2014), it is most parsimonious to assume that they are basal coelurosaurians rather than carcharodontosaurians as suggested before(Benson et al., 2010). However, their position within tyrannosauroidea is suspicious.

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Porfiri et al. (2014) stated that their juvenile *Megaraptor* specimen(MUCPv 595) has unfused nasals, unlike other tyrannosauroids(Holtz 2001, Li et al., 2009). Though they suggested this could be due to its juvenile condition, almost all other known tyrannosauroids have fused nasals even at young growth stages(Xu et al., 2004; Tsuihiji et al., 2011). Also, even the most basal tyrannosauroids have fused nasals as well(Xu et al., 2006), including "suggested" close relatives of megaraptorans like *Xiongguanlong* and *Eotyrannus*(Hutt et al., 2001; Li et al., 2009). Therefore, the unfused condition of nasal in *Megaraptor* casts doubts about its tyrannosauroid systematic position. Though we cannot dismiss the possibility about evolutionary reversals, no other tyrannosauroids have shown this yet.

It is worth to note that *Tanycolagreus*, the taxon which has unfused nasals(Carr and Williamson 2010), had assigned to tyrannosauroidea at least one author(Senter, 2007). However, the position of *Tanycolagreus* within tyrannosauroidea is in question, too(Rauhut et al., 2010).

Moreover, some cranial features of *Megaraptor* sharing with tyrannosauroids are rather more widespread within coelurosaurian dinosaurs. For example, D-shaped premaxillary teeth are found in non-tyrannosauroid coelurosaurs such as *Ornitholestes*(Zanno et al., 2011). All things considered, the current evidence supporting the position of Megaraptora within tyrannosauroidea are weak, and more complete known megaraptoran fossils and comparisons of them between basal tyrannosauroids and coelurosaurs would be necessary to solve this issue.

Benson, Carrano and Brusatte, 2010. A new clade of archaic large-bodied

predatory dinosaurs (Theropoda: Allosauroidea) that survived to the latest Mesozoic. Naturwissenschaften. 97(1), 71-78.

Carr and Williamson, 2010. *Bistahieversor sealeyi*, gen. et sp. nov., a new tyrannosauroid from New Mexico and the origin of deep snouts in Tyrannosauroidea. Journal of Vertebrate Paleontology. 30(1), 1-16.

Holtz, 2001. The phylogeny and taxonomy of the Tyrannosauridae. in Tanke and Carpenter (eds.). Mesozoic Vertebrate Life. 64-83.

Hutt, Naish, Martill, Barker and Newbery, 2001. A preliminary account of a new tyrannosauroid theropod from the Wessex Formation (Early Cretaceous) of southern England. Cretaceous Research. 22, 247-242.

Li, Norell, Gao, Smith and Makovicky, 2009. A longirostrine tyrannosauroid from the Early Cretaceous of China. Proceedings of the Royal Society B. 277(1679), 183-190.

Novas, Agnolin, Ezcurra, Porfiri and Canale, 2013. Evolution of the carnivorous dinosaurs during the Cretaceous: The evidence from Patagonia. Cretaceous Research. 45, 174-215.

Porfiri, Novas, Clavo, Agnolin, Ezcurra and Cerda, 2014. Juvenile specimen of *Megaraptor* (Dinosauria, Theropoda) sheds light about tyrannosauroid radiation. Cretaceous Research. 51, 35-55.

Rauhut, Milner and Moore-Fay, 2010. Cranial osteology and phylogenetic position of the theropod dinosaur *Proceratosaurus bradleyi* (Woodward, 1910) from the Middle Jurassic of England. Zoological Journal of the Linnean Society. 158(1), 155-

195.

Senter, 2007. A new look at the phylogeny of Coelurosauria (Dinosauria: Theropoda). Journal of Systematic Palaeontology. 5(4), 429-463.

Xu, Norell, Kuang, Wang, Zhao and Jia, 2004. Basal tyrannosauroids from China and evidence for protofeathers in tyrannosauroids. Nature. 431, 680-684.

Xu, Clark, Forster, Norell, Erickson, Eberth, Jia and Zhao, 2006. A basal tyrannosauroid dinosaur from the Late Jurassic of China. Nature. 439, 715-718.

Zanno, Lindsay E. and Makovicky, Peter J. (2011) 'On the earliest record of Cretaceous Tyrannosauroids in western North America: implications for an Early Cretaceous Laurasian interchange event', Historical Biology, First published on: 24 February 2011 (iFirst) To link to this Article: DOI: 10.1080/08912963.2010.543952