[JJ] Evening Poster | B (Biogeosciences) | B-PT Paleontology

[B-PT06]Biotic History

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The Biotic History session covers all aspects of ancient life and the history of biosphere through the geologic time. The study of ancient life is essential for unveiling mysteries of our planet earth. It also provides evidence for evolution of oceans, continents and island arcs. Modern progress in this field has been enhanced by interdisciplinary collaboration with allied sciences, such as paleoceanography and evolutionary biology. Our session intends to be a hub of communication amongst all earth scientists studying the biosphere; we welcome biological and biogeochemical approaches toward the understanding of the history of life.

[BPT06-P02]The homology of the vascular system in the forelimb of Reptiles

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The morphology of the forelimb in extant reptiles show a wide variety. In particular, the avian wing is highly specialized for powered flight, representing one of the major morphological transitions in the vertebrate evolution. The evolution and modifications of the forelimb skeleton and the associated musculature in the linage toward extant Aves have been well-documented. However, evolutionary analyses or reconstructions of the vascular system on this lineage have rarely been attempted. The vascular system transports various elements, including gases, heat and products of digestion that are necessary for various physiological activities, to and from tissues. Thus, information on the morphology of the vascular system is highly relevant in discussing organismal functions in extinct vertebrate animals. In the present study, the morphology of the vascular system in the forelimb of various extant reptiles were observed and described based on dissections and CT scan data. The main purpose of the present study was to establish homology hypotheses of vessels among reptiles. Such hypotheses then serve as the basis for inferring evolutionary sequences of morphological changes in the vascular system associated with powered flight in Aves.

In total, seven specimens were examined in this study: one specimen of *Varanus exanthemataicus* (Squamata, Varanidae), two specimens of *Chelydra serpentina* (Testudines, Cryptodira), one specimen of *Crocodylus porosus* (Crocodilia, Crocodilidae), one specimen of *Crocodylus siamensis* (Crocodilia, Crocodilidae), one specimen of *Columba livia* (Aves, Columbiformes) and one specimen of *Grus japonensis* (Aves, Gruiformes). The vascular systems in these specimens were injected with mixed solutions of latex and barium. The specimens were then CT-scanned and dissected for producing schematic diagrams of the vascular patterns.

The result shows that the morphology of the arterial system in the forelimb is fairly conservative among reptiles whereas that of the venous system shows a fair amount of variation. In all taxa, the artery that is inferred homologous to A. brachialis *sensu* Beumel (1993) branches into two arteries extending along the radial and ulnar sides, respectively. The artery running along the ulnar side extends to the posterior side of the manus in *V. exanthematicus* and *C. serpentina*. In the species of *Crocodylus, C. livia* and *G. japonensis*, on the other hand, this artery bifurcates at the proximal end of the ulna, with the resulting branches

extending to the anterior and posterior sides of the ulna, respectively. Therefore, this bifurcation of the arteries may be an archosaurian synapomorphy.

Varanus exanthematicus has one vein running along the dorsal side and two veins running along the superficial and deep ventral sides, respectively, in the brachium. The veins running on the dorsal and superficial ventral sides create a Y-shaped anastomosis in the ventral side of the elbow joint, as is also observed in many mammals. In contrast, the examined archosaurian specimens and *C. serpentina* do not have such an anastomosis. Therefore, it is possible that the Y-shaped anastomosis was primitively present at the ancestral node of Reptilia but has been lost after branching of Lepidosauria. Moreover, in the archosaurian specimens, some veins interpose the arteries, supposedly producing a countercurrent heat exchanger. Thus, it is possible that the loss of Y-shaped anastomosis and emergence of the vein interposing arteries contributed evolution of the endothermy of Aves.

This study provided detailed information on the vascular patterns in the forelimbs of reptiles. The homology hypotheses of the vasculature presented here serve as the basis for reconstructing this anatomical system in extinct reptiles. Future embryological observations would support or reject the present homology hypotheses of the vasculature and provide a firmer ground for assessing evolutionary sequences of vascular patterns.