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GSA Connects 2021 in Portland, Oregon

Paper No. 237-12

Presentation Time: 4:30 PM

SHADOWS OF THE PAST: THE DISJUNCT DISTRIBUTION OF EXTANT HORSESHOE CRABS EXPLAINED THROUGH BIOGEOGRAPHIC ANALYSIS OF FOSSIL TAXA

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Xiphosurids, or horseshoe crabs, are aquatic chelicerate arthropods with a fossil record extending back to the Ordovician. The four species of horseshoe crab existing today have a markedly disconnected geographic distribution, with *Limulus polyphemus* occurring along the eastern coast of North America (inhabiting the western North Atlantic Ocean and Gulf of Mexico) while *Tachypleus gigas*, *Tachypleus tridentatus*, and *Carcinoscorpius rotundicauda* have a combined occurrence around the eastern coastline of India through Bangladesh, Myanmar, Malaysia, Singapore, Cambodia, Vietnam, and China to the southern tip of Japan (inhabiting the Bay of Bengal and South China Sea). How these extant species ended up in their respective regions – at the opposite ends of two major oceans, separated by a continent – remains one of the major untested questions in horseshoe crab research. At present there persists the general assumption that modern horseshoe crab occurrences are the relics of a previously global distribution along with the somewhat contradictory hypothesis that the three closely related Asian species represent an in-situ diversification event after colonization by an ancestral species.

In order to test these hypotheses and reconstruct historical distribution patterns of Limulina, the clade of horseshoe crabs including the extant species, we conducted a biogeographic analysis in BioGeoBEARS of 41 species using an existing Bayesian phylogenetic topology. Limulina originate in the Carboniferous with Limuloidea, the clade including crown group horseshoe crabs, originating in the late Carboniferous but undergoing a major radiation in the Triassic. As such our analysis spans over 250 million years of geologic time during which continental configurations changed dramatically. In order to accommodate this we conducted analyses with 9 geographic regions defined, separating Europe into a number of smaller continental regions, as well as analyses uniting Europe into a single region. Both sets of analyses produce concordant results indicating a European origin for Limuloidea with repeated dispersal events to North America and Asia. Critically, the modern Asian species are the result of separate dispersal events while the disparate modern distribution of Xiphosura is due to the loss of their ancestral European range.

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Session No. 237

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Wednesday, 13 October 2021: 1:30 PM-5:30 PM

E141/E142 (Hybrid Room) (Oregon Convention Center)

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