Glide analysis and bone strength tests indicate powered flight capabilities in hatchling pterosaurs

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Pterosaur embryos and 'hatchling' specimens show a surprising level of skeletal development including well-ossified skeletons and large wings. This has prompted interpretations of pterosaurs as being flight-capable from the earliest ontogenetic stages, contrasting them against the majority of other flying animals, living or extinct. Though popular, this hypothesis is not universally accepted. Some authors propose that pterosaurs only became flight capable once they reached 50% of maximum size, explaining a slowing of growth rate in later ontogeny as metabolic resources were diverted into an energy-demanding form of locomotion. We investigated these hypotheses through glide performance and wing bone strength analysis on hatchling-grade specimens of two pterosaurs, *Pterodaustro guinazui* and *Sinopterus dongi*. We found that hatchling pterosaurs were excellent gliders, but with a wing ecomorphology more comparable to powered fliers than obligate gliders. Bone strength analysis shows that hatchling pterosaur wing bones are structurally identical to those of larger pterosaurs and – because of their very low body masses – their bending strength relative to body weight is very high, comparable to or exceeding the greatest values estimated for larger, more mature pterosaurs. Hatchling pterosaurs are thus as mechanically adapted to powered flight stresses as other pterosaurs, if not moreso. Together with our glide tests, this result supports interpretations of hatchling pterosaurs as flight-capable. Size differences between pterosaur hatchlings and larger members of their species dictate differences in wing ecomorphology and flight capabilities at different life stages, which might have bearing on pterosaur ontogenetic niching.