

## Alex Acker Thesis Defense Abstract

### New Insights on the Cranial Anatomy and Osteohistology of *Cyonosaurus*

This study investigates the cranial anatomy and life history of the small-bodied gorgonopsian *Cyonosaurus*. Previous research on gorgonopsians has disproportionately focused on larger members of the clade, leaving smaller forms relatively understudied. This gap has led to several unresolved questions, the most pressing of which concerns gorgonopsian ontogeny. Specifically, it remains unclear whether small-bodied gorgonopsians represent genuinely diminutive adult individuals or juveniles of larger species. As an adult specimen of the small-bodied gorgonopsid genus *Cyonosaurus*, NHCC LB1087 provides an ideal opportunity to address this issue and gain new insights on the biology of small-bodied gorgonopsians. The first chapter provides necessary background and context surrounding this research. The evolutionary history of synapsids is chronicled with special attention directed to the Permo-Triassic Mass extinction (PTME) and gorgonopsians. Specifically, this includes a synthesis of the proposed mechanisms which caused the PTME and a review of current knowledge regarding gorgonopsians. The second chapter examines the cranial anatomy of NHCC LB1087. Due to the specimen's preservation, many taxonomically relevant traits were obscured by the surrounding rock. To visualize these features, NHCC LB1087 was CT scanned and digitally segmented, revealing the underlying bone and internal structures that are rarely preserved. This analysis led to the identification of the specimen as *Cyonosaurus* sp., based on features such as six to seven closely packed postcanine teeth, a dentigerous and reniform palatine boss, and a wing-shaped postfrontal, among other diagnostic traits. The specimen was tentatively considered an adult based on basicranial fusion. Notably, NHCC LB1087 represents the first documented occurrence of *Cyonosaurus* in Zambia and provides evidence for complex gorgonopsian interactions within the Luangwa Basin.

The third chapter employs paleohistology to definitively assess the growth strategy and ontogenetic stage of NHCC LB1087. The growth rate of NHCC LB1087 generally aligns with previous findings in *Cyonosaurus* and other gorgonopsians, as NHCC LB1087 exhibits highly vascularized woven-parallel bone which indicates quick, sustained growth. However, this specimen also displays an azonal growth pattern, which is unique among gorgonopsians studied to date. The growth strategy observed in NHCC LB1087 challenges existing hypotheses about gorgonopsian biology and factors that contributed to their extinction during the Permo-Triassic Mass Extinction. The histological analysis also supports the identification of NHCC LB1087 as an adult, as proposed in Chapter 1, based on the presence of an external fundamental system at the sub-periosteal surface