Developing understanding about Australia's past, present and future from research into the World Heritage fossil deposits of Riversleigh

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While Riversleigh fossils in northwestern Queensland came to world attention in 1994 following listing of Riversleigh as a World Heritage property, fossils from limestones in this region have attracted researchers' attention for more than 150 years. Our ARC-supported research, begun in the late '70s, has involved more than 100 researchers in 26 institutions in 11 countries. It has more than trebled previous knowledge about the palaeodiversity and phylogenetics of Australian terrestrial vertebrates. Some of the deposits are rich also with invertebrates and plants. Many of the discoveries represent the first fossil records for entire families of modern vertebrates. Considering just mammals spanning the last 26 million years, hundreds of new species, genera, families and even a new order of very weird mammals have been described. Oligocene to Miocene mammal faunas are more diverse than any elsewhere in Australia today or at any time in its past. Forest birds being discovered compliment understanding about water birds known from 26-24 myo deposits in central Australia. Currently as much research focuses on structure and function of vertebrates represented by articulated skeletons, as on palaeobiodiversity. Riversleigh palaeohabitats and their faunas have changed over the last 25 my from cool temperate forest in the late Oligocene, to perpetually wet rainforests in the early to middle Miocene, to cool, dry increasingly more open vegetation in the late Miocene, to a brief interval of wetter conditions in the early Pliocene and then back to increasingly drier, more modern habitats through the Pleistocene. The record spans 2.5 climate change cycles. More than 200 distinct fossil deposits have been identified including Oligocene-Pliocene lacustrine and karst deposits and Quaternary karst and fluviatile deposits. Five Faunal Zones and five Depositional Phases are recognised. U/Pb radiometric dates now being obtained from palaeospeleothems in conjunction with the University of Melbourne are testing and in general corroborating previous age determinations based on biocorrelation. This research has resulted in over 300 publications and about 32 Honours and 45 PhD theses with most of these students obtaining professional jobs. Transcendent programs building on this understanding include assessment of long-term conservation status of contemporary lineages and use of increased understanding about palaeoecological resilience to develop translocation strategies to thwart extinction of climate-change threatened species. Recent research based on remote sensing by satellites has unexpectedly revealed that there are more fossiliferous deposits west of the World Heritage area than occur within that area. A grant from the National Geographic Society funded a helicopter to enable us to explore a small part of this new region in 2013. The current biggest challenge is how to resource exploration of the 75% of the remote 'New Riversleigh' region that has not yet been examined. As important as the scientific discoveries that have been, our whole team and the public volunteers who work with us have always had a tremendous amount of fun making and interpreting these discoveries at Riversleigh which, so far, show no signs of slowing down.