Plant-arthropod interactions through the Permian-Triassic transition at southern high latitudes

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The Sydney-Gunnedah-Bowen Basin complex, a retroarc foreland basin system in eastern Australia, incorporates a relatively continuous marine to continental early Permian to Middle Triassic sedimentary succession. Multi-disciplinary studies of bore-core and outcrop sections over the past six years are providing precise constraints on the age, depositional settings, geochemical characteristics, palaeoclimate and fossil content of this succession, particularly targeting events around the end-Guadalupian and end-Permian biotic crises. Importantly, this basin complex represents one of the very few successions in the world hosting relatively rich Early Triassic plant macrofossil assemblages that, in tandem with palynological data, enable analysis of the recovery of plant communities in the aftermath of the major Permian crises. Sydney Basin middle and late Permian plant fossil assemblages are overwhelmingly dominated by deciduous broad-leafed glossopterid gymnosperms typifying extensive high-palaeolatitude micro- to mesothermal wetland communities. These floras host a moderate to high intensity and diversity of herbivory damage. Little change in the floras or associated arthropod damage is obvious through the end-Guadalupian event. By contrast, the end-Permian event is marked by an abrupt collapse in glossopterid-dominated ecosystems, cessation of peat accumulation, and a drop in the diversity and complexity of arthropod feeding types. The lower Triassic succession is characterized by a coal gap globally. Plant assemblages immediately overlying the uppermost Permian coal seam are characterized by an influx of peltaspermalean seed-ferns and voltzialean conifers with generally small sclerophyllous leaves. Pleuromeian lycophytes are also present together with very rare hold-over elements of the preceding Permian communities. Slow, but progressive diversification of plant assemblages is evident through the Lower Triassic succession, with umkomasialean (corystosperm) taxa attaining dominance during the Olenekian. A general increase in leaf size among the dominant plants together with the re-appearance of coaly laminae suggest a return to more humid conditions around the Early to Middle Triassic transition. A similar pattern of vegetation turnover is apparent in the less intensely sampled Permian-Triassic succession in the Prince Charles Mountains, East Antarctica. Arthropod damage on earliest Triassic plant remains is sparse and dominated by simple margin-feeding injuries. From the late Olenekian to Late Triassic, foliar damage types are notably more abundant and complex attesting to synchronous recovery and diversification of plant and terrestrial herbivorous arthropod communities.