During the last 600 million years, life has developed an astounding diversity of forms to fill Earth’s geographical and ecological space. This spectacular variety of living things has risen and fallen over time, with diversity sometimes shrinking to as little as one-twentieth of its original level (Sepkoski et al., 1981; Raup, 1991; Jablonski, 2001; Benton and Twitchett, 2003; Alroy, 2008). Yet, even after the most severe mass extinctions, the rebounds in diversity have been extraordinary (Jablonski, 2001). Although forms that vanished never came back to life, the ones that replaced them have shown remarkably similar patterns of diversity and phenotype distributions in space (Foote, 1997; Erwin, 2001; Wagner, 2010). Thus, the trends studied by macroecologists – general patterns in species distribution in space (Brown, 1995; Rosenzweig, 1995; Blackburn and Gaston, 2003) – are, in principle, amenable to palaeobiological testing (Lieberman et al., 2007). In fact, trends such as Bergmann’s rule, the diversity/latitude relationship, the island rule, and patterns of species range distributions have been shown to apply to fossil clades (Klein, 1986; Miller, 1997; Crame, 2001; Jernvall and Fortelius, 2004; Hawkins et al., 2006; Raia and Meiri, 2006; Foote et al., 2007, 2008; Carotenuto et al., 2010, 2015; Lyons et al., 2010; Polly et al., 2011; Fritz et al., 2013; Jablonski et al., 2013).

Some ‘rules’, however, are specific to fossils, whose bearing on the geography and ecology of life today is arguably extremely important yet remains to be elucidated (Mittelbach et al., 2007; Araújo et al., 2008). For instance, taxonomic diversity more often than not achieves a peak around the middle of the existence of a clade (Foote, 2009). But the relationship between clade age and diversity is uncertain (Ricklefs, 2007; Rabosky et al., 2012). Thus, testing for differences in diversity among living clades and trying to distinguish between Raup’s (1981) widely accepted reasons for a clade to survive – good genes (the phenotype) and bad luck (accidents of history) – makes little sense except in a temporally resolved context (McPeek and Brown, 2007).

That is also the kind of context in which the effects of mass extinctions can be explored properly. For example, some would suggest that the rules of evolution change in the aftermath of a crisis. If that is the case, new groups will emerge after a crisis at a faster pace than...
they otherwise would. Or perhaps diversification events are insensitive to whether or not ecospace has been cleared catastrophically (Jablonski, 2005; Roopnarine, 2006; Brusatte et al., 2008; Sahney and Benton, 2008; Wagner, 2010; Ruta et al., 2011). Such questions also touch upon the nature of adaptive radiations and their influence on the current distribution and species richness of clades (Rosenzweig and McCord, 1991; Rabosky, 2009; Losos, 2010; Yoder et al., 2010).

Advances in community phylogenetics have provided an array of tools to deepen our understanding of how modes, trait evolution, and climate history impact the current distribution of species (Cavender-Bares et al., 2009; Kembel, 2009; Ives and Helmus, 2010; Pavoine et al., 2011; Pearse et al., 2014). Community phylogenetics draws directly on comparative phylogenetics, which provides a vast and rapidly growing number of methods that rely on phylogenetic trees to determine the history of clades and traits (Felsenstein, 1985; Harvey and Pagel, 1991; Blomberg and Garland, 2002; Losos and Glor, 2003; O’Meara, 2012).

Yet, none of these methods explicitly takes the history of fossil diversity into account, nor do they address how diversity interacts with the taxic evolution of clades (Villalobos et al., 2016). Only very recently have studies sought to use the fossil record directly to model the evolution of clad diversification, competition among clades, and the influence of traits on diversification (Hunt, 2007; Hunt et al., 2015; Silvestro et al., 2015). The importance of the fossil record to the current distribution and diversity of species is now becoming more widely understood, even in a field as distinct from palaeontology as conservation biology (Diniz-Filho et al., 2013).

Spatially explicit palaeontological information and methods are thus necessary to help understand why diversity looks the way it does, or why and how species numbers vary over space and time. Two issues of Evolutionary Ecology Research are dedicated to the integration of fossil and neontological information in an attempt to better understand both species and phenotype diversity in space and time.

In this, the January issue, we look at the path taken by diversity through time. Sahney and Benton (2017) provide evidence that the rise in generic diversity towards the recent is not an artefact of improved sampling towards the present (the so-called Pull of the Recent effect). Castiglione and colleagues (2017) analyse the path taken by diversity in Palaeozoic and Mesozoic fossil marine clades and find that, in more than 90% of them, the models producing the observed diversity patterns include a rapid early diversification phase followed by steadily rising rates of extinction. Silvestro and associates (2017) provide a novel approach to the study of the age-old macroevolutionary question of whether clades compete with each other in time. Polly and colleagues (2017) look at the evolution of cursoriality in American Carnivora. They find that clade-level trait-based sorting has a strong impact on community-level trait distributions but population-level selection is either too weak or ineffective to produce hind limb trait gradients within carnivore species. Finally, Lima-Ribeiro and Diniz-Filho (2017) find that, contrary to conventional wisdom human over-exploitation (the overkill hypothesis) is unlikely to explain the end-Pleistocene extinction of the ground sloth (Megatherium).

The March issue focuses on phenotypic evolution. Maiorino and colleagues (2017) present an extensive study of cranial shape evolution in ceratopsian dinosaurs. They discover that cranial shape and angiosperm occurrences are closely related. They also discover a trend for decreasing shape differentiation in psittacosaurids. Villalobos and colleagues (2017) look at body size evolution in pterosaurs. They find that these winged ornithodirans did not follow Bergmann’s rule; during the Cretaceous, pterosaurs even followed the reverse pattern. Schnitzler and associates (2017) address shape evolution in fossil Musteloidea (the clade
that includes weasels, martens, and badgers). Their study provides evidence for a trend of increasing digitigrady in this group – crucially, however, this trend is evident only when fossil information is included. Finally, Feranec and Pagnac (2017) study the evolution of molar isotopic composition in Miocene horses. Surprisingly, they find that $C_4$ grasses occurred in the mid-Miocene in southern California, up to 8 million years before the global spread of $C_4$ ecosystems.

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