Nothing less than the history of life on earth can be gleaned from fossils; but that isn’t possible unless one understands the pitfalls inherent in both stratigraphic biases and the statistical methods used to correct for them. Simply totting up taxa and graphing their numbers through time ignores the realities of preservation and leads to a suppressed diversity curve. However, graphing means or medians throughout time can introduce variations of their own. In this paper, the author looks at shelled invertebrate fossils from a continuous local stack in New Zealand from the Late Miocene through the Pleistocene. The outcrops vary from lithified (which predominates the older rocks) to unlithified (prevalent in younger rocks). The author’s aim was to assess how diversity is conserved or lost with increasing cementation of the sediment, and all the mechanical and chemical weathering that implies.

Of course, any examination of diagenetic effects is crucial and welcomed. The fossil record can’t be properly understood without extensive analysis of the filters that control it. I liked the author’s approach of looking at the extent of lithification, and connecting that to dissolution. It was interesting that he considered lithification to be roughly analogous to degree of cementation, as opposed to compaction. This makes me wonder what could be learned from the stable isotope variation among the lithified and unlithified samples (and their cements). It would have been fascinating if he had linked his data to recent shell depositional sites, as Valentine did in the last paper to concern fossil assemblages. I also appreciated his in-depth discussion of his methods, as I was able to follow his thought process and clearly saw how his conclusions proceeded from his findings and the ways in which he had analyzed them.

It seems insufficient to look only at Neogene sediments. The late Miocene and Pleistocene are separated by only about four to five million years, and are both situated on the drastic upswing in preservation of unlithified sediment. So, can this time interval be considered a proper microcosm of diagenetic effects in the Phanerozoic? He does admit that in an attempt to limit the effects of time-averaging, his results are applicable to a narrow range of habitats, but he doesn’t discuss how they’d be applicable to a limited time-frame as well. Methinks comparative studies of this sort would be needed on larger time intervals, going a bit further back in time, to gain a fuller picture of this specific bias in the fossil record. I’m a bit surprised the paper neglected to mention prevailing ocean chemistry as an influence on cementation; wouldn’t aragonitic organisms be better preserved if they were buried in an aragonite sea? I was disappointed that he didn’t factor this into his conclusions.

Figure 1 was a handy summary of both the introduction and the research question. Graph A showed Phanerozoic diversity trends on two levels, both generic richness (as a line) and “within-community diversity” at the species level. I do wish, however, that the caption had clarified what “within-community” meant. Depositional environments? Occurrences? Graph B, meanwhile, was much more straightforward, neatly summarizing the problem of diminishing availability of unaltered fossils back in time. Figure 2A was equally illustrative, showing the inverse linear relationship between rock hardness (as a proxy for degree of lithification) and average generic richness over time. Fitting all three components into one graph is impressive, and conveys all the information presented in the results section! 2B was a reiteration of the same data, showing their spread rather than their distribution through time. Figures 3 and 4 would have benefited hugely from either different symbols or different colors. The top two graphs were simply indistinguishable in their masses of gray lines; I gleaned that the lithified sediments clustered toward the bottom of both graphs, but I didn’t get a sense of the actual trends of the data. Figure 5 was also a great graph, which presented the author’s mineralogical findings concisely and clearly.

As usual, I’d like to see photos of representative samples; I have found all the graphs and charts are hard to contextualize without images, and they would have been appropriate in a paper about lithification.