METAGENOMICS

Phages apart

The rock-like structures are thrombolites from Pozas Azules II, Mexico. Picture kindly provided by Valeria Souza, Universidad Nacional Autónoma de México, Mexico.

Recent evidence has suggested that phages, one of the most abundant living entities, are distributed ubiquitously around the world — that is, they are 'cosmopolitan'. However, Christelle Desnues *et al.* now report in *Nature* that some phages are found only in specific geographical regions, providing the first evidence of endemism in phages.

To examine phage distribution, Desnues and colleagues examined the metagenomics of viral communities from three geographically distinct microbialites. Microbialites are evolutionarily ancient sedimentary structures that are created by microorganisms, and are called stromatolites when they have a layered internal structure and thrombolites when they have a clotted internal structure. The authors analysed a marine stromatolite from Highborne Cay, Bahamas, and a freshwater thrombolite and freshwater stromatolite from neighbouring areas in the Cuatro Cienegas Basin, Mexico (Pozas Azules II and Rio Mesquites, respectively).

Most of the genetic material from the viral communities in these microbialites was unique — no matches were found when sequences were screened against established databases. Whereas previous viral metagenomes have been 70–90% unique, the viral metagenomes from Highborne Cay, Pozas Azules II and Rio Mesquites were 98.8%, 99.3% and 97.7% unique, respectively. Furthermore, there was little overlap between randomly selected sequences from the three viromes, indicating that the viruses present in the three microbialites are genetically unique.

Analysis of the non-unique sequences indicated that *Shewanella oneidensis* prophages and *Burkholderia cepacia* phages dominated the Rio Mesquites thrombolite, whereas microphages (which infect *Escherichia coli* and species of *Bdellovibrio*, *Chlamydia* and *Spiroplasma*) were the most common constituent of the Highborne Cay and Pozas Azules II stromatolites. However, nucleic-acid-sequence analysis indicated that the microphages from the Highborne Cay and Pozas Azules II communities had diverged significantly. Furthermore, microphages from the Highborne Cay stromatolite were not detected in 63 samples from around the world in which cosmopolitan phages had previously been detected. However, microphages from the Highborne Cay stromatolite were detected in new stromatolites from Highborne Cay, indicating that these microphages are native to Highborne Cay and persist over time.

Interestingly, the non-unique sequences of the Pozas Azules II community possessed a 'marine signature' and overlapped with sequences from Sargasso Sea and Gulf of Mexico phage communities, even though these environments have been geographically separated for tens of millions of years. This finding, the authors conclude, suggests that the phages in microbialites "may be relicts from an ancient community." "Because of their unique biodiversity," Desnues adds, "these microbialites should be targets for conservation efforts."

Asher Mullard

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