Structural analysis of new archaeal viruses

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DPANN archaea represent a superphylum within the archaeal domain, consisting of lineages with reduced genomes, limited metabolic capacities, and in many cases symbiotic or parasitic lifestyles. Despite their ecological significance and unusual biology, very little is known about viruses infecting DPANN members.

In our study, we identified two previously uncharacterized groups of viruses infecting YN1 and YN4 DPANN archaea, representing the first viruses reported for this lineage. We examined their infection using TEM and cryo-electron tomography and structural details using subtomogram averaging. Although the mechanisms of infection of these viruses remain unknown, it is thought that filaments extending from either DPANN cells or their hosts may act as concentrators and facilitate viral entry. qPCR analysis indicates that the number of DPANNs decreases significantly following infection, suggesting lytic activity of these viruses. These findings expand our understanding of archaeal virus diversity and virus–host interactions within the enigmatic DPANN superphylum.

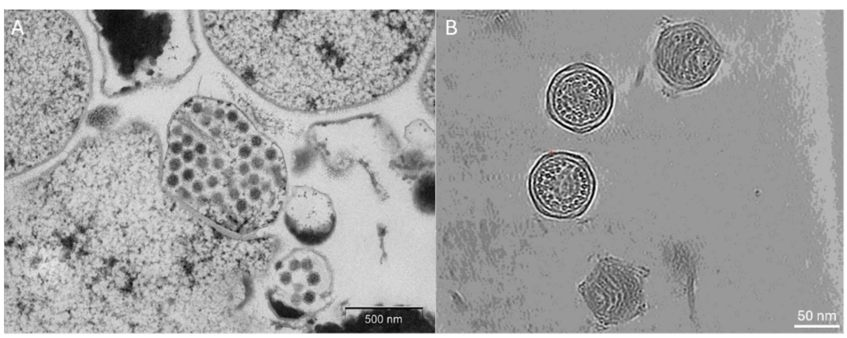

Fig. 1. (A) TEM image of YN1 DPANN cells infected by multiple archaeal viruses. (B) Denoised cryo-electron tomogram of archaeal viruses revealing the icosahedral symmetry of the capsid and bead-like nucleoprotein structures.

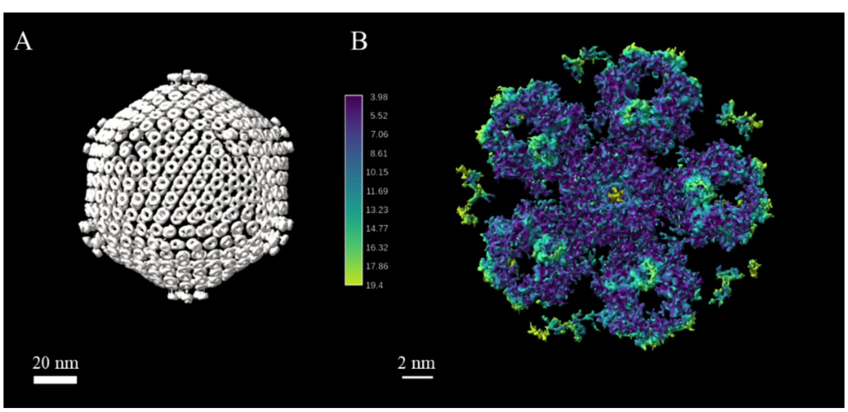

Fig. 2. (A) Subtomogram average of the viral capsid at 12.824 Å/px from ~2000 manually picked particles. (B) Penton refinement performed in EMAN2 at 1.603 Å/px.