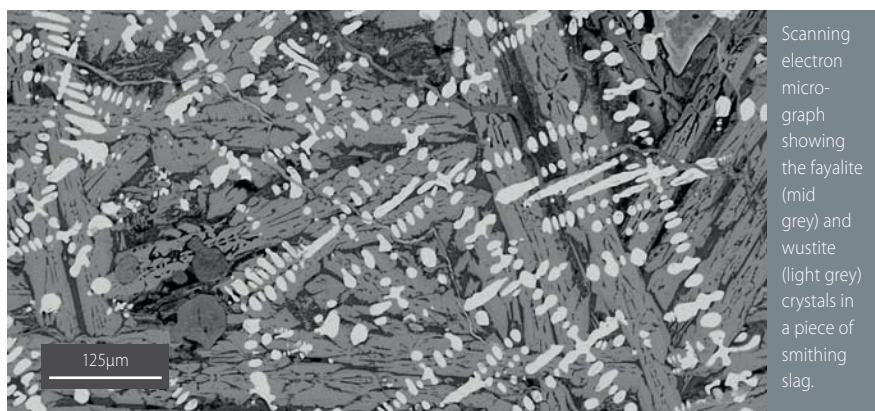


ANCIENT GREEK SLAGS OF ZAGORA

Zagora is a complete, undisturbed Early Iron Age Aegean settlement from the 9th-8th centuries BC. Archaeological survey and excavation at the site has found an abundance of metallurgical slag, waste material from the metalworking industry. Iron production occurred in Greece for a century or two before the occupation of the site but limited work has been done on Greek metalworking from this period.



Scanning electron micrograph showing the fayalite (mid grey) and wustite (light grey) crystals in a piece of smithing slag.

Ms Ivana Vetta, a postgraduate student at the University of Sydney (UoS) is using scanning electron microscopy coupled with elemental and crystal orientation analyses in the AMMRF at the UoS to uncover the unique microstructure of the slag. This in turn provides information about the pyrotechnological skills and processes used by the ancient smiths.

From the outside, the slag appears simply as a lump of mildly magnetic rock

but inside the structures are highly variable and contain a complex mixture of iron-rich minerals. The presence and structure of the minerals fayalite and wustite in the Zagora slags indicates that the slags are most likely to have come from the iron smithing phase. It also reveals that a lot of iron was lost in the slag, indicating a very inefficient process for iron production at this stage of history. Analysis also revealed the presence

of quartz and silicate minerals, suggesting that sand may have been used as a flux to help purify the iron prior to smithing.

Ms Vetta's results are combining with other archaeological evidence to uncover ancient metalworking processes and how they connect to the wider civilisation.

Ms Vetta acknowledges the permission of the Hellenic Ministry of Culture under the Aegis of the Australian Archaeological Institute at Athens (AAIA).



DELIVERING TOXIC DRUGS : NANOSCALE SOLUTIONS

The delivery of toxic drugs for therapeutic benefit, such as in cancer chemotherapy and some anti-fungal and pain-relief treatments, is increasingly being accomplished using nanoscale liposomes. These are roughly spherical nanoparticles with a water-filled central cavity surrounded by an impermeable outer layer of lipids. Encapsulating the drug in a liposome prevents accumulation in non-target tissues as it travels around the body, reducing undesirable side effects. However, the problem is then how to trigger release of the drug from the nanoparticle once it gets to its destination.

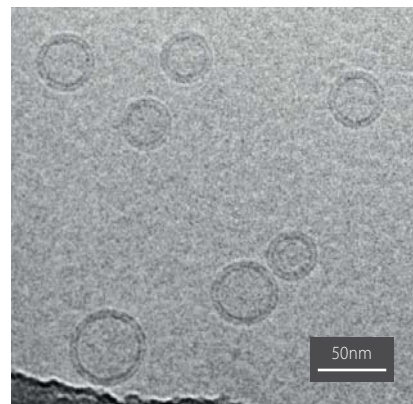
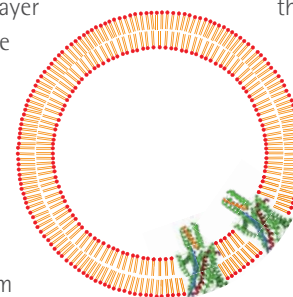
A team led by Dr Michael Landsberg from the University of Queensland (UQ) and Prof. Boris Martinac from the Victor Chang Cardiac Research Institute have been developing prototype liposomal drug delivery

systems that incorporate specialised bacterial proteins that could act as triggerable nanovalves. The nanovalves are embedded within the lipid layer and when activated will open a pore, releasing the drug. The team use high-resolution cryo-transmission electron microscopy (TEM) in

the AMMRF at UQ to visualise their liposomes and investigate the factors influencing the efficiency of drug release. They found that the size of the liposome is significant, an important observation since liposomal formulations often contain a mixture of

sizes. They are currently using TEM to evaluate new methods that produce more uniformly sized formulations. Lipid composition of the membranes also appears to influence the size of the liposomes and the cargo release efficiency.

A major focus of future work is on developing mechanisms that can be used safely in the body to trigger opening of the nanovalves.



Cryo-TEM image of liposomes and an illustration showing how the nanovalves sit in the lipid bilayer.