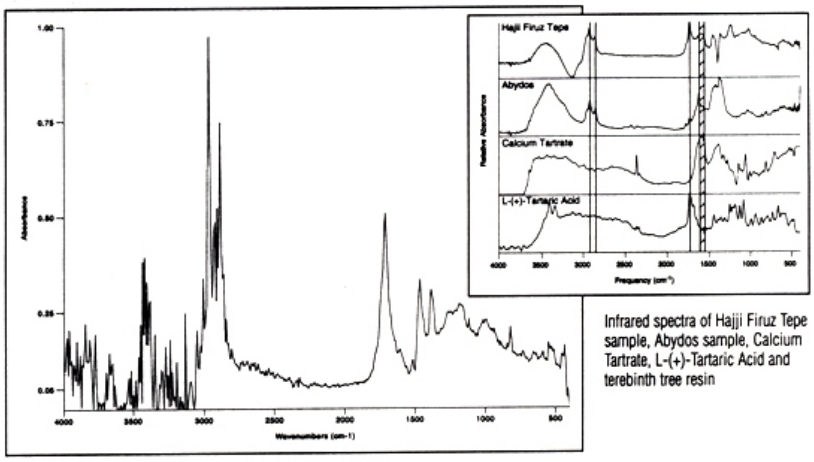
THUMBS UP

FTIR Analysis Reveals Historic Origins of Wine

The art of winemaking has been handed down through the generations, and yet history does not tell us where this tradition began. Where wine was first made and the specifics of its creation have remained a mystery, until now. Professor Patrick McGovern of the University of Pennsylvania Museum has taken a new approach and employed a new tool in this historical search – a Nicolet 5DXB fourier transform infrared (FT-IR) spectrometer.



Infrared spectra of Hajji Firuz Tepe sample, Abydos sample, Calcium Tartrate, L-(+)-Tartaric Acid and terebinth tree resin

Clues Discovered in Ancient Iranian Village

In 1968 a jar containing a yellowish residue was excavated at Hajji Firuz Tepe in northwestern Iran. The first jar and another, this one with a red residue, were both found in a kitchen area dated around 5400-5000 BC. Infrared spectroscopy, liquid chromatographic and wet chemical analyses were performed on these residues. The results showed the presence of calcium tartrate in both jars. Grapes are the only natural source of large amounts of tartaric acid in Middle Eastern plants.

The long, narrow neck of the jars suggested that a liquid had been stored in them. At room temperature, grape juice will normally ferment quite quickly, because of natural yeast on the grape skins. Slow processing and high temperatures likely caused the grape juice to start fermenting before it ever reached the jar. Stoppers found near the jars suggest that people had developed the technology to seal the jars, therefore preventing the wine from becoming vinegar.

The liquid chromatographic results also contributed another piece of evidence making it almost certain that the jars held wine. An unknown component was discovered in the residues from the jars. The absorption spectrum of this unknown component closely matches that of terebinth tree resin, which is known to have been used as a preservative.

In mountainous regions, such as northwestern Iran, wild grapes and terebinth trees grew together and produced their fruit and resin around the same time. The mixing of these two ingredients would therefore have been natural, whether this was done intentionally or by accident. No matter how the grape juice and terebinth resin came together, it is likely that the resultant mixture fermented to become wine.

A Send-off Fit for a King

Another interesting discovery was unearthed at Abydos in Egypt. Here an ancient tomb of one of Egypt's first kings, Scorpion I, held 700 jars in three rooms of a multi-chambered tomb. The tomb, denoted Tomb U-j, is dated to about 3150 BC using radiocarbon techniques. A number of the jars contained yellow residue, which chemical tests determined to be resinated wine due to the presence of tartaric acid, calcium tartrate (its salt) and tree resin. Altogether the jars found in the tomb likely held about 4500 liters of wine – quite a send-off for the afterlife!

Tomb U-j

These chemical results and those of Professor McGovern's other archeological chemistry studies provide strong evidence for the development of wine by prehistoric cultures. Although the production and preservation of wine has changed much in the interceding centuries, chemical spectra point to when our ancestors first developed this prized beverage and shed light on the techniques of the first wine producers. ■

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