Trace Analysis of Wine from 6000 BC

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Abstract
The Neolithic (10,000-3,500 BC) was the age of achievement and expansion. This period represented a transition where food-collecting cultures shifted to food-producing ones, which allowed people to establish year round settlements. Many plants were domesticated including the Eurasian grape, which is believed to be the first grape used to ferment wine. There is an ongoing archeological dig in the Republic of Georgia to investigate the earliest winemaking and the emergence of wine culture as part of the Gadachrili Gora Regional Archaeological Project Excavations (G.R.A.P.E.). Sherds of pottery jars excavated from the dig site, along with corresponding soil samples, were analyzed for the presence of four characteristic grape/wine acids (tartaric acid, citric acid, malic acid, and succinic acid) by high performance liquid chromatography-mass spectrometry. All four acids were detected in trace amounts in every sample; however, there was no significant difference in the amount of acids found in the sherd samples versus the soil samples. As a result, we could not verify the presence of wine in these particular archaeological sherds.

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Sherds of pottery jars were excavated from the dig site in the Republic of Georgia in spring 2018. Corresponding soil samples were taken from where the sherds were found. Sherd 4002 (soil 4003) comes from Loc 55 (interior of a house, and it appears to have been a purposeful deposit). Sherd 4047 (soil 4048) comes from Loc 69 which is a fill layer between three buildings (Loc 40, 54, and 66) and an ash deposit (Loc 99). Sherd 4156 (soil 4157) comes from Loc 80 (not shown in annotated photo but far top right corner of the photo (under loc 58 near loc 30).

Tartaric acid is the most characteristic, as the Eurasian grape is the only fruit/berry in the caucus region that produces it. Malic acid and citric acid are commonly found in many fruits and berries, but help to further confirm the presence of the grape. Succinic acid is a byproduct of the fermentation process, which helps to confirm that Georgians were fermenting the grape into wine. The sherds and their corresponding soil samples were analyzed for these four characteristic organic acids.