# Chemometrics Identifies Oil Families and Paleoclimatic Control on Source Organofacies, Santa Maria, CA

**K. Peters[1,2], P. Lillis[3], T. Lorenson[4], J. Zumberge[5]**

**[1]Schlumberger, Mill Valley, CA 94941 kpeters2@slb.com**
**[2]Stanford University, CA kepeters@stanford.edu**
**[3]U.S. Geological Survey, Denver, CO 80225, plillis@usgs.gov**
**[4]U.S. Geological Survey, Santa Cruz, CA 95060, tlorenson@usgs.gov**
**[5]GeoMark Research LLC, Houston, TX 77095, jzumberge@geomarkresearch.com**

Traditional correlations to establish petroleum systems rely on mass chromatograms and bivariate plots to interpret multivariate geochemical data. Instrumentation advances may improve interpretation, but the traditional method lacks a computational component and ignores much of the data. This paper applies a novel chemometric (multivariate) approach that is superior because it (1) reliably identifies oil families in more detail, and (2) mathematically quantifies the degree of certainty for each assignment. A training set of 48 oils from the Santa Maria area was used to create a 'chemometric decision tree' to classify additional oils based on 21 source-related biomarker and isotope ratios selected from a larger collection of ratios using principal component loadings. The geochemistry of each family was controlled by redox and carbonate vs. siliceous input to organofacies like those in the lower calcareous-siliceous, carbonaceous marl, and clayey-siliceous members of the Monterey Formation source rock. These organofacies are linked to paleoclimatic cooling after ~13.9 Ma, up-section increase in carbon isotope ratios of generated oil, decreased carbonate from foraminifera, and increased silica from diatoms. Organofacies account for many of the geochemical differences between the oil families; an interpretation that would not be possible using traditional geochemical correlation. This chemometric-organofacies model for oil from the Monterey Formation will enhance future exploration in many areas of coastal California.