Evaluating oil-shale product yields and compositions by hydrous pyrolysis

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Hydrous pyrolysis involves heating source rocks in the presence of liquid H_2O at sub-critical water temperatures (<374 ºC) for hours to days. The method simulates subsurface oil formation by generating expelled oil that is physically and chemically similar to natural crude oils. H_2O in these experiments has been shown to facilitate oil expulsion and provide a source of hydrogen. This method provides a comprehensive evaluation of oil-shale product yields and compositions, as well as a baseline to evaluate various retorting processes. The procedure involves heating 200-g aliquots of oil shale in the presence of water at 360 ºC for 72 h. Hydrous-pyrolysis under these conditions does not necessarily determine ultimate maximum oil yields possible for all retorting conditions, but it does provide a baseline to compare yields and compositions of generated gases, expelled oils, recovered waters, and residual spent rocks. It also provides a baseline to compare byproducts of environmental concern in generated gases, recovered waters, and residual spent rocks. Hydrous pyrolysis results are also compared with results from Rock-Eval and Fischer assay. Oil shale used in this study includes kukersite (Estonia), Green River Fm. mahogany shale (Colorado, USA), Irati Fm. (Brazil), Permian torbanite (NSW, Australia), Pumpherston Shale (Scotland), Kimmeridgian Blackstone (England), Ghareb Limestone (Israel and Jordan), Retort Phosphatic Shale Member of the Phosphoria Fm. (Montana, USA), New Albany Shale (Indiana, USA), Timahdit oil shale (Morocco), and Alum Shale (Sweden).