Targeting Zones of Fracture-Enhanced Production

Many wells in the Appalachians produce from reservoir rocks which have fracture-enhanced matrix porosity. In these rocks, natural fractures are essential for significant production because matrix porosities are highly variable and commonly low. However, only certain penetrative, interconnected, and open fractures are capable of significantly increasing production. It therefore becomes necessary to differentiate these production-related fractures from other fractures in order to predict their occurrence.

The most definitive method for differentiating fractures is by combining petrofabric and geochemical techniques. Basic to this approach are geochemical and textural data on paragenesis and homogenization of methane-bearing inclusions in matrix and vein minerals. This approach has been routinely used in the Appalachians to differentiate and characterize fracture systems and identify their involvement in the migration, entrapment, and production of hydrocarbons. The results provide the explorationist with an improved capability to predict locations of highly fractured zones within potential reservoir rocks.

This approach has helped to define the main fracture domains in New York: the foreland fold; foreland fracture, intratinectional fracture, basement fault, strike-slip fault; and normal fault domains. Analysis of the fracture fabrics in each domain has revealed those fractures that are open under the contemporary stress field and that enhance bulk-rock permeability.

For efficient targeting of zones of fracture-enhanced permeability, exploration programs need to concentrate on the production-related fractures. Once these fractures have been identified, analysis of structural contours, isopachs, lineaments, seismic profiles, production trends, logs, and surface petrofabric data can prove to be more rewarding.

Use of Optical Axis of Vitrinite as an Indicator of Paleos- and In-Situ Stresses in Coal and Coal-Bearing Strata

Increasing level of coalification causes realignment of the optical axis of vitrinite in a direction coinciding with the direction of the maximum compressive stress, either vertical load stress or the resultant of vertical load stress and lateral tectonic stress. Measurable tilting of the optical axis occurs in horizontal coal bed in Beckley, West Virginia, region coinciding with the reported occurrence of strong in-situ lateral stress in the area. The average angle of tilting is 14° in the deeper buried Beckley Seam, and 7° in the shallow Sewell Seam. The former has severe ground-control problems. The basic assumption invoked is that coal, being organic in nature, is readily deformed under relatively lower temperature and pressure conditions than the inorganic host rocks.

Application of Remote Sensing to Underground Coal Mining: Observations and Experience

Remote sensing in the form of linear analysis has been used for a number of years for the prediction of roof stability in underground coal mines. The advantages and limitations of this predictive method determined from the 6-year working experience of the Roof Control Division of the Mine Safety and Health Administration will be presented. The effectiveness of this method can be quite variable on both a regional and local scale. Factors contributing to this variation, such as mining practices and mine geology, will be discussed.

While the precise nature of the influence of a linear is not always known, a number of observations and experiences provide for a better understanding of the effects of these features. In addition to roof falls and poor roof conditions, more subtle characteristics of some lines have been observed: (1) time-dependent behavior with roof instability deteriorating with time; (2) roof stability which was good during development becoming poor upon retreat mining; and (3) water closely associated with some lines causing mining and roof control problems.

The predictive technique of linear analysis will not delineate all areas where poor roof conditions will be encountered, nor will roof instability be experienced along all lines plotted using this method. To be effective this technique must be integrated with existing engineering and geologic knowledge and practices.