Introduction to unconventional petroleum systems

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INTRODUCTION

The collection of articles included in this theme issue of the AAPG Bulletin originated in the AAPG Research Group on Unconventional Petroleum Systems (UPS). The members of the group, after considerable discussion, concluded that there was a need to present an overview of selected unconventional gas systems and to clarify and expand upon these systems as factors in meeting the increasing energy needs of developing and industrialized countries of the world. Natural gas is expected to be the fastest growing component of world energy consumption by 2020 (DOE/EIA, 2002); natural gas consumption in 2020 is projected to be 162 tcf, nearly double the 1999 total of 84 tcf. Most of the increase is expected to be in developing countries. Although there appear to be sufficient gas resources to meet anticipated world consumption through 2020, several regions, such as Mexico, western Europe, and the United States, are increasingly dependent on imported supplies of gas.

Globally, there are different perceptions of the definition of an unconventional gas system. In the United States, earlier distinctions between conventional and unconventional resources were primarily based on economics; in the early to middle 1970s, subeconomic or marginally economic gas resources such as coalbed methane, shale gas, and tight (low-permeability) gas were considered by most exploration geologists as unconventional. However, with the stimuli of price incentives and federally funded research beginning in the late 1970s, these gas systems are now economically viable resources, and some exploration companies no longer refer to them as unconventional. Aside from economic considerations, there is a fundamentally important geologic distinction: conventional gas resources are buoyancy-driven deposits, occurring as discrete accumulations in structural and/or stratigraphic traps, whereas unconventional gas resources are generally not buoyancy-driven accumulations. They are regionally pervasive accumulations, most commonly independent of structural and stratigraphic traps.

As the more easily exploited, conventional gas resources are produced, unconventional gas resources are becoming a larger contributor to annual gas production in the United States. For example, gas in low-permeability (tight) reservoirs, coalbed methane, and shale gas account for more than 26% of the daily United States production. With the emergence of unconventional gas resources...