Coal seam methane potential, resources, and exploration targets in the Sydney-Gunnedah Basin, Australia

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A coalbed methane exploration model integrating six key hydrogeologic factors affecting coalbed methane potential was applied to the Upper Permian Coal Measures of the Sydney-Gunnedah Basin. Data were collected only from public sources, and the results of previous studies were integrated into a basin-wide evaluation.

Net coal thickness ranges from less than 32 ft (9.8 m) to more than 230 ft (70.1 m) with the thickest coals occurring in a north–south trend paralleling a paleo-depositional axis. The thickest coals occur along the eastern margin of the basin and generally thin westward. Coal rank ranges from high-volatile C bituminous along basin margins to low-volatile bituminous near the Sydney coastline, indicating that the coals have generated significant quantities of methane over most of the basin. Coal seam gases are predominantly thermogenic, but isotopic data indicates that secondary biogenic gases are present in some areas. Gas content values ranges from less than 32 scf/ton to more than 700 scf/ton, and is generally higher than values found in coals over a similar depth range in other parts of the world. Present-day in situ stress is generally perpendicular to face cleat orientation suggesting that permeability will probably be the limiting factor for coal gas production. However, areas of better permeability may be located where local variations in face cleat geometry and/or in situ stress enhance permeability.

Coal resources for the Sydney-Gunnedah Basin are estimated to be approximately 1,139 Gt and coal seam methane resources range between 58 Tcf and 248 Tcf; the best estimate for in-place gas resources is 139 Tcf. A dozen exploration target areas were delineated with the coalbed methane exploration model.

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