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Workshop on the Geology of Southeastern British Columbia Coalfields

W. J. McMillan

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ocean basins during the 1970s. As stressed in the conference resume, laboratory funds are limited and collaboration with industry based research teams which are often technologically more advanced must be viewed as a means of supporting ocean research in the 1980s. There is perhaps need for concentrating the sparse systems of observation in fewer places to obtain less ambiguous data.

The conference was organized by Dean Presnall and Anton Hales of Texas and Fred Frey of M.I.T., all of whom are to be congratulated for putting together a stimulating program.

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Workshop on the Geology of Southeastern British Columbia Coalfields

W. J. McMillan
B.C. Ministry of Energy, Mines and Petroleum Resources
Parliament Buildings
Victoria, B.C. V8V 1X4

Introduction

The workshop was held February 11 and 12, 1981 in Fernie, B.C., the weatherman smiled and 100 geologists interested in coal were treated to a technically and socially well organized workshop on southeastern B.C. coalfields. In general, the talks were of high caliber and well illustrated. David Grieve, District Geologist in Fernie for the Ministry of Energy, Mines and Petroleum Resources, did an excellent job of organizing and orchestrating the meeting.

The meeting opened with a general session on the stratigraphy and sedimentology of the Jurassic-Cretaceous Kootenay Group. The depositional environments were portrayed by Dave Gibson, maceral compositions and their significance by Alex Cameron, and palynology by Art Sweet, all with the GSC in Calgary. Dave Grieve zeroed in on stratigraphy of the coal seams, and Peter Daignault illustrated some of the difficulties in correlating seams at Fording Coal.

The afternoon session painted a picture of the structural setting of the deposits. Pete Gordy of Shell Oil led off with a rapid-fire structural tour around the coalfields. Dave Pearson, a consultant, outlined the usefulness of coal rank studies in determining tectonic history. Marc Bustin of UBC followed with a meticulous description of small and large scale tectonic features in Crowsnest Pass area coal deposits. Dave Grieve gave a brief overview of the Flathead Coalfield then detailed papers were given for the Lillyburt deposit by Brian McKinstry of Crows Nest Resources, and for the Sage Creek property by Owen Cullingham of Pan Ocean.

The evening featured a prime rib dinner followed by a slide tour entitled "Coal liquefaction plants I have known", humorously and energetically delivered by Dave Pearson.

The second day of the meeting concentrated on detailed property reports. The morning was devoted to the Crowsnest (Fernie Basin) Coalfield and Coal Mountain. After a brief overview by Dave Pearson, the Michel area was outlined by Lynn Taylor of B.C. Coal (formerly Kaiser Resources) and Tom Cole of Crows Nest Resources described the Lodgepole property. The geology of the Dominion Coal Blocks and Coal Mountain were well described by Neil Ollerenshaw of the GSC and Marc Bustin respectively. The afternoon was devoted to the Elk Valley Coalfield. After an overview by Dave Grieve, the Line Creek mine (by Ted Hannah of Crows Nest Resources), the Greenhills property (by Sam Samuelson of B.C. Coal), Fording Coal properties (by Ken Komenac) and the Elco property (by Gary Lawrence), were described.

Selected Highlights

The difficulty of correlating coal seams in an area of rapid facies changes and complex structural history was continuously stressed. However, to a non-expert like myself, it was equally clear that work to date has partially succeeded in outlining criteria for successful correlation within individual properties.

As Dave Gibson explained, sediments in the Kootenay Group were derived from the west and transported by meandering and braided streams toward the Fernie Sea. As a result facies reflect alluvial fan, alluvial plain, coastal plain, and beach environments within wave-dominated deltaic systems.

The sedimentary rocks are time-transgressive; they young eastward and northward and rapid lateral facies changes are the rule. The components of the Kootenay Group, from oldest to youngest, are the basal Morrissey Formation sandstone, the coal-bearing Mist Mountain Formation and the Elk Formation. The overlying Cadomin Formation of the Blairmore Group is interpreted to be either a braided plain or a sediment lag deposit.

Maceral composition in the coals is controlled by the source vegetation and the rank. There are a staggering number of subdivisions of maceral type but they fall into three broad groups: vitrinite, exinite and inertinite, and of prime interest in assessing coal quality is the vitrinite to inertinite ratio. Alex Cameron described variations that occur in modern peat environments and their applicability in

interpreting variations in coals. Modern environments where peat forms include open water, reed moors and forested swamps. The influence of fires in swamps (and they seem to occur frequently) is critical because replacement plant communities can be completely different, and also because fires tend to produce constituents which become inertinite macerals in coal. Cameron also pointed out that there are many subenvironments within swamps that will influence the composition of coals that eventually form.

Lateral changes in thickness of formations in the Kootenay Group may be related to tectonic or depositional factors but, as Dave Grieve pointed out, can also be due to variation in the compactibility of the sediments. For example, he cited one example of closely-spaced sections where total thicknesses vary by several hundred feet because of thick peat sections compacted to coal. Lateral variations, structural complexity, and lack of both rock and fossil "markers" make coal seam correlation tricky. Some possible approaches Grieve reviewed are identification of cyclothems, marine horizons, or tonsteins (ash layers); of these only rare tonsteins have been recognized. Mapping coal seams is hampered by structural complexity, facies changes, and discontinuity of outcrops. Neither coal petrology nor petrography have been successful to date as correlation tools partly because of the effects of strain. Nor have ash mineralogy, levels of radioactivity, rheological properties or other factors been successful. Successful correlation within individual coal properties relies on relatively closely spaced drilling (for example, Peter Daignault commented that a spacing less than 1,000 feet is necessary at Fording Coal), geophysical logging and use of one or more coal quality parameters.

Although correlation problems are many, almost all the papers left the general impression that coal seams are thicker, more persistent and have fewer splits in the lower part of the Mist Mountain Formation. For example, at Line Creek, lower units can be correlated for a distance of about 5 km.

Talks on structural aspects of the southeast coalfields pointed out that they are in the hanging wall of the Lewis thrust and in the footwall of the Bourgeau thrust. Studies in the Fernie Basin by Dave Pearson and Dave Grieve of the coal rank (vitrinite) enable the relative timing of coalification and structural deformation to be determined. The studies suggest that coalification continued after thrust faulting and folding, but was complete before normal faulting took place. Coal rank distributions may therefore be partially explained by structural setting, although regional rank gradients have been superimposed.

Marc Bustin presented evidence that coal was sheared, moved into fold cores, and flowed cataclastically along fold axes in the Crowsnest Pass area. Folds in the coal seams are disharmonic with those in the surrounding rock.

In the talks detailing individual coal properties, it was obvious that careful stratigraphic and structural studies are essential in so-called mountain coals. Structural settings vary; for example, Brian McKinstry indicated that thermal coal on the Lillyburt property in Flathead Coalfield lies in an east-plunging syncline bordered on the north and south by normal faults whereas the Sage Creek thermal coal deposits are in a fault-chopped north-south monocline, and metallurgical coal deposits at Elco property are in the east limb of a tight syncline. Lynn Taylor gave a fascinating historical "tour" of the development of geological thinking in the Michel area. As drill hole-spacing decreased, structural complexity "increased", culminating in recognition that the metallurgical coal is cut by a series of en echelon thrust faults and later normal faults.

Perhaps it has not been clearly stated that the coalfields have many seams but not all are economically interesting. Tom Cole described 8 seams in the 200 m thick coal-bearing sequence on the Lodgepole property, Sam Samuelson talked about 29 seams on the Greenhills property, and Ted Hannah, 16 seams at Line Creek. However, generally only a few seams, 4 at Greenhills, for example, comprise the majority of the reserves. Operations at B.C. Coal and Byron Creek Collieries depend almost exclusively on single coal seams.

On the Dominion Coal Blocks, Neil Ollerenshaw described disharmonic folding between Triassic, Jurassic and Cretaceous rocks. Each package is separated by a decollement and there appears to be a major detachment zone between the Jurassic and Cretaceous rocks. Ollerenshaw also provided new insight into stratigraphy of the Elk Formation and the overlying Blairmore Group. He interprets the Cadomin Formation conglomerate, for example, to be a series of conglomerate units separated by shales.

On Coal Mountain, Marc Bustin's excellent maps and cross-sections told a story of incredibly complex structural geology. This complexity has contributed to the thickening of the "Mammoth" coal seam to greater than 45 m in some locations.

Conclusion

It was impressive to see so many geologists with experience and interest in southeastern B.C. coalfields gathered in one place. All present appreciated the opportunity to hear the latest in both property developments and academic research. The relaxed interchange of ideas between geologists in various companies, universities and government departments made the workshop a success.

MS received June 17, 1981.