ABSTRAK

GEOLOGI DAN PENGARUH STRUKTUR GEOLOGI TERHADAP KUALITAS BATUBARA FORMASI WARUKIN PADA *SEAM* H1, H2, DAN G1, *PIT* TUTUPAN SELATAN, KABUPATEN BALANGAN, KALIMANTAN SELATAN

Oleh
Rafi Abhista Putra
NIM: 111220249
(Program Studi Sarjana Teknik Geologi)

Pit Tutupan Selatan di Kabupaten Balangan, Kalimantan Selatan, menyingkapkan tiga lapisan batubara Formasi Warukin berumur Miosen (Seam H1, H2, dan G1) yang kualitas batubaranya berfluktuasi secara lateral maupun vertikal. Lingkungan pengendapan tidak sepenuhnya menjelaskan keragaman tersebut sehingga deformasi tektonik pasca-pengendapan berupa perlipatan (sinklin) dan pengekaran (*cleat*) akibat Orogenesa Meratus diduga menjadi pengendali tambahan. Penelitian ini bertujuan menentukan pengaruh struktur geologi lipatan sinklin dan rekahan alami (*cleat*) terhadap nilai *Inherent Moisture* (IM), kadar abu, serta *Calorific Value Air Dried Basis* (CV adb). Metode penelitian mengintegrasikan pemetaan geologi permukaan dengan data sekunder berupa log bor dan uji proksimat batubara. Pengukuran lapangan merekam kedudukan sayap lipatan beserta dimensi *cleat* (panjang, spasi, bukaan) pada enam stasiun pengamatan. Genesa rekahan ditetapkan melalui rotasi lapisan ke bidang horizontal, sedangkan keterkaitannya dengan kualitas batubara diuji memakai *scatter plot* dan koefisien determinasi (R^2). Analisis stereografis mengungkap sinklin bersumbu N205°E (penunjaman 5°) dengan bidang sumbu N027°E/79°, dan seluruh kekar terbukti sebagai *cleat* eksogenik bentukan tektonik. Posisi lapisan terhadap *hinge* mengendalikan kualitas batubara melalui *Inverted Coal Maturity Trend* pada Seam H2; meskipun termuda, seam ini terletak di sumbu sinklin sehingga justru memiliki kualitas paling baik (IM 16,17%; abu 1,93%; CV 5.773,67 kcal/kg), melampaui kontrol umur dan kedalaman penimbunan. Panjang dan bukaan rekahan berkorelasi positif terhadap CV (R^2=0,69 dan 0,65) serta berbanding terbalik dengan IM dan kadar abu, sementara spasi menunjukkan hal sebaliknya. *Frictional heat*, evakuasi fluida, dan presipitasi mineral sekunder menjadi mekanisme pengendali utama dalam penentuan kualitas batubara pada proses *coalification* sehingga peringkat batubara meningkat dari *Subbituminous* C (G1) menuju *Subbituminous* A (H2) ke arah inti lipatan. Kontrol struktur dari lipatan dan *cleat* terbukti dominan terhadap heterogenitas kualitas batubara dan layak menjadi pertimbangan utama dalam perencanaan tambang.

Kata kunci: *cleat*, Formasi Warukin, kontrol tektonik, kualitas batubara, sinklin.

ABSTRACT

GEOLOGY AND THE EFFECT OF GEOLOGICAL STRUCTURE ON THE QUALITY OF WARUKIN FORMATION COAL IN SEAM H1, H2, AND G1, SOUTH TUTUPAN PIT, BALANGAN REGENCY, SOUTH KALIMANTAN

By
Rafi Abhista Putra
NIM: 111220249
(*Geological Engineering Undergraduated Program*)

The South Tutupan Pit in Balangan Regency, South Kalimantan, exposes three Miocene coal seams of the Warukin Formation (Seams H1, H2, and G1) whose coal quality fluctuates both laterally and vertically. The depositional environment does not fully explain this variability, so post-depositional tectonic deformation in the form of folding (syncline) and jointing (cleat) caused by the Meratus Orogeny is inferred to be an additional control. This study aims to determine the influence of synclinal fold structures and natural fractures (cleat) on Inherent Moisture (IM), ash content, and Calorific Value Air Dried Basis (CV adb). The research method integrates surface geological mapping with secondary data in the form of borehole logs and coal proximate analysis. Field measurements recorded the attitudes of the fold limbs together with cleat dimensions (length, spacing, aperture) at six observation stations. Fracture genesis was established by rotating the beds back to the horizontal plane, while its relationship with coal quality was tested using scatter plots and the coefficient of determination (R^2). Stereographic analysis revealed a syncline with an axis trending N205°E (plunge 5°) and an axial plane of N027°E/79°, and all joints proved to be tectonically formed exogenic cleats. The position of the beds relative to the hinge controls coal quality through an Inverted Coal Maturity Trend in Seam H2; although it is the youngest, this seam lies on the syncline axis and therefore has the best quality (IM 16.17%; ash 1.93%; CV 5,773.67 kcal/kg), surpassing the controls of age and burial depth. Cleat length and aperture correlate positively with CV (R^2=0.69 and 0.65) and inversely with IM and ash content, whereas spacing shows the opposite. Frictional heat, fluid evacuation, and secondary mineral precipitation are the main controlling mechanisms in determining coal quality during coalification, so that coal rank increases from Subbituminous C (G1) to Subbituminous A (H2) toward the fold core. Structural control from folds and cleats proves dominant over coal quality heterogeneity and is worth being a primary consideration in mine planning.

Keywords: *cleat, coal quality, syncline, tectonic control, Warukin Formation.*