

Thesis Title Sedimentology Petrology and Geochemistry of Coal
and Oil Shale Deposits in Delbi-Moye Basin South
Western Ethiopia

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Abstract

The Delbi-Moye Basin in South Western Ethiopia at Latitudes 7° $12'-24'N$ and Longitudes 36° $50'-53'E$ is subjected to sedimentological, petrological, and geochemical studies, for a possible explanation of their genesis and depositional environments. Its lithologic evolution is largely governed by the prerift volcanic activities and the associated fluvio-lacustrine deposits. These lithologies are subdivided into three phases of basaltic volcanism into lower, middle, and upper units, and two episodes of interbasaltic sedimentation designated as sediment I and II units. The sediments are assumed to have been originated in intervolcanic rifted basin comprising, the Lower mudstone unit, the Lower oil shale unit, the Middle mudstone unit, the Upper oil shale unit, and the Upper coal-bearing units. Facies characteristics in the basin are built in

response to four environmental factors. These include, alluvial fan facies, fluvial facies, marginal lacustrine facies, and open lacustrine (unstable, stable, and swamp or bog related) facies.

In the study, the geophysical methods indicated several gravity anomalies reflecting patterns of more restricted subsidences. Current understanding suggested that the total mass under the gravity stations at the western subquadrant and central to eastern subparts of the basin are the sites of the thickest sediment depositions.

The organic petrological studies indicated that the western subpart coals are essentially humic and are originated from a forest swamp accumulations. The recognition of cutinites resinites and spornites in the eastern subbasin suggested swamp or bog related environments of sapropelic origin, developed from a reed marsh. In the oil shale an increase in volume of terrestrial plant matter in the marginal western subparts produced coaly torbanites, and algal derived organic matter at the central to eastern subparts accumulated torbanitic shales.

The Rock-eval pyrolysis and Fischer assay methods have shown a three component systems, essentially of type I and II kerogens for the Upper oil shale unit, type II Kerogens for the Lower oil shale unit and mainly of type III Kerogens for the western subpart. Their specific oil yields and hydrocarbon potentials varied considerably, in which type I and II dominated kerogens in the eastern part generated more hydrocarbons than type III dominated western subparts.

Rank determinations of the coals range from subbituminous through high volatile bituminous C and A coals. The majority of the coal seams in the area exhibited higher ranks due to the proximity of volcanic extrusions.

The inorganic fractions of the sediments as studied by X-ray diffraction methods have shown three clay mineral types of kaolinites, muscovites, and montmorillonites. The none clay minerals include, quartz, pyrite, dolomite, siderite, calcite, and feldspars. The clastic sediments that comprized the detrital minerals are probably transported from upland sources. However, the presence of authigenic minerals marked their formation under a reducing environmental conditions. As rarely indicated by montmorillonites, calcites, and dolomites it is presumed that there could have been a chemically controlled brakish environment.

The results of the palynological analysis, as indicated by *verrutricolporites rotundiporis*, *Florschuetzia semilobata*, *Florschuetzia trolobata*, *Didymosporites spp.*, *Nuxpollenites crokettansis*, *Retimonosulusites ovapus*, as well as the related back ground on the geology and structural aspects of the region confirmed that a range of Eocene to Miocene ages are considered for the whole sequence of Delbi-Moye Basin. The areal distribution of the volcanics are in accord with respect to the palynological studies. The chronological data (K/Ar) for the basal volcanics are in the pre Oligocene ages (49.4 to 46.4 Ma) of the Ashangi groups and the younger volcanics in the post Oligocene catagories (31 to 21 Ma and 13.0 Ma to present day) of the

Magdala groups. The Delbi-Moye and other smaller basins in the South Western Ethiopia are parts of the ubiquitous sedimentary intercalations within these volcanics.

The potential resources of the Delbi-Moye coals show indicated and inferred, resources of 3.8×10^6 and 15×10^6 tons for Delbi and Moye coals, respectively. However, the rheological property for Moye coals is predicted as to be a good coking coal, and that of Delbi coals permitted a better combustion behaviour. The inferred resources for the oil shales with average thickness of 10m and shale oil yields greater than 30-60 l/T are estimated to be 100×10^6 tons.

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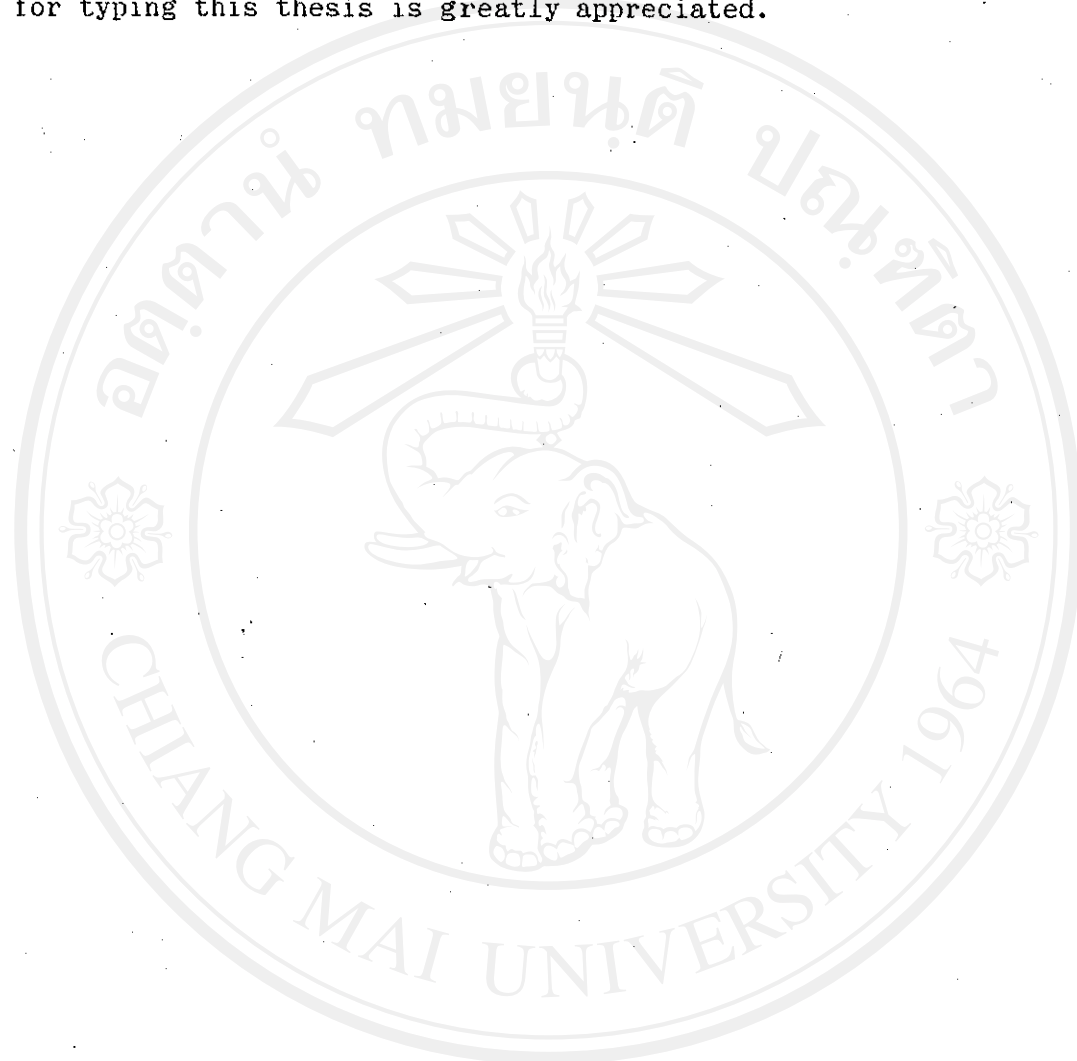
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