LAB MANUAL

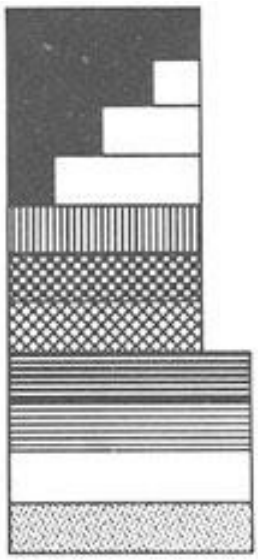
Coal Geology and Organic Petrology Lab./AGL

Sub: Coal Geology Practical (GLC 516)

General Instructions:

a. Students should come with Practical file (containing white papers and ruled papers) as per instruction, pocket lens, graph papers, set square, protractor, pencils, eraser, calculator
b. While doing micopetrography under microscope, students are to be careful.
c. Coal samples are delicate and soft. Students are directed to handle samples with care.

1. **Megascopic identification: (Practical Periods:3):** Megascopic identification of different varieties of coal
   Objective: To identify different varieties and ranks of coal have distinguishing characteristics
   Brief Theory: Various ranks and different type of coal have distinguishing properties
   Peat: Colour-yellow, yellowish brown; **Hardness-**~0.5; Sp.gr.- ~0.5; Not an economic fuel; **Use:** Fertilizer, manufacture of briquettes
   Lignite: Colour- yellowish brown, brown, dark brown; **Hardness-**~0.5; Sp.gr.- ~0.5
   SubBituminous Coal:
   Bituminous Coal
   SemiBituminous or SuperBituminous Coal
   Semianthracite
   Anthracite:
   Additional Instruction: To see various varieties of coal in geological museum
   Learning Outcome: Understanding of different varieties and ranks of coal.
   Questions: 1) Difference between Peat and Lignite
   2) Difference between Lignite and Bituminous coal
   3) Significnce of Hardness and Specific Gravity
2. **Lithotypes: : (Practical Periods:6)** Identification of lithotypes, lithotype logging and cleat attributes
   Objective: To identify different lithotypes, lithotype logging and cleat attributes
   First Run: To identify different lithotypes
   Second Run: Lithotype logging and cleat attributes
   Brief Theory: To designate various types of lithotypes on proportion of bright and dull bands.



Bright Coal (Vitrain)

Banded Bright Coal (Clarain)

Banded Coal (Duroclarain)

Banded Dull Coal (Cladodurain)

Dull Coal (Durain)

Fibrous Coal (Fusain)

Shaly Coal

Coaly/Carbonaceous Shale

Shale

Claystone/Tonstein

Sandstone

Lithotype	Symbol	Description
Bright coal (vitrain)	B	Vitreous to subvitreous lustre; even to conchoidal fracture; brittle; may contain up to 10% dull coal in bands less than 5mm thick
Banded bright coal (clarain)	Bb	Mainly bright coal containing thin (less than 5 mm) dull coal bands ranging in proportion between 10 and 40%; even fracture
Banded coal (duroclarain)	Bd	Contains bright and dull coal bands (all less than 5 mm) ranging proportion between 40 and 60% each
Banded dull coal (clarodurain)	Db	Mainly dull coal containing thin (less than 5 mm) bright bands ranging in proportion between 10 and 40%; uneven fracture
Dull coal (durain)	D	Matt lustre and uneven fracture; may contain 10% of bright coal bands less than 5 mm thick
Fibrous coal (Fusain)	F	Dull with satin sheen; friable; may contain up to 10% of other coal lithotypes less than 5 mm thick
Shaly coal	Cs	Contains between 30 and 60% of clay and silt either in intimate mixture with coal or in separate bands each less than 5 mm thick
Coaly shale, mudstone, sandstone etc.	Sc	Consists of alternating laminae (each less than 5 mm thick) of non-coal and coal, the latter not exceeding 40% of total
Carbonaceous shale, mudstone, siltstone etc.		Any sediment containing 60 to 90% finely disseminated carbonaceous matter
Shale, mudstone, siltstone, sandstone etc.		Any sediment containing less than 10% carbonaceous matter

Cleat types: Face cleat, Butt cleat, Tertiary cleat, Master cleat

Cleat intensity

Cleat density

Learning Outcome: identification of various lithotypes, logging and cleats

Vitrain
Clarain
Duroclarain
Calrodurain
Durain
Coaly shale
Carbonceous shale
Shale

Learning Outcome: preparation of seam formation curves and their interpretations

Reducing

Questions: 1) What is lithotype?

2) Difference between clarodurain and duroclarain

3) How you differentiate between face cleat and tt cleat

3. **Identification of macerals**: **: (Practical Periods:9)** Identification of macerals and minerals under transmitted light; Identification of macerals and minerals under reflected light; Reflectance measurements and rank determination of coal.
   Objective: Identification of macerals and minerals.
   First run: Identification of maceral groups
   Second run: Identification of various vitrinite, liptinite and inertinite macerals under transmitted light
   Third run : Identification of various vitrinite, liptinite and inertinite macerals under reflected light
   Brief Theory: Macerals have distinguishing characteristics under transmitted as wee as in reflected light.
   Apparatus/ components required: Transmitted and Reflectance Microscope

MACERAL GROUPS: THREE MACERALS GROUPS: -

(i) Vitrinite group;
(ii) Liptinite or exinite (group);
(iii) Inertinite group.

VITRINITE

Vitrinite designates a groups of macerals whose clour is grey and whose reflectance is generally between that of the associated darker liptinites and lighter inertinites over the rank in which the three respective macerals groups can be readily recognized – (ICCP system, 1994).

Liptinite (Exinite) – The macerals of liptinite group have brown red distinct morphology and the colour varies a lot. It may be golden yellow, orange, red and even of the same colour as the associated vetrinite. The different primary macerals of this group are:

Inertinite : The macerals of this group were supposed to be inert during carbonization reactions. The characteristic optical property of inertinite macerals is their high reflectance. The important macerals of inertinite are given below:

Microlithotypes: Associations of macerals are termed as microlithotype Microlithotypes are divided into three groups – (1) Monomaceral, (2) Bimaceral, and (3) Trimaceral microlithotypes.

VITRINITE

Telinite – consists of clearly recognizable cell walls of more less intact plant tissue

Collotelinite – homogeneous, more or less structureless appearance.

Vitrodetrinite – occurring as discrete small vitrinite small fragments of varying shape that become discernible when surrounded by non-vitrinite material.

Collodetrinite – occurring as mottled vitrinitic groundmass binding over coal components.

Gelinite – homogeneous, structureless colloidal in-fillings of cracks and other voids.

Corpogelinite – homogeneous and discrete colloidal bodies representing cell infillings.

Liptinite (Exinite) –

Sporinite – disc shaped; originated from spore and pollen exine and entine, fluorescence characteristics (F.Ch) – yellow to orange, rarely green, Fluorescence intensity (F.I) – moderate

Varieties- (a) Teneuisporinite – thin walled

(b) Crassisporinite – thick walled

(c) Microsporinite – small

(d) Marcrosporinite – large

(e) Megasporinite – very large.

Cutinite – Flattened sheets, more rarely cylindrical, serrated margin, originated from higher plant typically from leaves, F.Ch – similar to sporinite but commonly with a greater range, F.I. – variable through high, moderate to weak even in one sample.

Resinite – Lensoidal masses, cell infillings or isolated bodies, originated from higher plants, F.Ch – green, yellow orange or reddish-brown. F.I. – high to very weak; occurs in canneloid coals, some mixed oil shales, dom (disposed organic matter).

Alginite A – Lensoidal fan or disc shaped; originated from Boryococcus, Pila Reinschia Gloeocapsomorpha Tasmanites, F.Ch – Greeen to yellow orange; F.I. – high, occurs in lamosite torbanites, kukersites.

Alginite B – Irregular stacked sheet like masses; F.Ch-Yellow to orange less commonly greenish yellow, F.I.-Moderate to high, occurs in lamosites; possibly in cannels and torbanites.

Acritarchs and Dinoflagellates – Flattened cysts, originated from acritarchs and dinoflagellates, F.Ch-greenish yellow, F.I.- high.

Bituminite – Amorphous to lamellar, may be associated with inertinite, characteristic ground mass of cannels; originated from anaerobic degradation of higher plants and/or algae, may be equivalent in part to alginite B, F.Ch-Yellow, orange, brown, F.I.-weak but with strong positive alteration.

Fluorinite – Cell fillings or as veins, originated from oils of higher plants possibly crude oil in some cases, F.Ch-Blue, green, yellow, F.I-very high to high.

Suberinite – Surrounding cells, also as massive layers, F.Ch-Orange, brown, rarely yellow, C.I-Typically weak but moderate at very low ranks, occurs in cannels and shales.

Exsudatinite – Veins, pore fillings, originated from expelled hydrocarbons, F.Ch-Orange, rarely yellow, F.I.-Moderate to weak, occurs in cannels.

Liptodetrinite – Small fragments; originated from fragments of other liptinite macerals, F.Ch – Green, yellow, orange, brown, F.I. – high to weak.

Recently in 1997 one new maceral "barkinite" is reported from China.

Inertinite :

Maceral	**Submaceral**
Micrinite	
Macrinite	
Semifusinite	Oxysemifusinite(Degradosemifusinite)
	Pyrosemifusinite
Fusinite	Oxyfusinite(Degradofusinite)
	Pyrofusinite
Selerotinite	Fungoselerotinite
Inertodetrinite	

Learning Outcome: Identification of macerals under microscope
Questions: 1) What is maceral?
2) Difference between Vitrinite and Inertinite macerals
3) Difference between sporinite and cutinite

4. **Coal Reserve: : (Practical Periods:6)** Estimation of Coal Reserve and quality
First Run: Three-point problem with delineation of coal body.
Second Run: Reserve calculation of coal body
Objective: Reserve computation of a coal body
Brief Theory: The main purpose of reserve computation of a coal body is to determine – the quantity (tonnage), the quality (grade) of and amenability to commercial exploitation of the coal.
The reserves of the entire body are computed by determining areas and volumes for each block, converting block volumes to tonnages of raw mineral material, determining average quality and tonnages of valuable components, and finally, tabulating the result of blocks of same category.
Apparatus / Components Required: Graph paper, set square, pencil, eraser etc.
Learning Outcome: Estimation of coal reserve
Questions: 1) What is reserve?
2) Difference between Resource and Reserve
3) Effect of fault on reserve in a specified area

5. **Coding of coal characters: : (Practical Periods:6)**
Coal classification
First Run: Reporting of Proximate Analyses on various basis
Second Run: Coding and decoding of coal characters following International Coal classification
Objective: To learn coal classification
Apparatus / Components Required: International Coal classification
Learning Outcome: understanding of coal classification.
Questions: 1) What are salient features of International Coal classification?
2) Difference among $VM^{daf,}$, VM^{a} , VM^{dmmf} and VM^{mmmf}
3) What is unit coal?

6. **Location of coalfields: : (Practical Periods:3)** Location of coalfields on geographical maps and comments about quality of coal.
Objective: Distribution of coal and lignite basins in India
Apparatus / Components Required: Outline map of India
Learning Outcome: understanding coal basins and their coal quality.
Questions: 1) What are difference between Gondwana and Tertiary coal basins
2) Where lignites are found?
3) Where coking coals are mainly found and why?

Text Books:

- Taylor, G.H., Teichmüller, M., Davis, A., Diessel, C.F.K., Littke, R., Robert, P., 1998. Org. Petrol. Gerbrüder Borntraeger, Berlin.16, 704.
- van Krevelen, D.W., 1993. Coal: Typology-chemistry-physics-constitution. Elsevier Science, Amsterdam, 963.
- Applied Coal Petrology-The Role of Coal Petrology in Coal Utilization by Isabel Suárez-Ruiz and John C. Crelling (Eds**)** Elsevier,Academic Press (2008).

Reference Books:

1. Introduction to Geology of coal and Indian Coalfields by N.L.Sharma & K.S.V. Ram,1979
2. Coal resources of India. Mem.GSI, vol.88,1971
3. Coal Geology and Coal Technology by C.R.Ward,1984
4. Coal bearing depositional system by CFK Diessel, 1992 Edition
5. The Chemistry and technology of coal- James G. Speight,1994
6. Coal and coal bearing strata Ed. A,C.Scott,1987
7. Coalbed Methane and Coal Geology-Eds. R.Gayer and I. Harris, 1996.
8. Coalbed Methane: scientific, environmental and economic evaluation-Masatalerz and others, 1999.
9. Progress of Coal Petrology in India by H.S.Pareek, 2004.
10. Coal Resources of West Bengal (Bull.Geol.Surv.Ind.Series A No.45, 2003)RK Datta,A.B.Dutt.

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