Benha University
Faculty of Science
Geology Department

Post graduated Exam
Petroleum Geology Diploma

2ed Jan. 2017

Answer Model of Petroleum Geology Course ***Code (G501)*** ***Time allowed: 3hrs*** ********

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1- Facies Sequence

A facies sequence is a series of facies that pass gradually from one into another. A sequence can have an abrupt or erosive boundary, or be bounded by a hiatus, as indicated by a rootlet bed, reworking, or early diagenesis. Clastic environments have two important types of sequences. In one, there is a coarsening upward sequence that develops above a sharp or erosional base; a second type is the fining upward sequence. This is important in interpretation of depositional environments, because grain size is normally a measure of the hydraulic power at the time of deposition and a coarsening upward sequence indicates an increase in flow power. This may be due to shallowing as a delta, shoreline, or river crevasse builds out into deeper water, or to progradation of a submarine fan. Fining upward sequences can be formed by a migrating point bar in a river or by filling of an abandoned channel.

Walther's Law

Walther's Law states that "the various deposits of the same facies area and, similarly, the sum of the rocks of different facies areas were formed beside each other in space, but in a crustal profile we see them lying on top of each other...it is a basic statement of far-reaching significance that only those facies and facies areas can be superimposed, without a break, that can be observed beside each other at the present time." This is interpreted to mean that facies occurring in a conformable vertical sequence were formed in aerially adjacent environments and the facies in vertical contact must be the product of neighboring environments.

2- **The density of crude oil is usually measured in "specific gravity". Specific gravity is the ratio of one** substance to an equal volume of pure water, at a standard temperature (generally 60°F (15°C)). The API gravity scale, used in the petroleum industry, is an arbitrary one, and does not have a straight-line relationship with specific gravity or any other physical property, such as viscosity. High values of API gravity correspond to low specific gravities, and low values of API gravity correspond to high specific gravities.

3- When the interstitial water is below 10 percent, the resistivities approach infinity.

4- Isopach and Isochore Maps

These maps are produced from seismic or well data, but the contours represent thickness of a specific mapping unit. An isochore map delineates the true vertical thickness of a rock unit, and the contours represent lines of thickness between two datum planes, usually the oil water contact (OWC) and the cap
rock, while an isopach map illustrates the true stratigraphic thickness of a unit. An isopached unit may be as small as an individual sand only a few feet thick, or as large as several thousand feet thick and encompassing a number of sand units. These maps are extremely useful in determining the structural relationship responsible

for a given type of sedimentation. The shape of a basin, the position of the shoreline, areas of uplift, and in some circumstances the amount of vertical uplift and erosion, can be recognized by mapping the variations in thickness of a given stratigraphic interval. Geologists use isopach maps in depositional environment studies, genetic sand studies, growth history
analyses, depositional fairway studies, derivative mapping, determining the history of fault movements, and calculation of hydrocarbon volumes. An interval isopach map delineates the true stratigraphic thickness of a specific unit. Net sand isopachs are isochore maps which represent the total aggregate vertical thickness of porous, reservoir quality rock present in particular stratigraphic intervals. A net pay isopach map is a special isochore map that delineates the thickness of reservoir quality sand which contains hydrocarbons. Sandstone percentage maps have contours that represent percentage of sandstone of a particular horizon and can help delineate particular plays.

5- The SP curve provides formation boundary location with excellent vertical resolution when: 1) the logs are run in fresh muds, 2) the formations are mainly sands and shales, and 3) the formations have low to medium resistivities. Under these conditions, the inflection points on the SP curve fall very close to the boundary of the formation. Location of the formation boundary from the SP are at the inflection points. Inflection points occur where there is the greatest potential drop. The inflection point always occurs at the bed boundary though its horizontal position within the curve may vary.

6- All kerogen types experience chemical alteration during maturation. This results in the formation of petroleum, and generally begins with the loss of oxygen, followed by hydrogen, to arrive at a form of hydrocarbon. The terms “sapropelic” and “humic” organic matter are often referred to when using visual descriptions of kerogen. Humic material is thought to be derived from plant matter, while sapropelic material originates from algae or plankton.

7- Vitrinite reflectance is certainly one of the most valuable tools for measuring the maturation stage of Type III kerogen and coal. Other marine or lacustrine kerogens (Type I and Type II) may also contain particles resembling vitrinite, although their composition and the evolution of optical properties may be different. In this case, it is advisable to interpret reflectance based on kerogen type and to associate the optical index with a chemically derived parameter. The indices obtained from pyrolysis may be associated with vitrinite reflectance.

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Inorganic Mechanical (primary)	Structures Chemical (secondary)	Organic Structures
A. Bedding: Geometry 1. Laminations 2. Wavy Bedding	A. Solution Structures 1. Stylolites 2. Corrosion zones 3. Vugs, Oolicasts	A. Petrifactions
B. Bedding: Internal Structures 1. Cross-Bedding 2. Ripple-Bedding 3. Graded Bedding 4. Growth Bedding	B. Accretionary Structures 1. Nodules 2. Concretions 3. Crystal Aggregates 4. Veinlets 5. Color Banding	B. Bedding 1. Stromatolites
C. Bedding Plane Markings (on sole) 1. Scour or Current Marks 2. Tool Marks	C. Composite Structures 1. Geodes 2. Septaria 3. Cone-in-Cone	C. Miscellaneous 1. Borings 2. Tracks & Trails 3. Casts & Molds 4. Fecal Pellets
D. Bedding Plane Markings (on surface) 1. Wave & Swash marks 2. Rain Pits & Prints 3. Parting lineation		
E. Deformed Bedding 1. Load & Founder structures 2. Synsedimentary folds 3. Sandstone dikes & sills		