Subsurface Mapping

The purpose of subsurface mapping in the geology of petroleum Is to find traps that contain oil and gas pools and the information obtained from wells forms the heart of the data upon which subsurface geology depends, other information are obtained from :

Geophysical surveys.

Pressure and temperature surveys.

The production history of producing oil and gas pools.

1 TYPES OF SUBSURFACE MAPS:-

1.1 Structural Maps and Sections: -

Subsurface structures may mapped on any formation boundary, unconformity, or producing formation that can be identified and correlated by well data. Structure may be shown by contour elevation maps or by cross-sections.

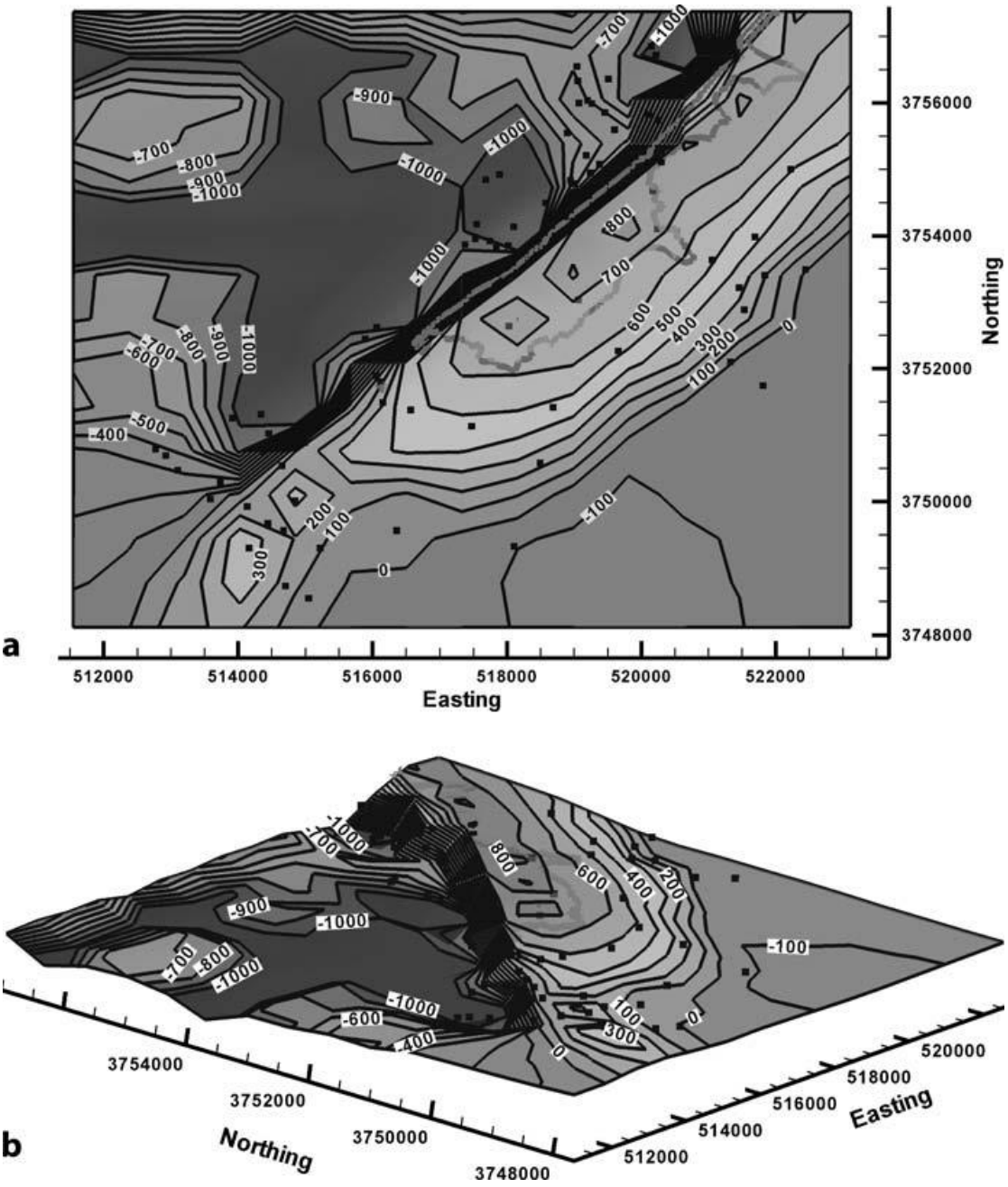


Figure 1: Composite-surface map

1.2 Isopach Maps:-

Isopach maps show by means of contours the varying thickness of the rock intervening between two reference planes commonly bedding planes or surfaces of unconformity.

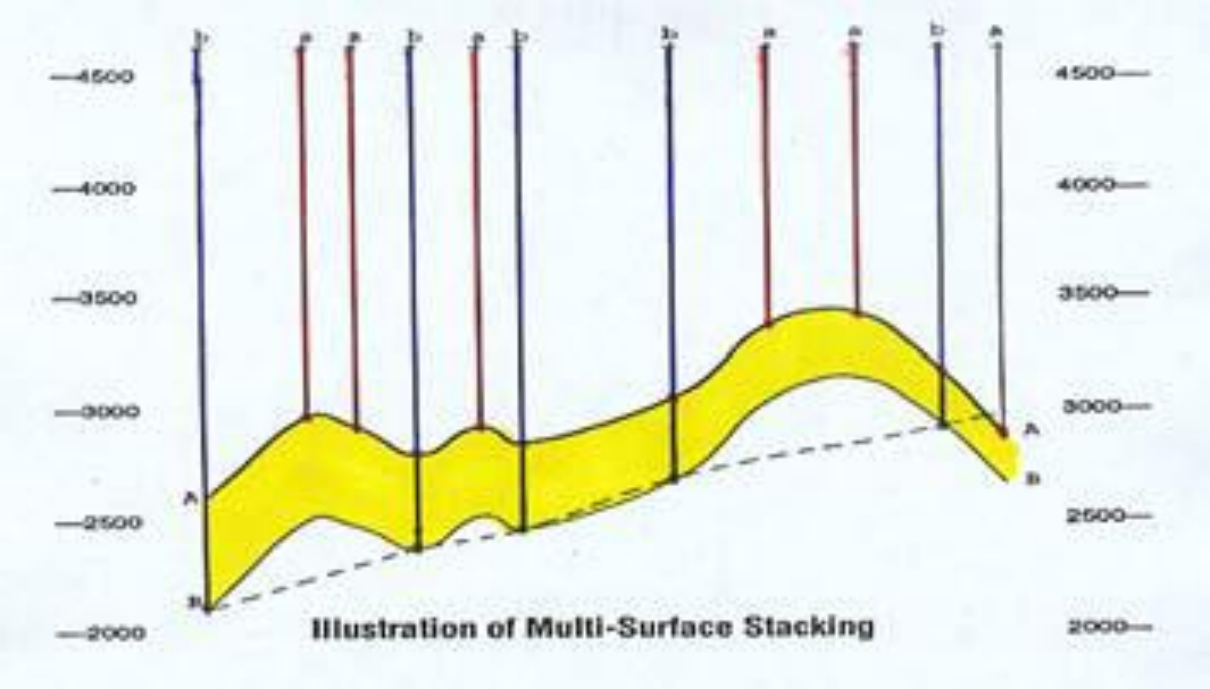
Isopach maps offer a simple method of showing the distribution of a geological unit in three-dimensions (3D) thickness of individual formations of reservoir rocks of groups of formations of intervals between unconformities and a normal stratigraphic contact or formation boundary, may be mapped in this manner.

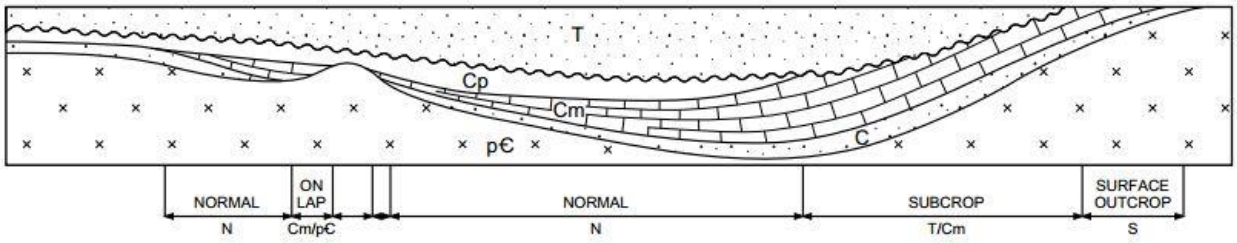
Isopach Maps are used to:

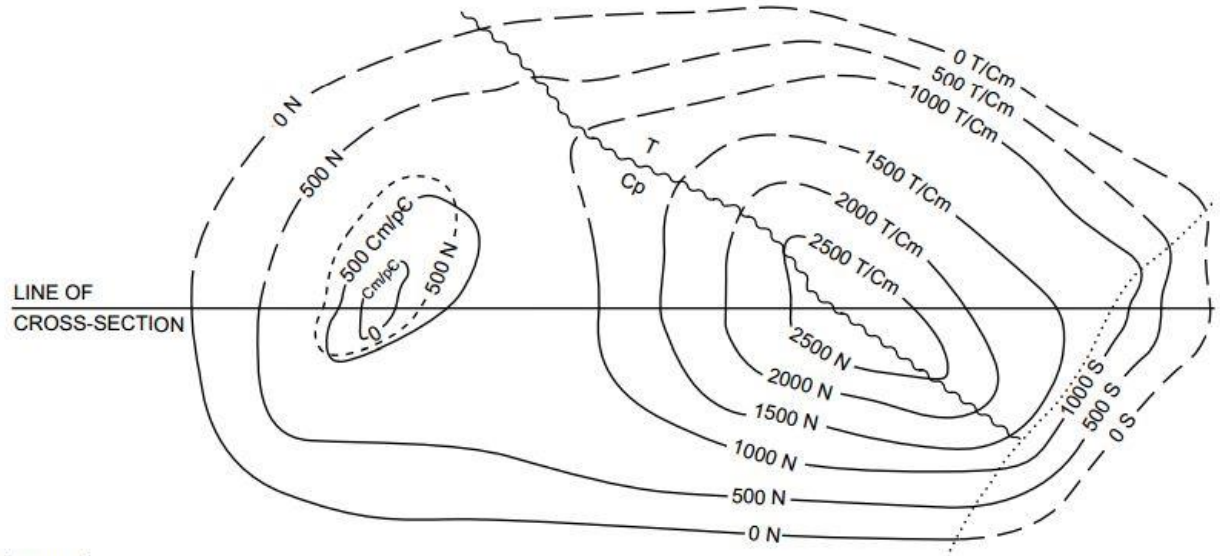
Determine the time of faulting and folding.

The time of traps formation in regional studies.

Development of a pool, especially in showing the thickness of the pay formation.







Isopach map of Cm formation

Legend

N	Normal formation boundaries, layer in normal stratigraphical succession
T/Cm	Abnormal formation contact at top of layer indicating truncated subcrop
Cm/p€	Abnormal formation contact at bottom of layer indicating onlap
S	Surface outcrop, layer truncated by erosion

Thus, an isochore and isopach map are the same only when both the top and bottom surfaces of the layer shown are horizontal. When the layer shown is inclined, as is usually the case, the thicknesses displayed in an isochore map of the layer will be greater than the thicknesses displayed in an isopach map of the same layer. Unfortunately the terms isopach and isochore are widely confused, and many times maps of True Vertical Thickness (TVT), which by definition are isochore maps, are incorrectly labeled isopach maps.

1.3 Facies Maps: -

There are several kinds of facies maps, but the most common type used in petroleum geology is "Lithofacies Maps" which distinguish the various lithologic types rather than formation.

1.4 Paleogeologic and Subcorp Maps: -

Paleogeology may be defined as the science that treats the geology as it was during various geologic periods. A map in the past that shows the paleogeology of an ancient surface is called a paleogeologic map.

Asubcrop map is a paleogeologic map in which the overlying formation is still present where as a paleogeologic map shows the formation boundaries projected in part into the area from which the overlying formation has been eroded.

1.5 Internal Property Maps:-

Maps detect the characteristics of a single unit and its shape. It includes many types:

Iso-porosity maps.

Iso-volume or iso-vol. maps.

Iso-concentration maps.

Iso-hydrocarbon maps.

Iso-bar maps

Iso-potential maps.

Water- encroachment map.

1.6 Geophysical Maps:

These maps depend on geophysical anomaly (such as local variations or irregularity in the normal pattern) which after correction may be attributed to some geologic phenomena.

1.7 Geochemical Maps:-

These maps are used for mapping various kinds of chemical analysis of rocks and their fluid contents. It may show the surface distribution of hydrocarbons where those hydrocarbons are found at the surface in large amounts than normal indicating that there is a seepage of oil or gas.

1.8 MISCELLANEOUS MAPS:-

ISO POROSITY MAPS:

The Maps which show the lines of equal porosity in the potential reservoir rock.

ISO VOLUME MAPS:

The Maps which show the contours of equal porosity-meters or porosity-ft (net thickness X porosity).

ISO POTENTIAL MAPS:

The Maps which show the initial or calculated daily rate production of wells in a pool.

ISO BARIC MAPS:

The Maps which show by contours the reservoir pressure in a pool.

ISO CONCENTRATION MAPS:

The Maps which show the concentration of salts in oil-field waters by contours.

WATER ENCROACHMENT MAPS:

The Maps which show the position of wells from which water is produced along with the oil.

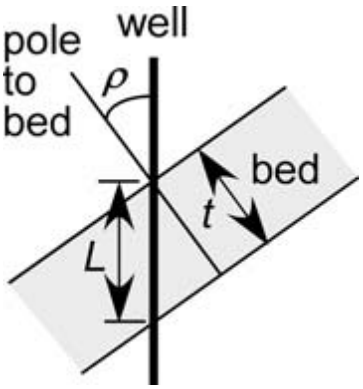
ISO CHORE MAPS:

The Maps which are lines joining points of equal vertical thickness. So isochore maps record the vertical thickness of geological units .These maps illustrate such features as

the depth of overburden above some deposits ,or the real variations in the vertical thickness of some concerted unit .

ISO PACHYTE MAPS:

Isopachytes joint points of equal stratigraphical thickness and are used to produce maps which are usually of greater interest to the geologist than engineer. These maps cannot be interpreted as quickly as those of isochors.



t = L cosΦ

Where: Φ = The true angle of dip.

t = Stratigraphic thickness.

L = Vertical thickness.

1.9 GEOLOGICAL CROSS-SECTIONS:

They represent the geologic data as maps but in the vertical view. There are several types of cross-sections but the most common in Petroleum Geology are as follows:

Correlation Cross-Sections:

They are the first figures to be drawn in the first phase of exploratory drilling and they enable the geologist to decide stratigraphic equivalences between the wells.

Structural Cross-Sections:

They show the present structural altitudes of rocks in relation to sea level as a horizontal datum.

Stratigraphic Cross Section:

They show the correlation of strata with respect to one of them selected as a horizontal datum.