Lecture-2

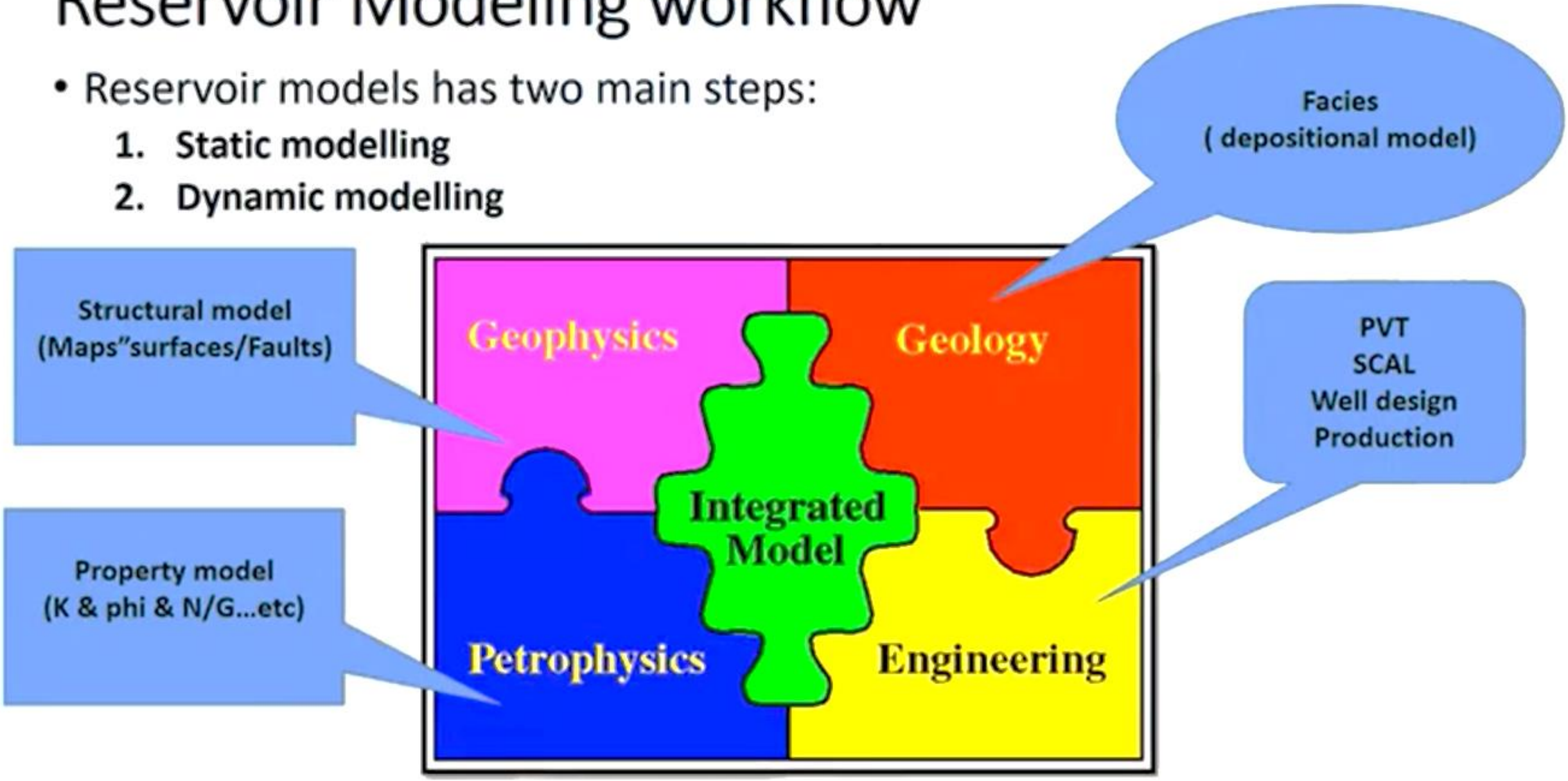
Reservoir Modeling

Petroleum & Mining Engineering Collage/ Fourth Year

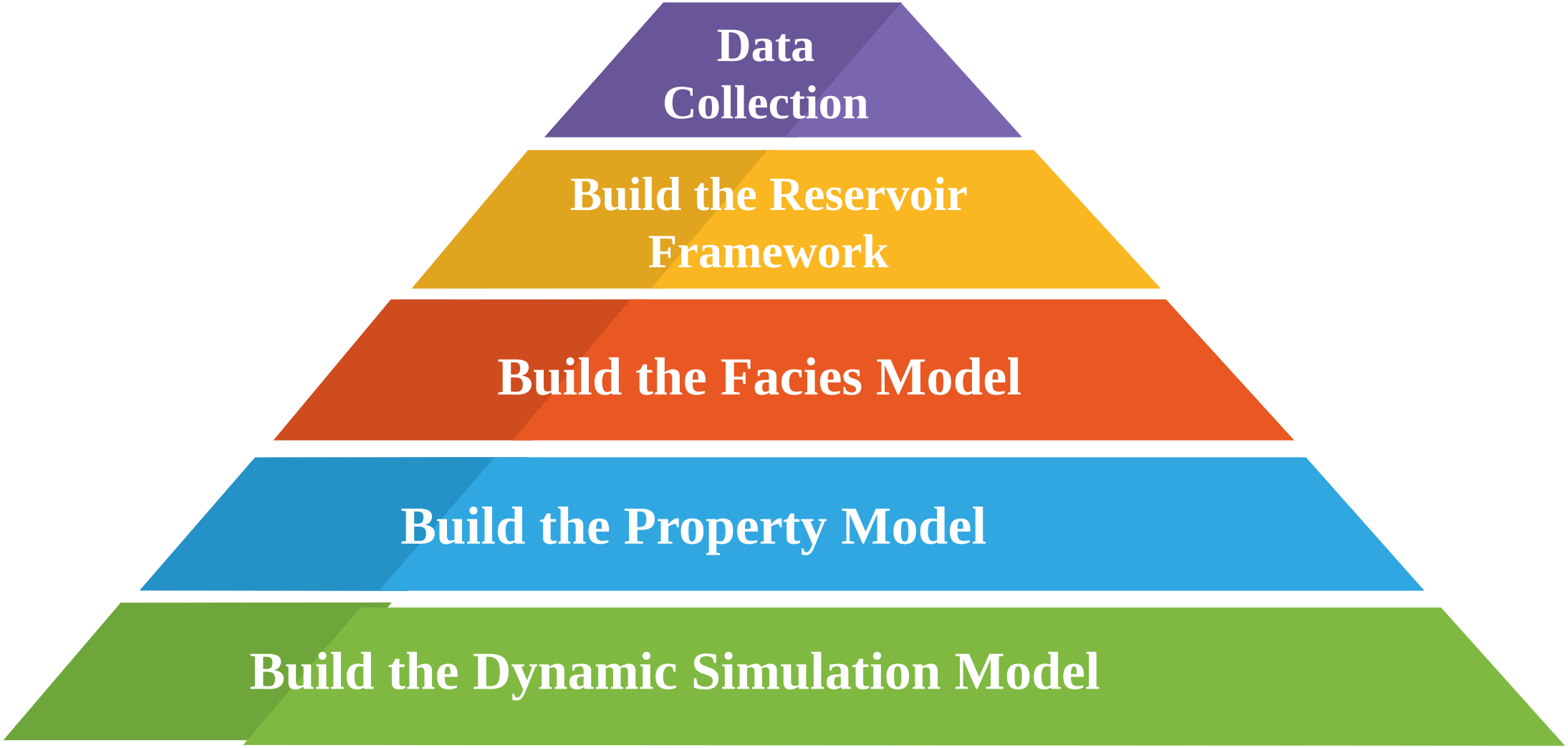
Dr. Maha Muneeb

Reservoir Modeling workflow

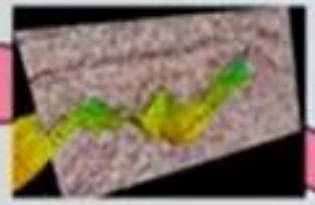
- Reservoir models has two main steps:
  1. **Static modelling**
  2. **Dynamic modelling**



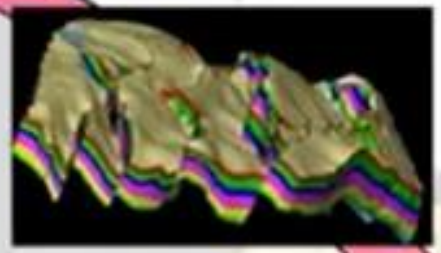
The Modeling Workflow



Reservoir Static Modeling workflow

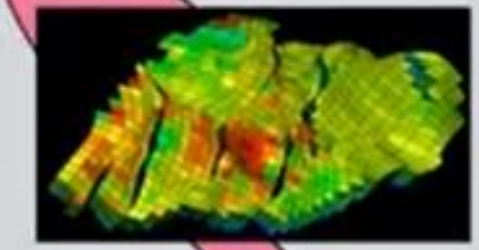


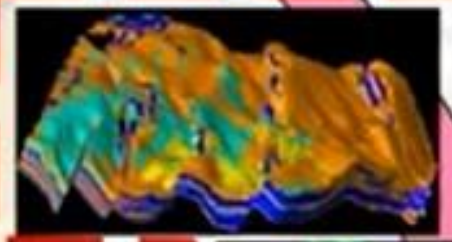
Data preparation
and interpretation



Structural modeling
and Stratigraphic
modelling

Upscaling &
Post-prosess

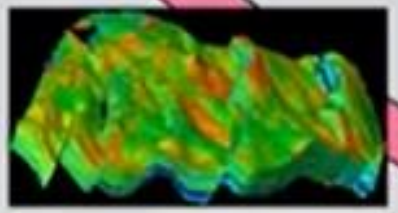


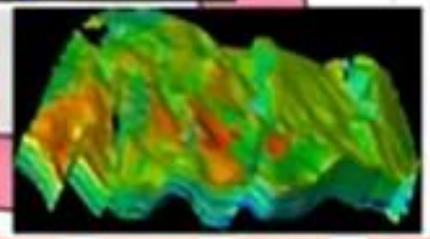


Facies
modelling

Property
Modeling

uncertainty analysis
& OOIP Calculation

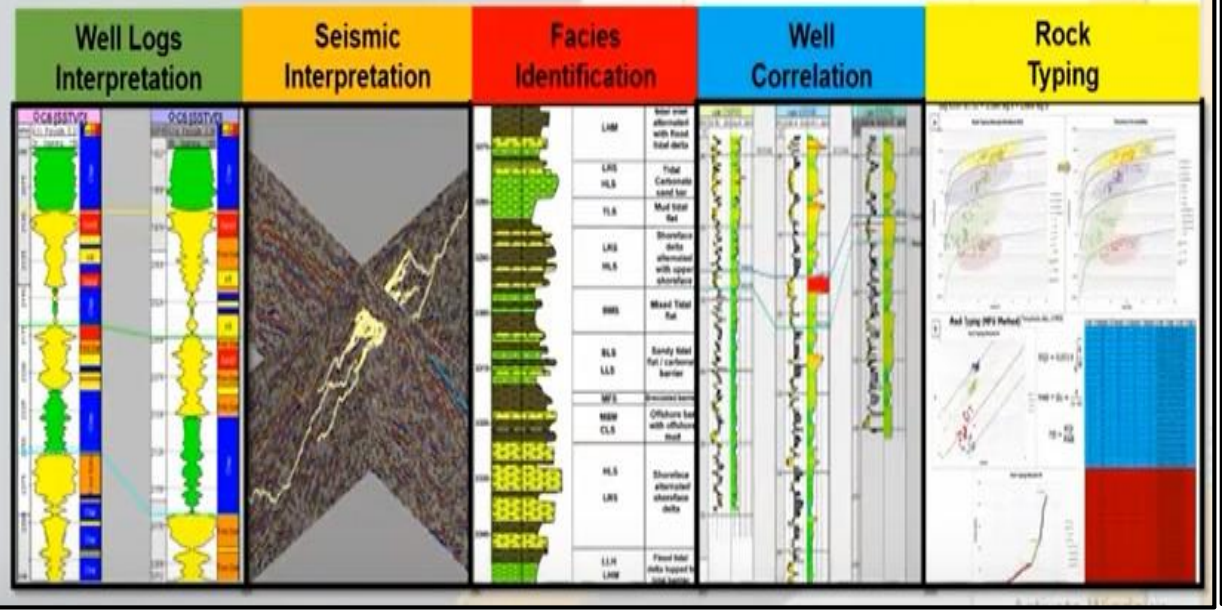




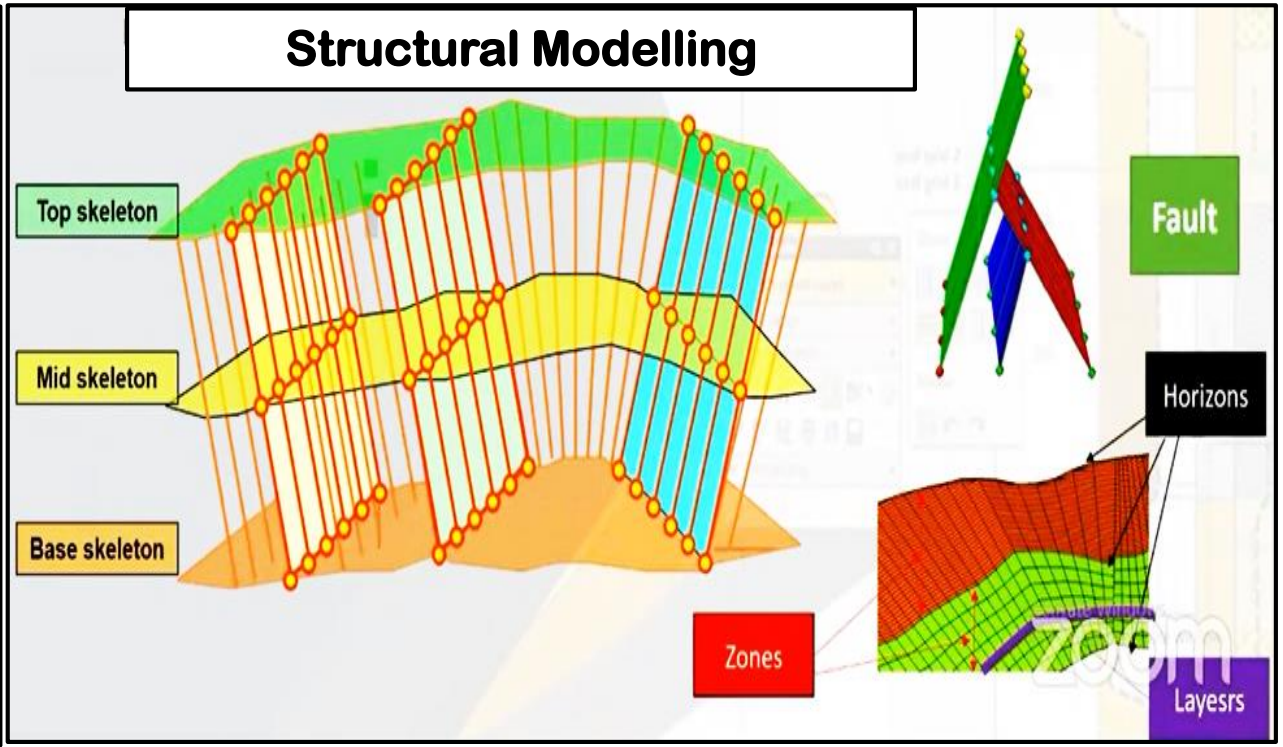
Petrophysical
modelling

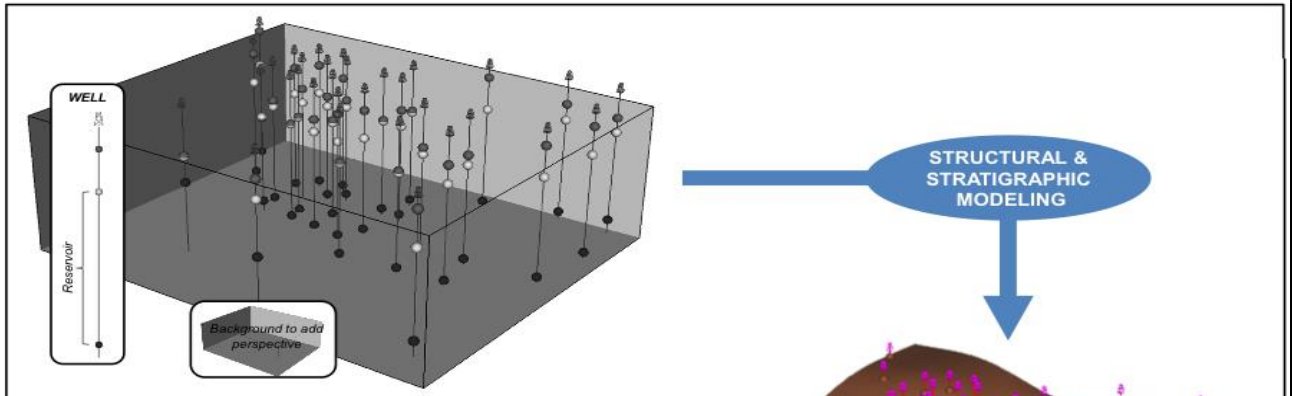
$$HIIP = \frac{GRV * N:G * \phi * (1 - S_w)}{FVF}$$

• Data preparation and interpretation Examples:

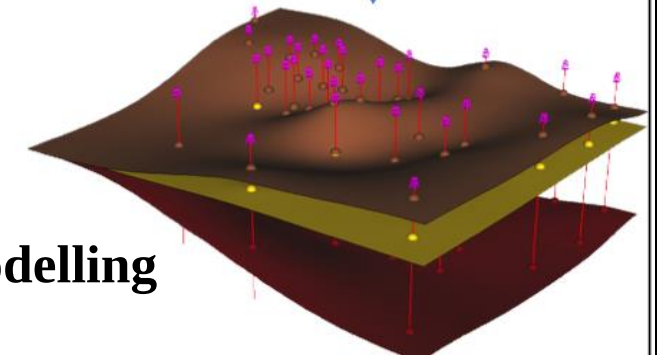


Structural Modelling

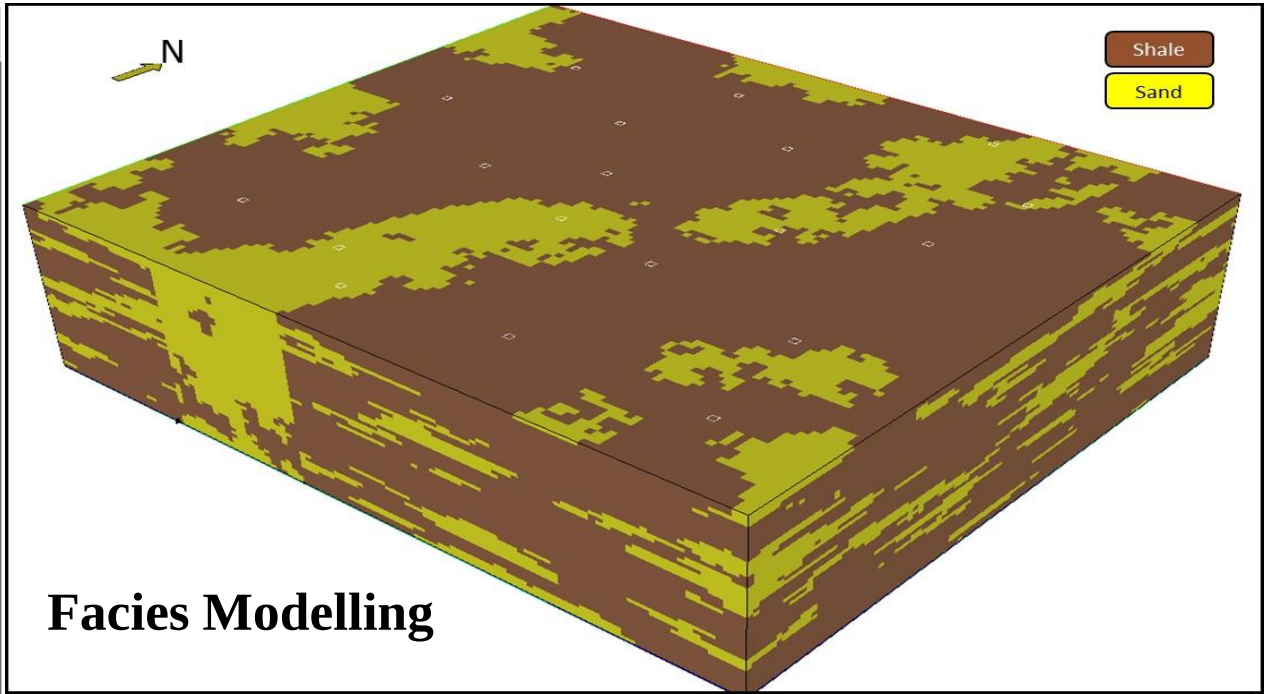




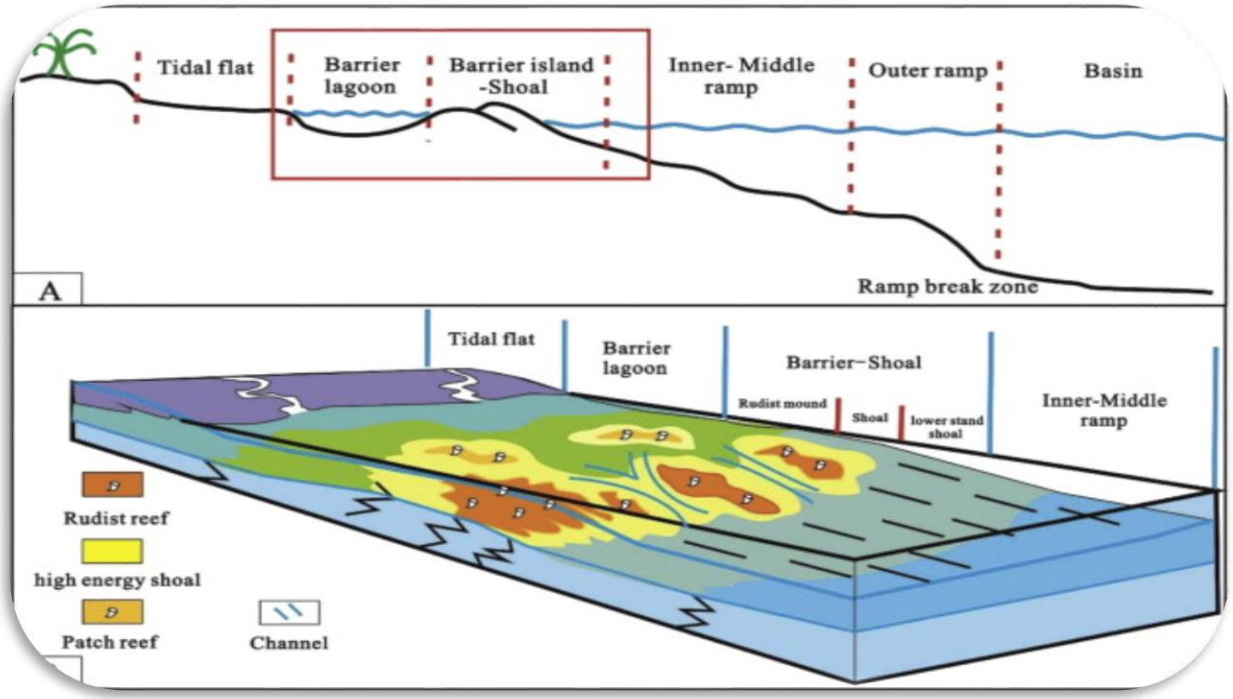
STRUCTURAL & STRATIGRAPHIC MODELING

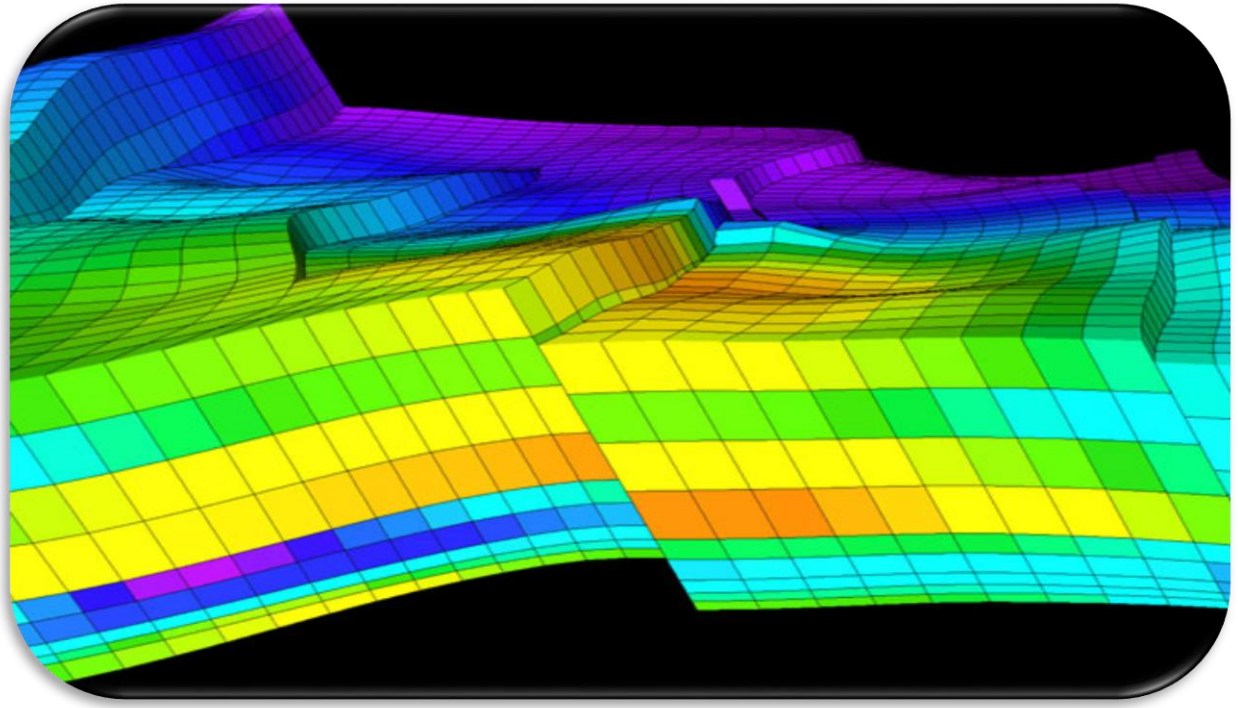


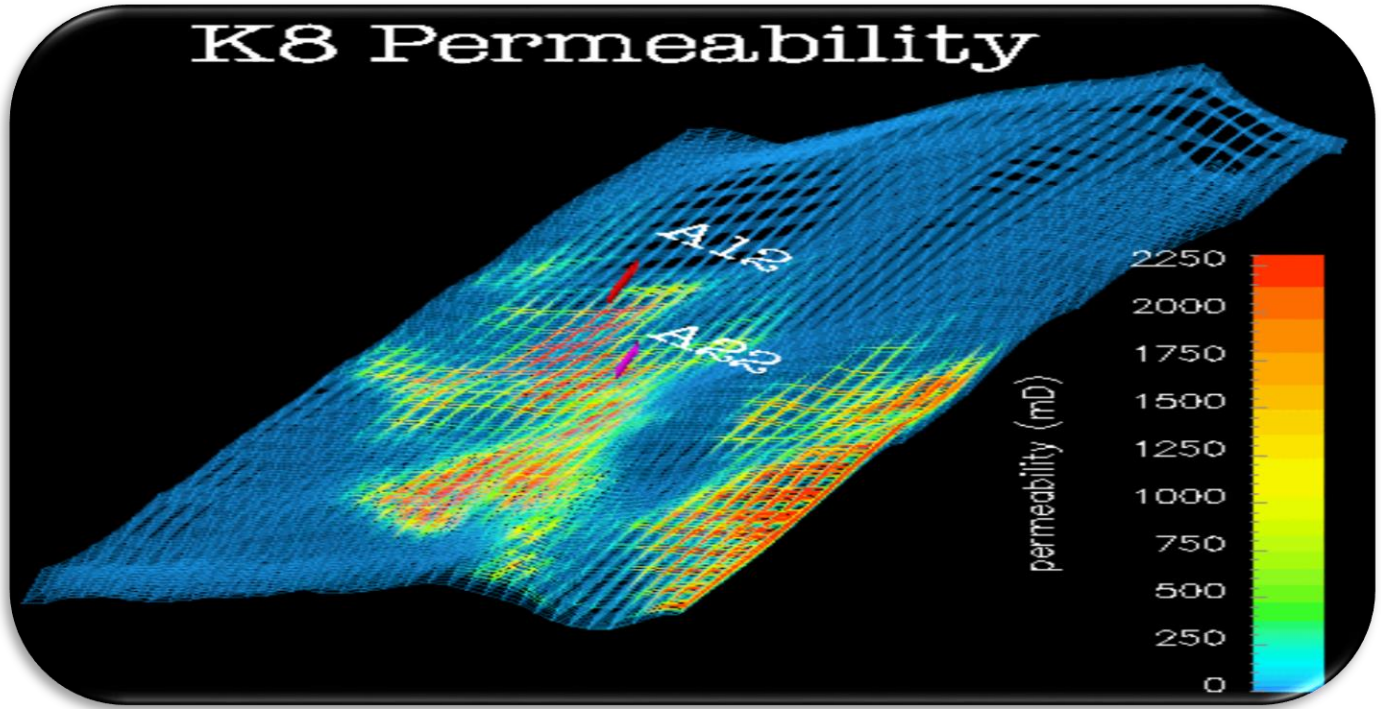
Stratigraphic Modelling



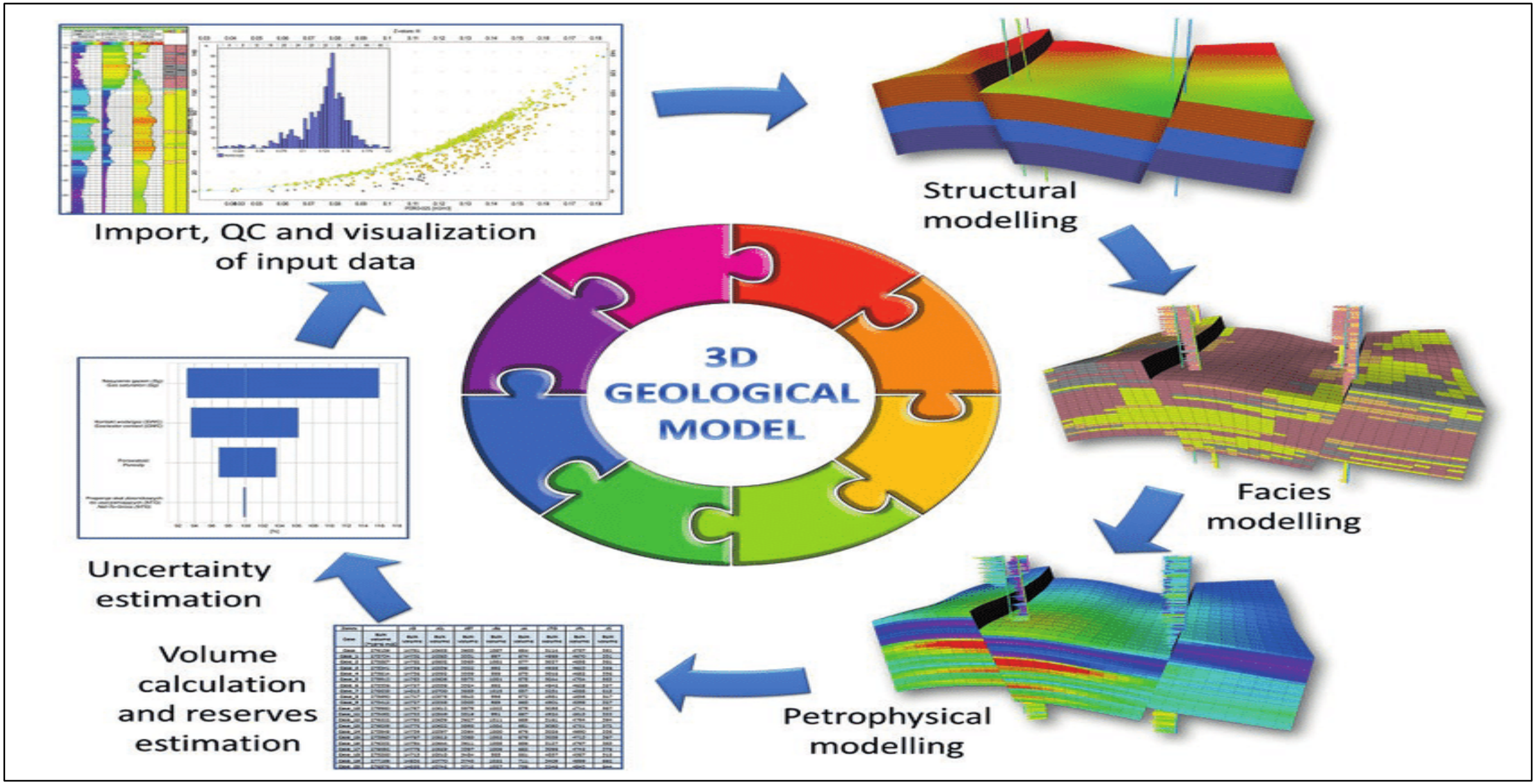
Facies Modelling


Tidal flat
Barrier lagoon
Barrier island -Shoal
Inner- Middle ramp
Outer ramp
Basin
Ramp break zone
A
Tidal flat
Barrier lagoon
Barrier–Shoal
Rudist mound
Shoal
lower stand shoal
Inner-Middle ramp
Rudist reef
high energy shoal
Patch reef
Channel




K8 Permeability
A12
A22
permeability (mD)
2250
2000
1750
1500
1250
1000
750
500
250
0

Modeling Workflow



Basic Geological Elements in Modeling

Zone

Geological unit bounded by horizons

1

Horizon

Surface bounding a reservoir zone

- Interpreted Horizons
- Calculated Horizons

2

Surface

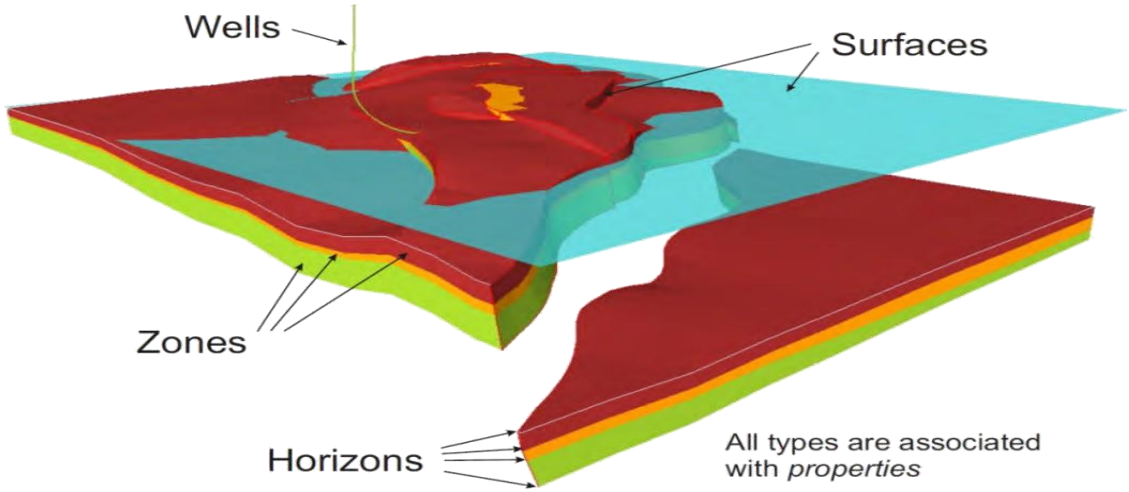
boundaries or interfaces between different geological units or zones.

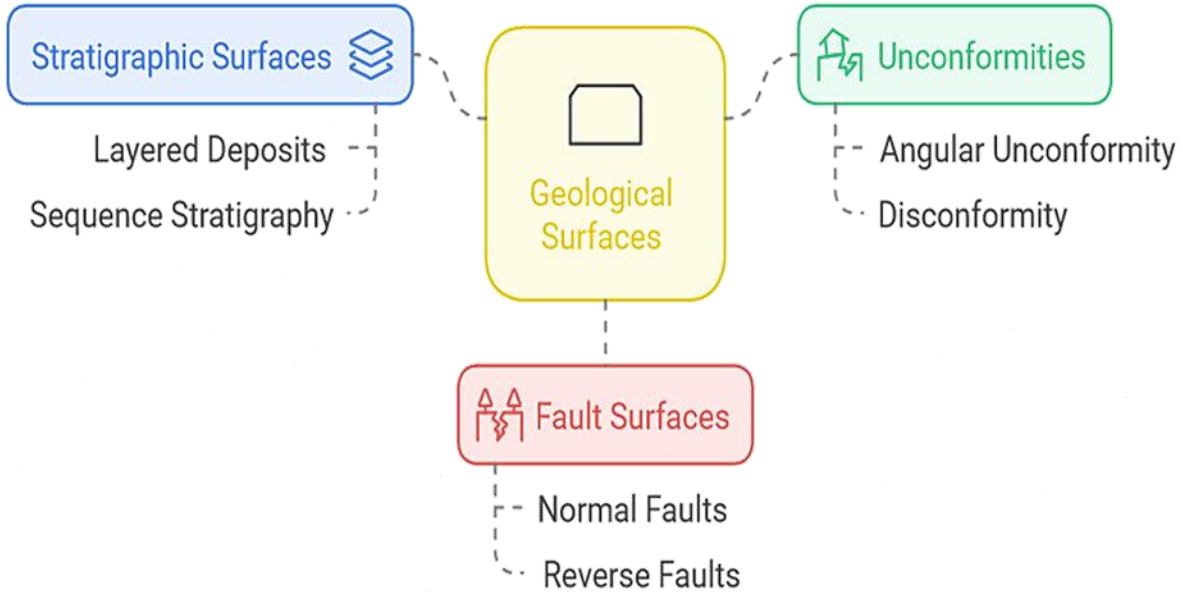
3

Well

Described by a trajectory (path) and associated logs, in addition to a well history.

4





Reservoir Properties

Static Reservoir Properties

- Stratigraphy
- Geometry
- Lithology
- Structure Framework
- Size
- Temperature

Reservoir Properties

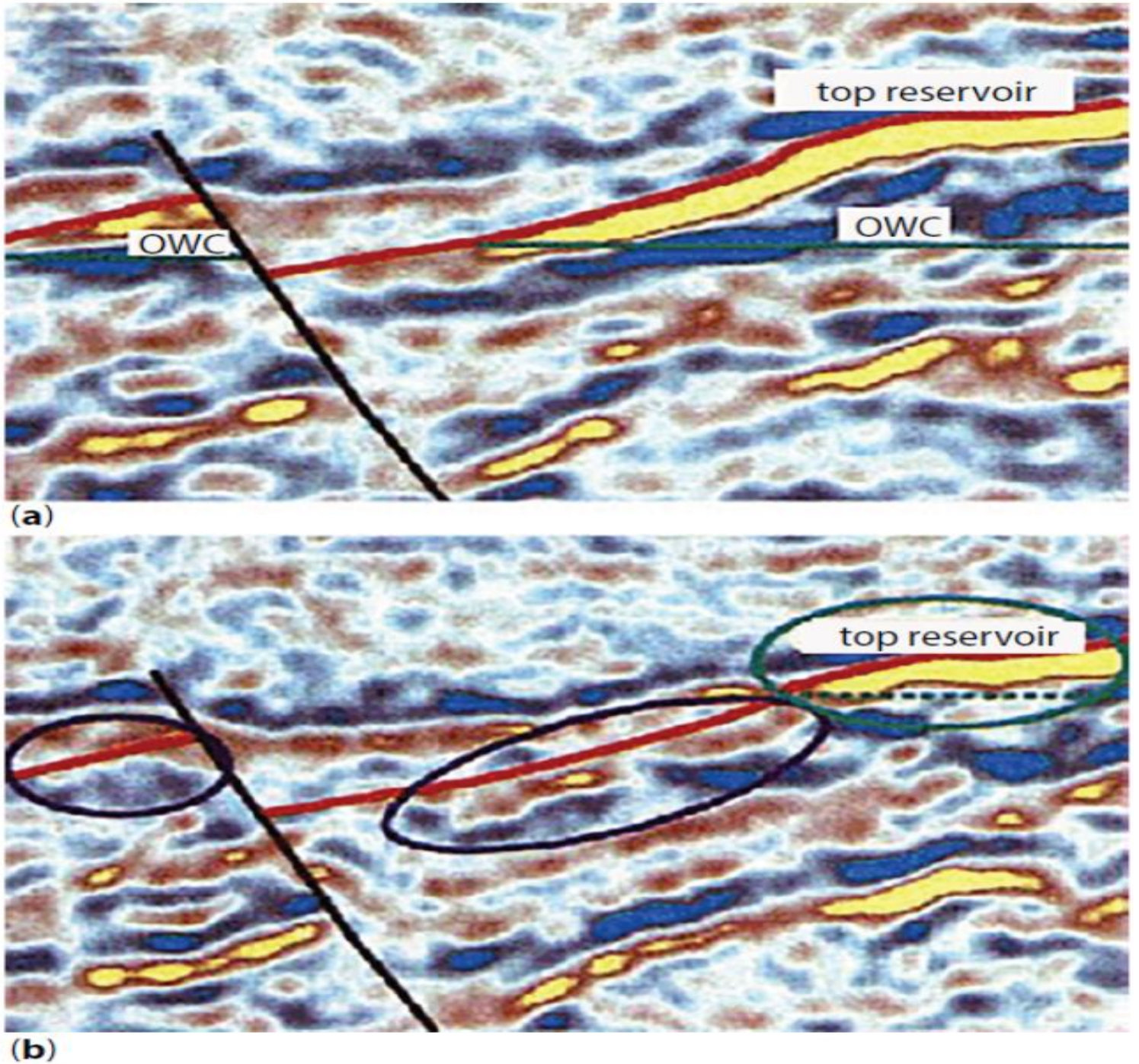
Dynamic Reservoir Properties

- Fluid saturations
- Production and fluid-flow rates
- Fluid compositions
- Acoustic (Seismic) properties
- Fluid contacts
- Pressure

The different positions of oil-water contact (OWC)

(a) Oil-water contact level before production

(b) after production for 10 years.



Question: The formation thickness is

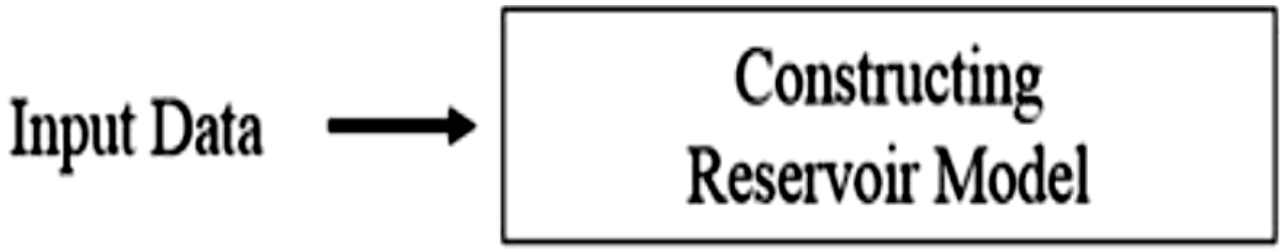
A- Static Property

B- Dynamic Property

C- That depend on fluid content

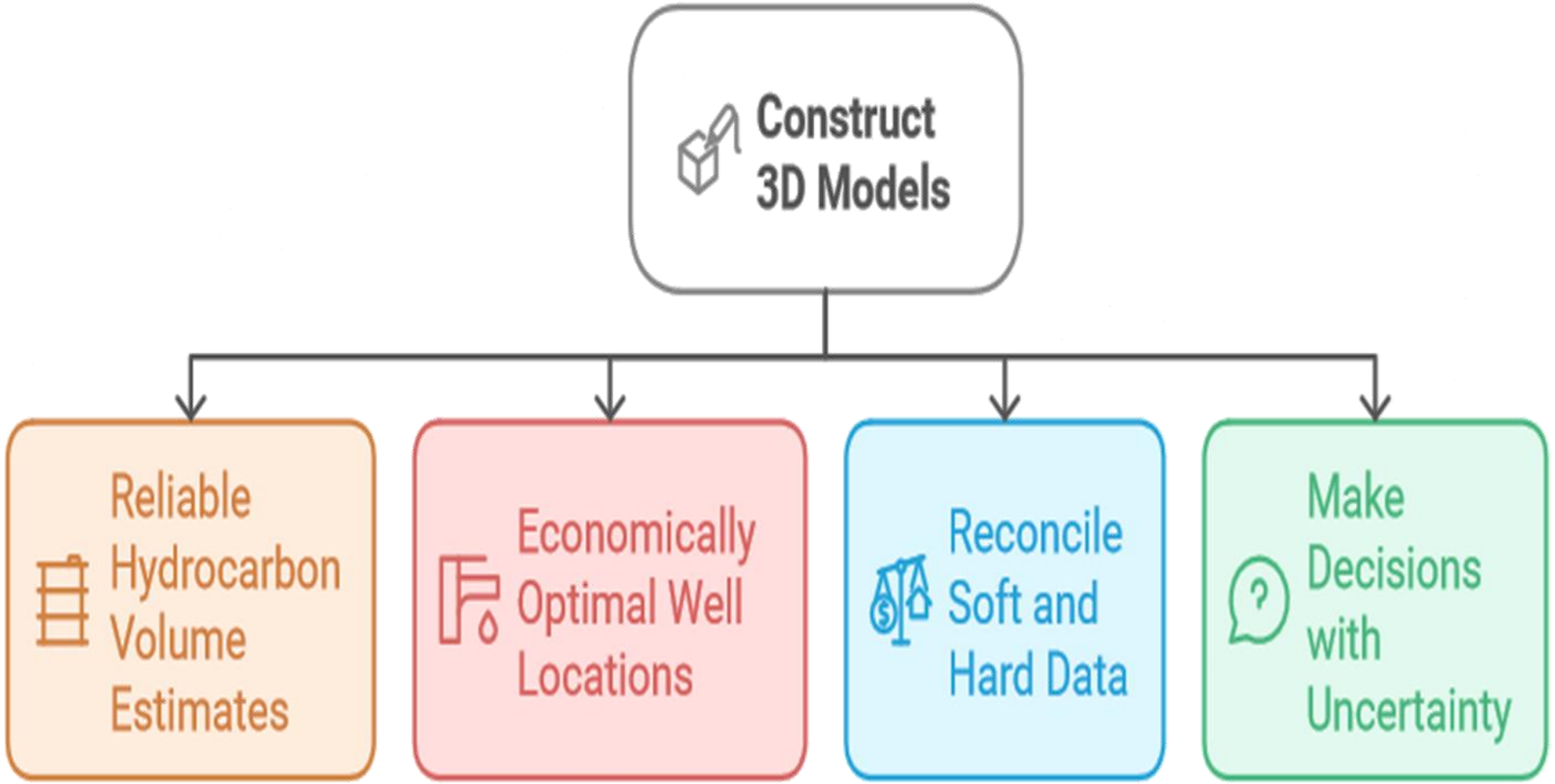
D- None of the above

Key Elements of Reservoir Modelling:



- Geological interpretations
- Core and well logs
- Seismic data
- Production data
- Fracture data

- Structural and stratigraphic analyses
- Depositional characteristics
- Statistical data analytics
- Geostatistical analysis and modeling
- Integrated modeling workflow
- Discrete fracture network (DFN) modeling

- Structural and stratigraphic framework and 3D grid
- 3D facies model
- 3D porosity model
- 3D fluid saturation model
- 3D permeability model
- Volumetrics
- DFN models
- Geomechanical property models

Specific Reasons for Constructing R 3D Models: