

Energy and Fossil fuel

Definitions basic

- Energy is the Capacity to do work
- $Work = Force \times distance$
- Force causes change of state of rest or of uniform motion and is measured as rate of change of momentum (quantity of motion).
- $Force = Mass \times acceleration$
- Mass is quantity of matter
- Acceleration is rate of change of velocity

Type of Energy

- Mechanical energy ;Potential /Kinetic (motion)
- Heat/ Thermal energy (temperature)
- Electromagnetic energy (sunlight, radio waves)
- Chemical energy (Food/Fossil fuel)
- Nuclear energy (Sun, fission and fusion)
- $E = M \times C \times C$; Einstein
- Mass and energy is interchangeable and in fission/fusion mass is converted to energy

Potential energy

- Energy due to the position of a body in a force field
- Gravitational ; (escape velocity from earth 11km/sec)
- Elastic
- Electromagnetic
- Energy can not be created or destroyed ,it only gets converted from one form to the other

Fission/Fusion

- Fission is Breakup of heavy elements like Uranium 235; Plutonium 239 are broken down
- $92_{\text{U}}_{235} + 1n \rightarrow 56_{\text{Ba}}_{141} + 36_{\text{Kr}}_{92} + 3n.$
- $94_{\text{Pu}}_{239} + 1n \rightarrow 58_{\text{Ce}}_{148} + 36_{\text{Kr}}_{89} + 3n.$
- Output is electromagnetic radiation and heat

- 7 Mev/nucleon with U yields 200 Mev/nucleon which is 0.1 % of U 235

- Very high energy density.

- Fusion is fusing lighter elements like H and its isotopes to form heavier element ;in this case Helium Still higher energy density / Needs higher initial energy eg stars/sun

Rocks

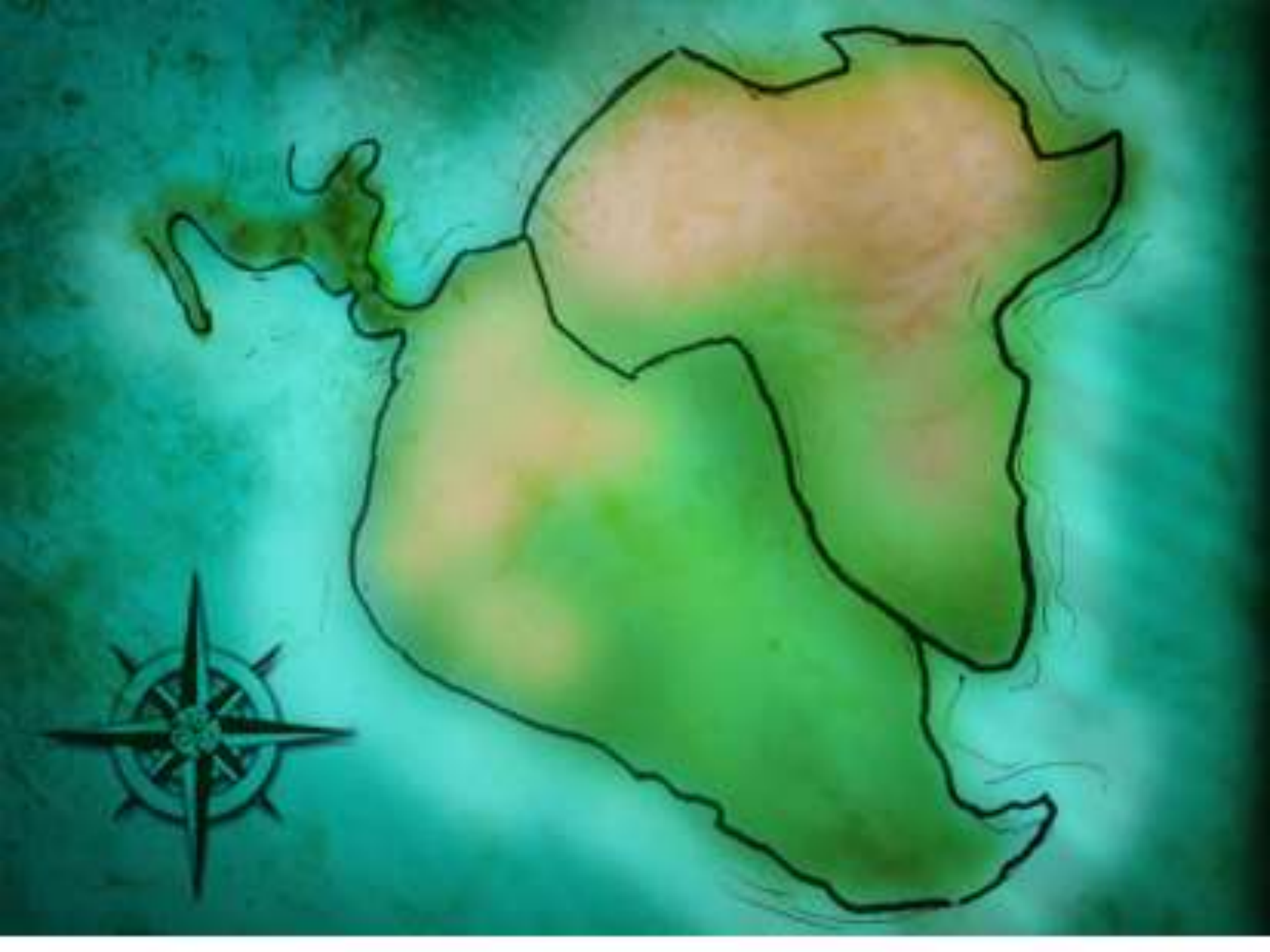
- Rock is a naturally occurring solid aggregate of one or more minerals or mineraloids.
- Granite is a combination of the quartz, feldspar and biotite minerals.
- The Earth's outer solid layer, the lithosphere, is made of rock.
- Three major groups of rocks are defined: igneous, sedimentary, and metamorphic.
- Igneous rocks forms through the cooling and solidification of magma or lava and is about 65% of the Earth's crust by volume.

Rocks Contd

- Sedimentary rocks are formed by weathering of earlier rocks by erosion, transportation, deposition and cementation .
- About 8% of the crust by volume with 82% of those being shales, limestone 6% ,sandstone 12%. Sedimentary rocks often contain fossils.
- Metamorphic rocks are formed by subjecting a rock to 150 to 200 °C and high pressures and compose 27% of the crust by volume

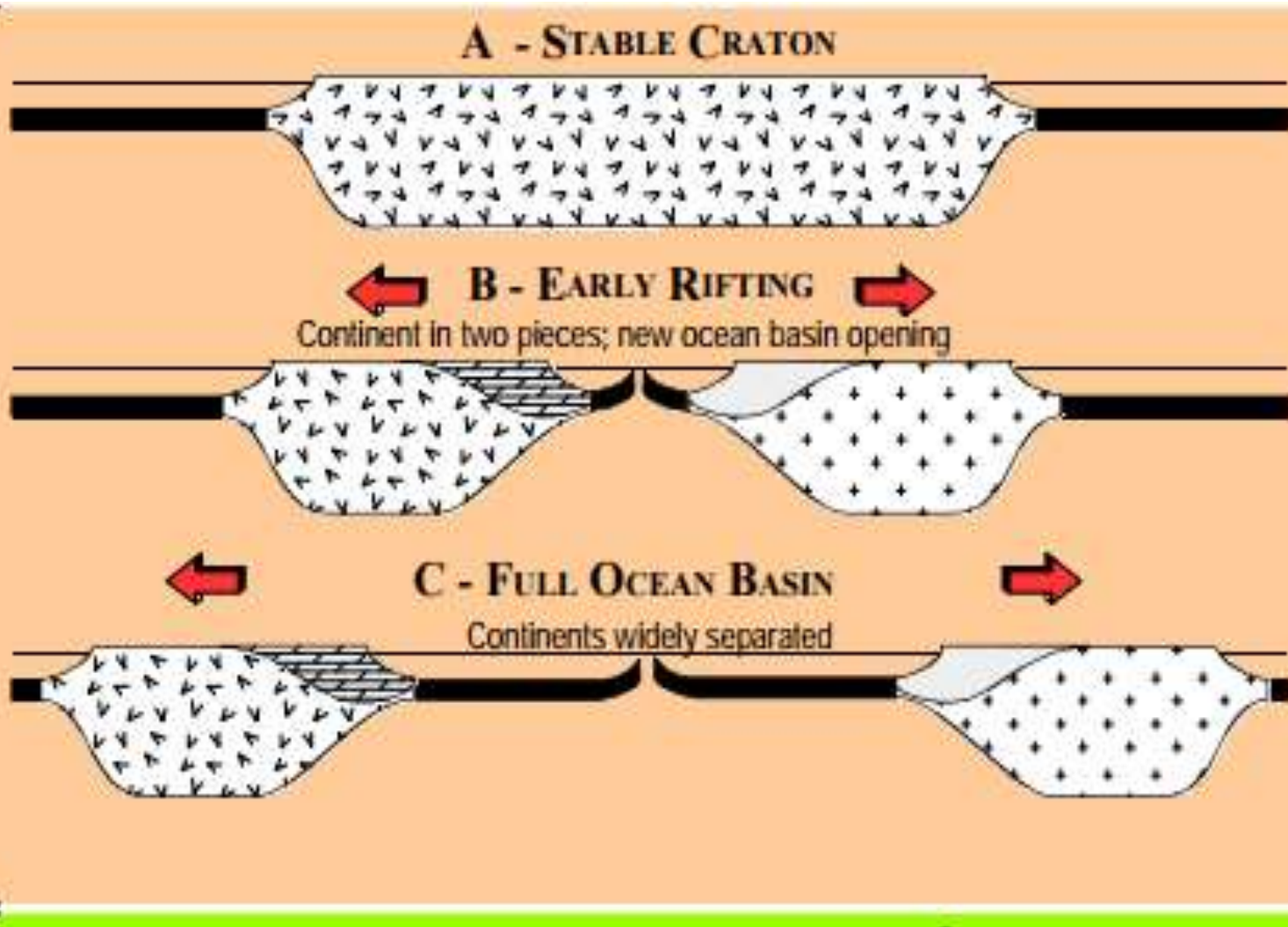
Plate Tectonics

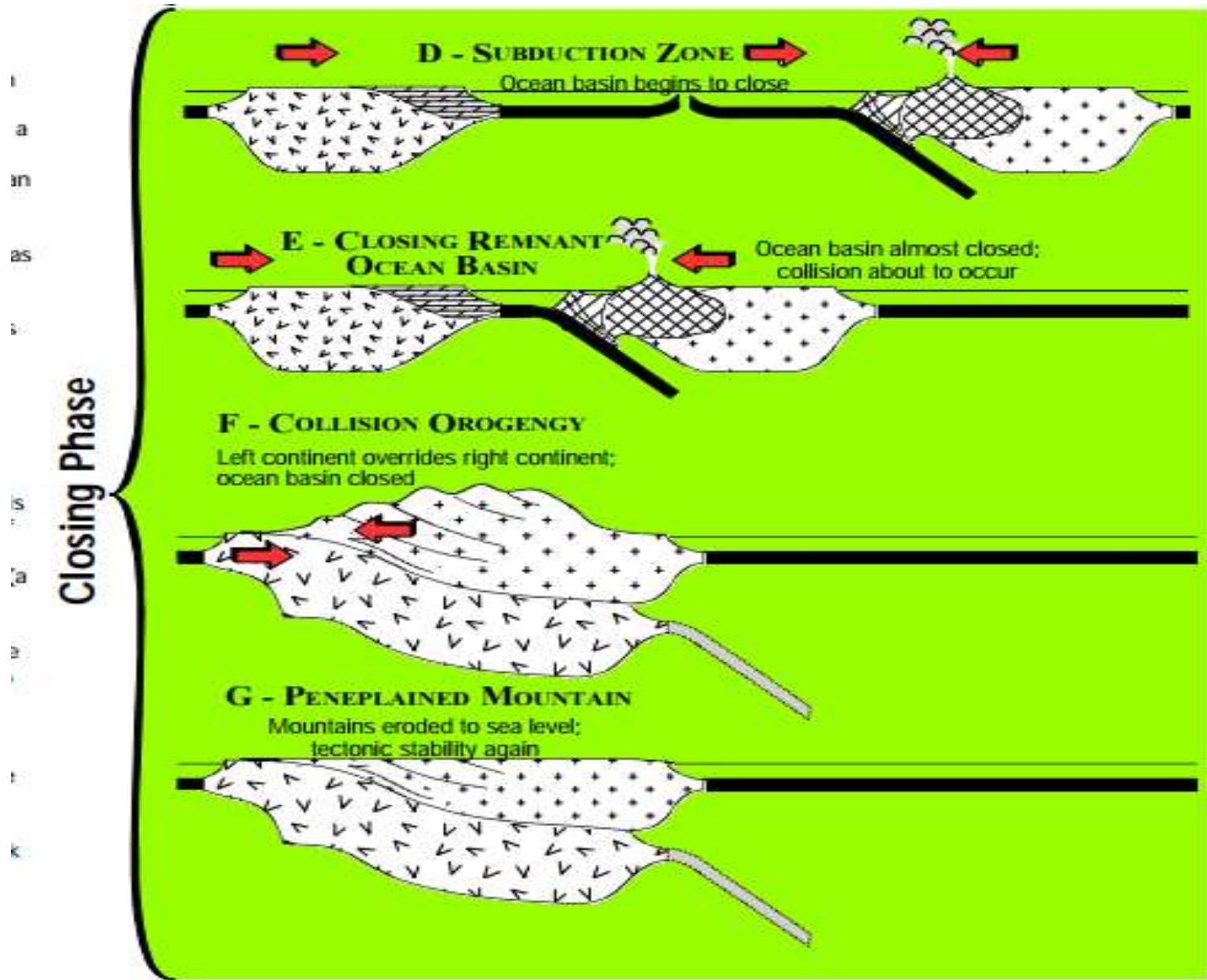
- Plate tectonics is movement of lithosphere because of convection currents have generated mountains, valleys, rivers and sedimentary basins.
- It is possible that this is unique with our planet and no life could have existed without plate tectonics



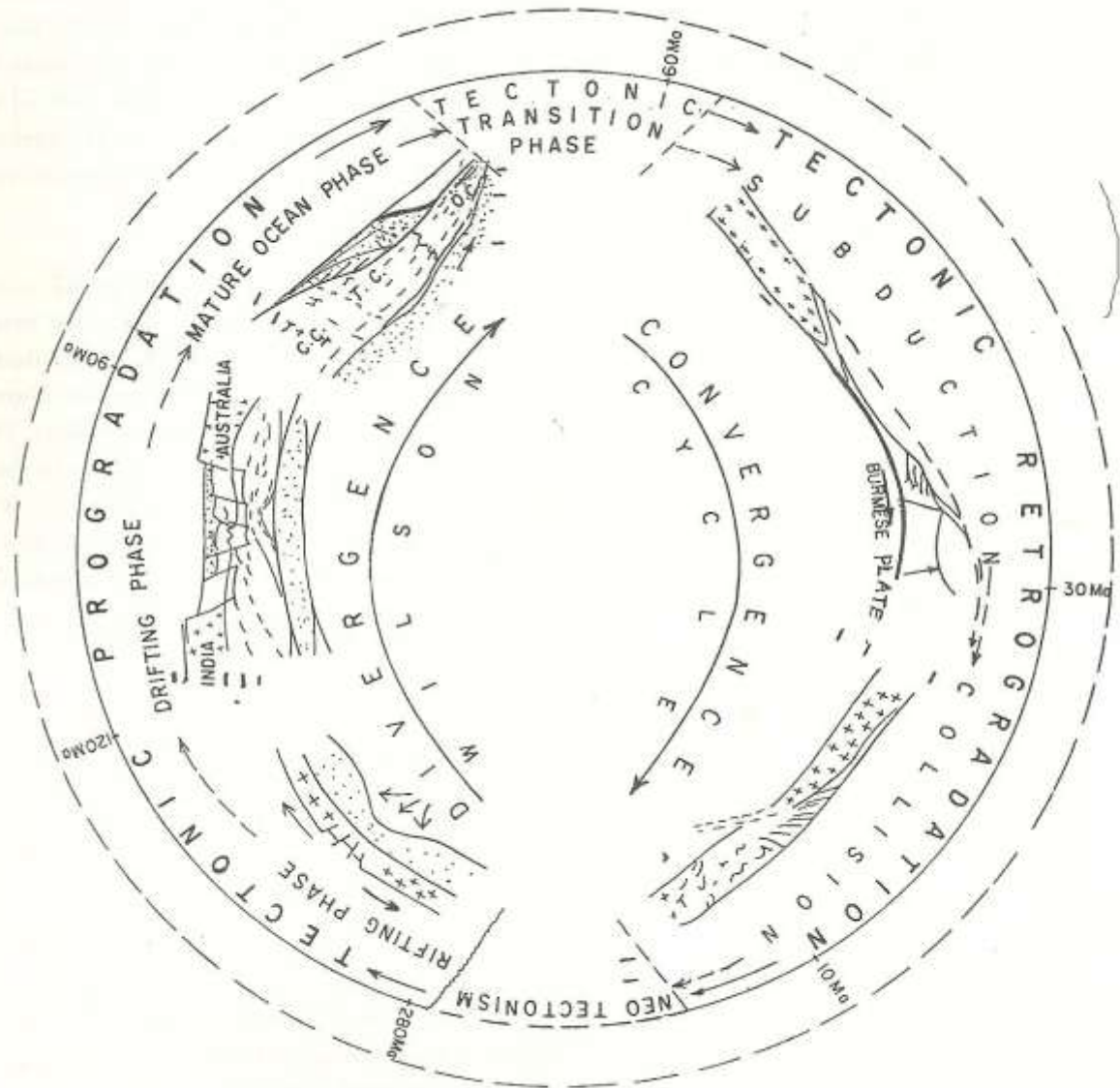
Wilson Cycle

Opening Phase

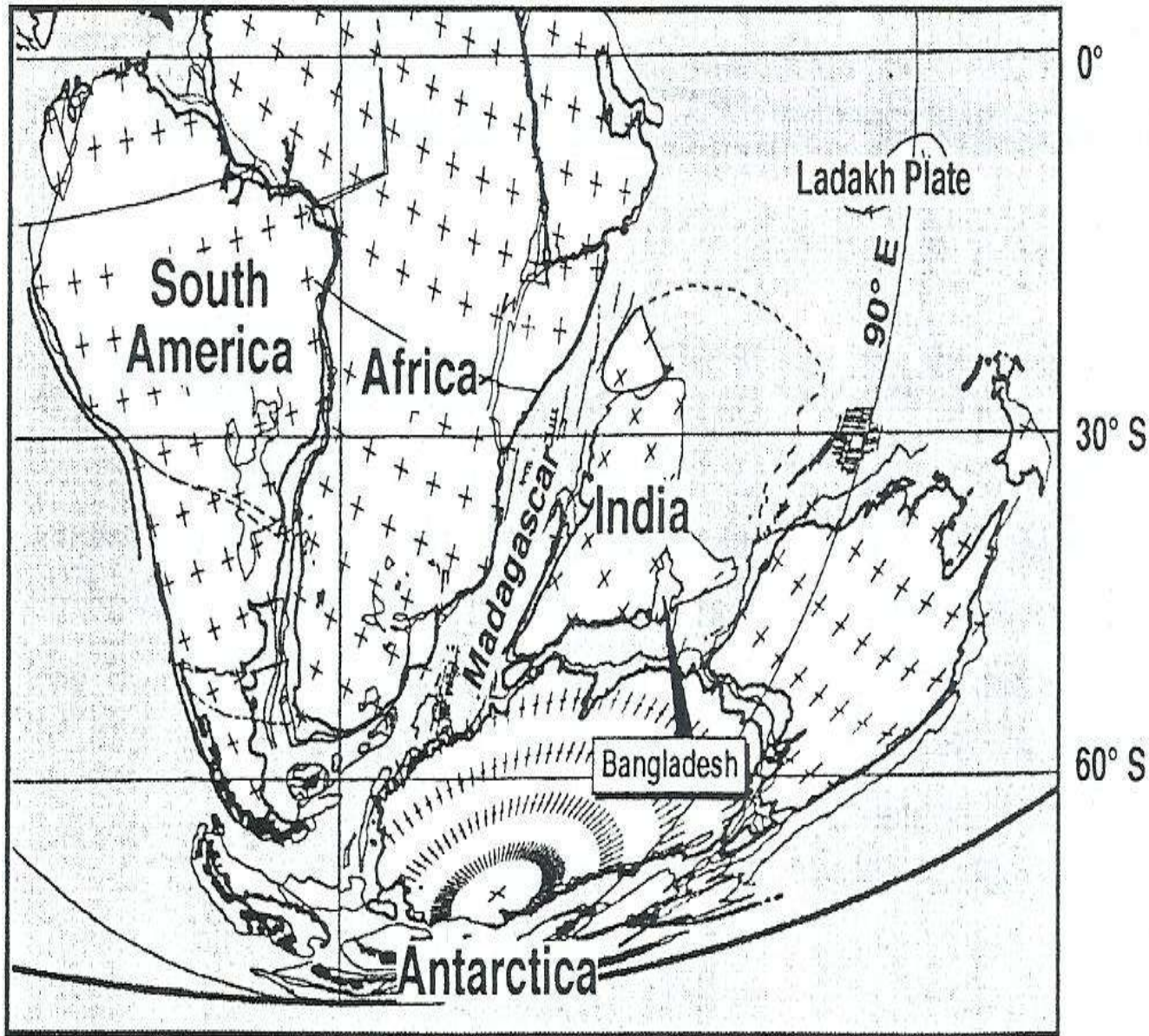




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Wilson cycle in northeastern tectonic province



Early Cretaceous (Hauterivian, 130 Ma) plate tectonic setting of the Indian Ocean region, showing rifting of India/Madagascar from Africa and rifting of the east coast of India away from east Antarctica and Australia (modified after Coffin and Lawver, 1998). The Rajmahal traps were emplaced at this time.



Fig 1: The northward drift of India from 71 Ma ago to present time. Note the simultaneous counterclockwise rotation of India. Collision of the Indian continent with Eurasia occurred at about 55 Ma. Source: www.usgs.org (modified)

Oil and Gas

- Sedimentary basins are regions of the earth of long-term subsidence creating accommodation space for infilling by sediments and formation of basins are associated with plate tectonic
- Oil and gas is generated and entrapped in Sedimentary basins
- Petroleum is a fossil fuel derived from ancient fossilized organic materials, such as zooplankton and algae mixing with sediments and being buried under anoxic conditions.
- As further layers settled to the sea or lake bed, intense heat and pressure build up in the lower regions.

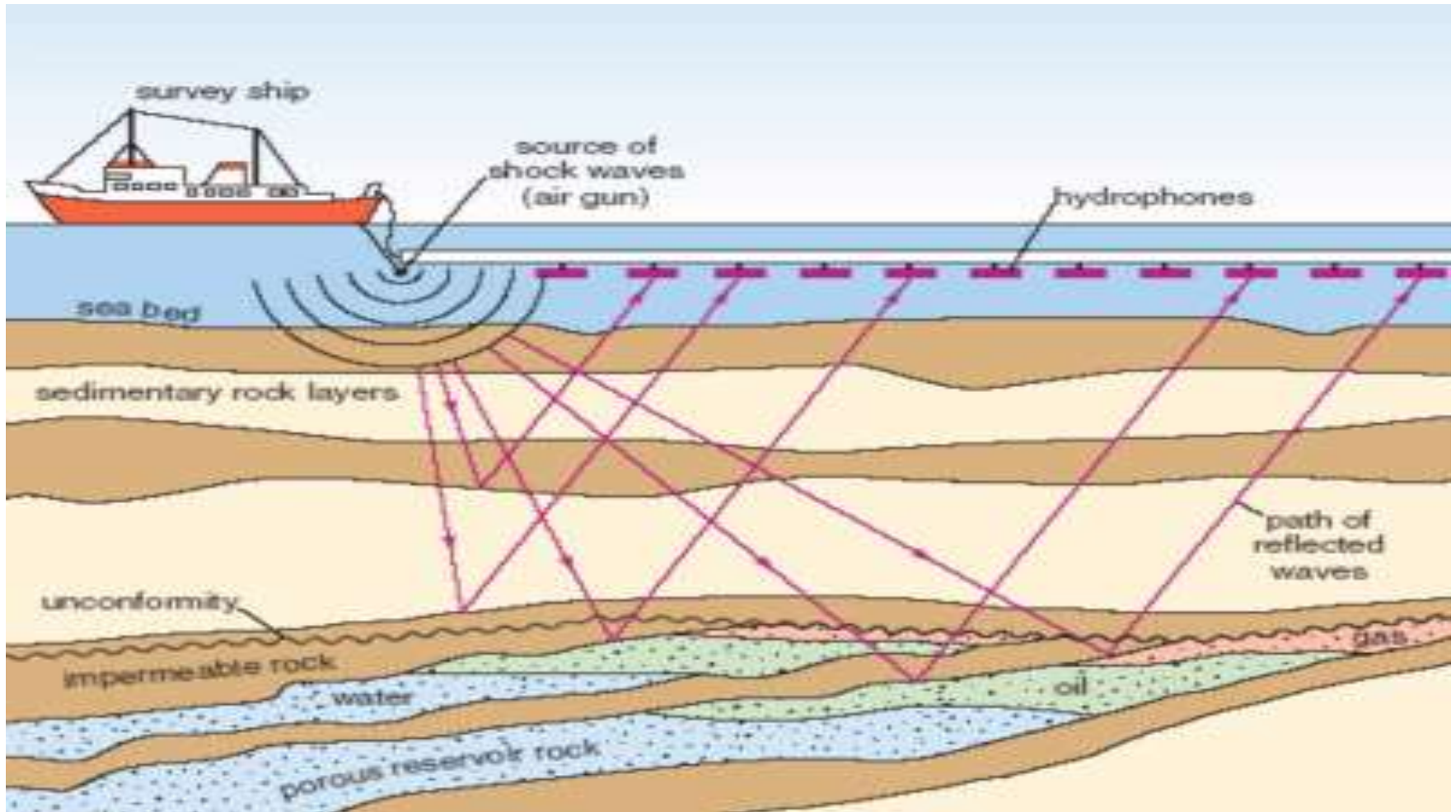
Oil and Gas generation contd

- This process caused the organic matter to change, first into a waxy material known as [kerogen](#), which is found in various [oil shales](#) around the world,
- This then gets buried to around say 3/4 km or more and with more heat gets converted into liquid and gaseous hydrocarbons via a process known as [catagenesis](#).
- Oil window is 120 deg and gas window is 160 deg centigrade

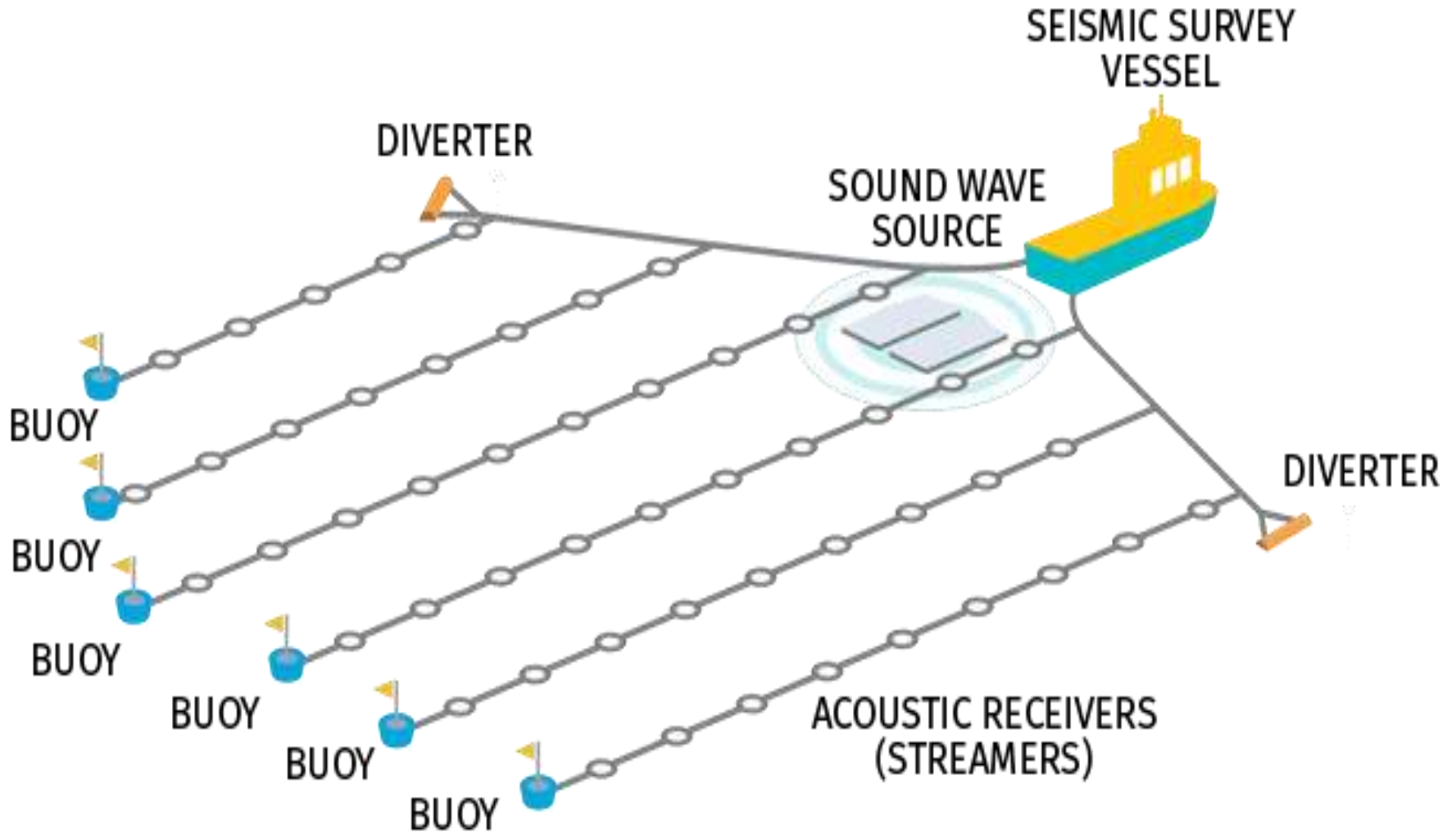
Coal generation

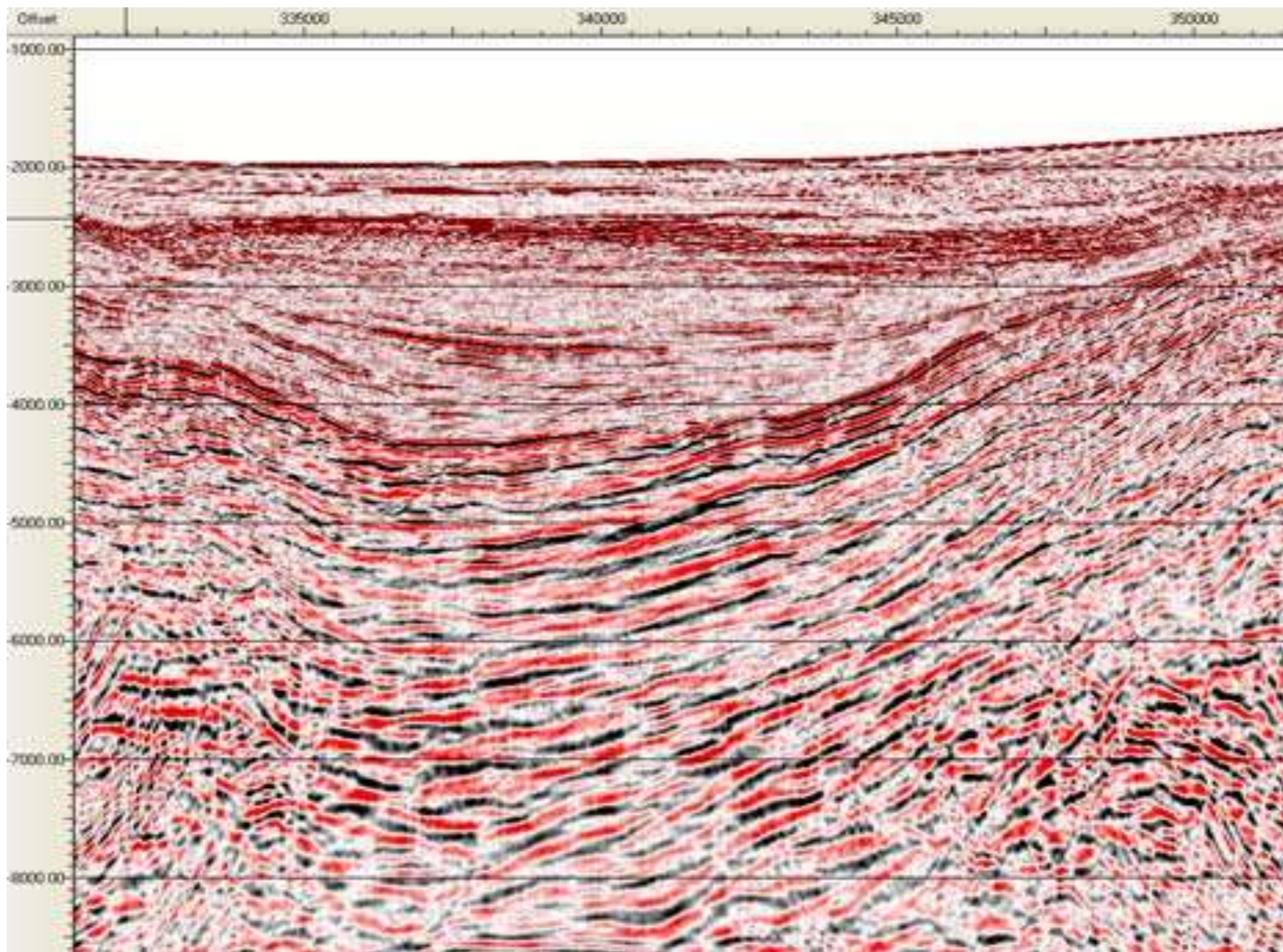
- Dense forests, mangroves in low-lying wetland areas due to flooding, were buried underneath soil compacted with further burial and temperature also rose
- As the process continued the plant matter was protected from [biodegradation](#) and [oxidation](#), usually by mud or acidic water.
- This trapped the carbon in immense [peat bogs](#) that were eventually covered and deeply buried by sediments.
- Under high pressure and high temperature, dead vegetation was slowly converted to coal.
- As coal contains mainly carbon, the conversion of dead vegetation into coal is called carbonization. [\[13\]](#)

Offshore seismic survey

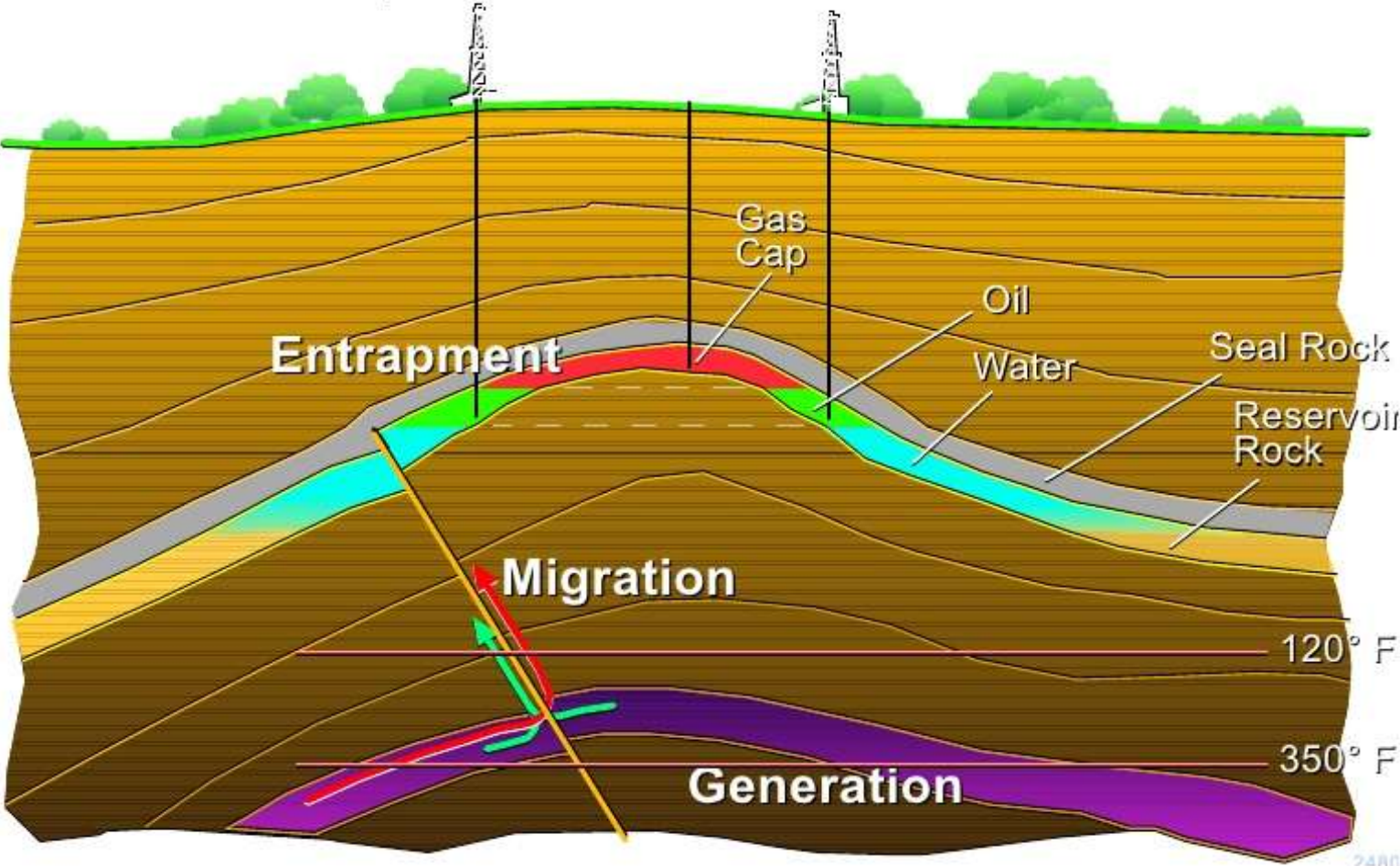


Multi streamer ; offshore 3 D





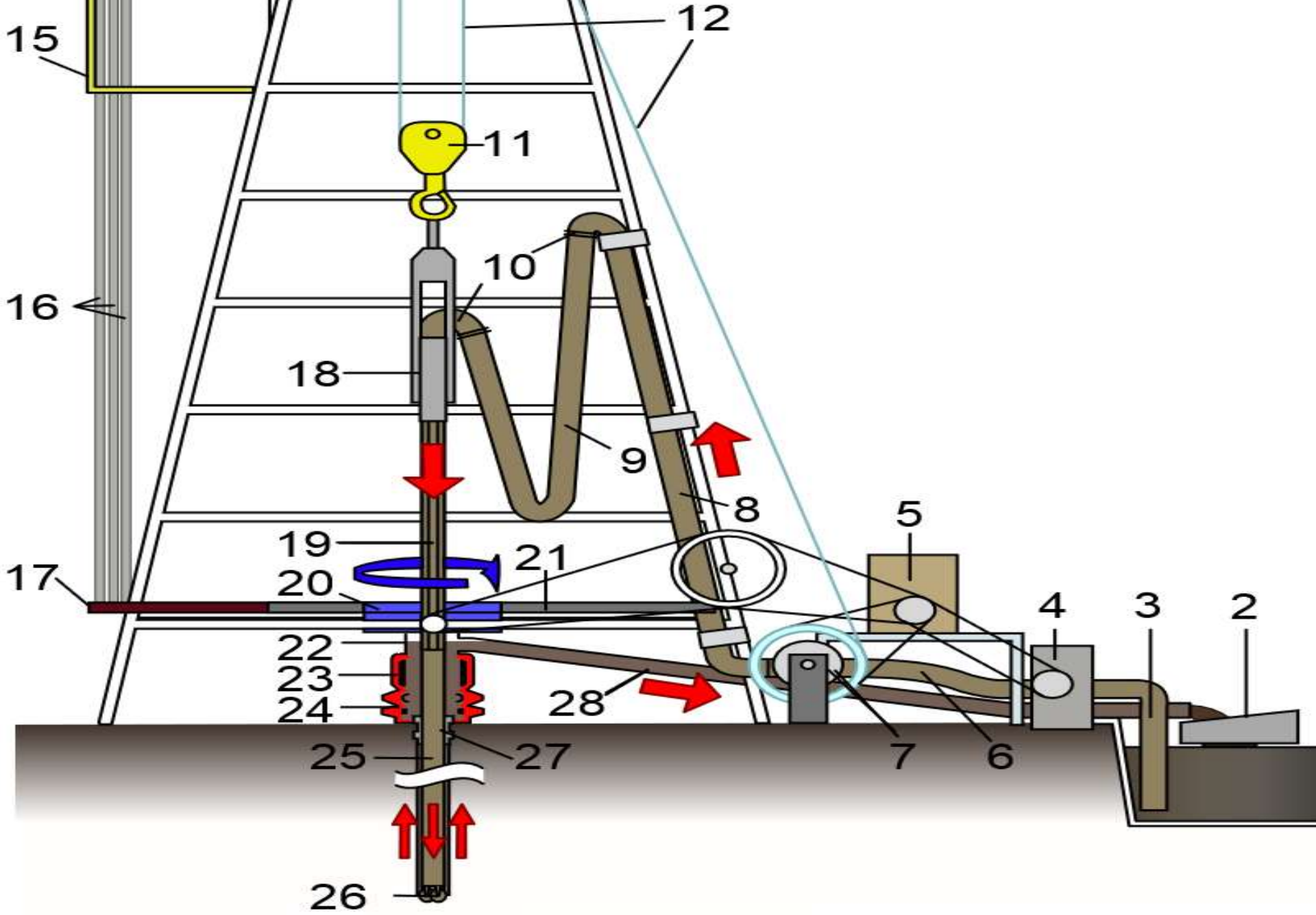
Petroleum System Processes



Source: AAPG

Offshore rig





Drill bits



**Polycrystalline
Diamond Compact Bit**



Natural Diamond Bit



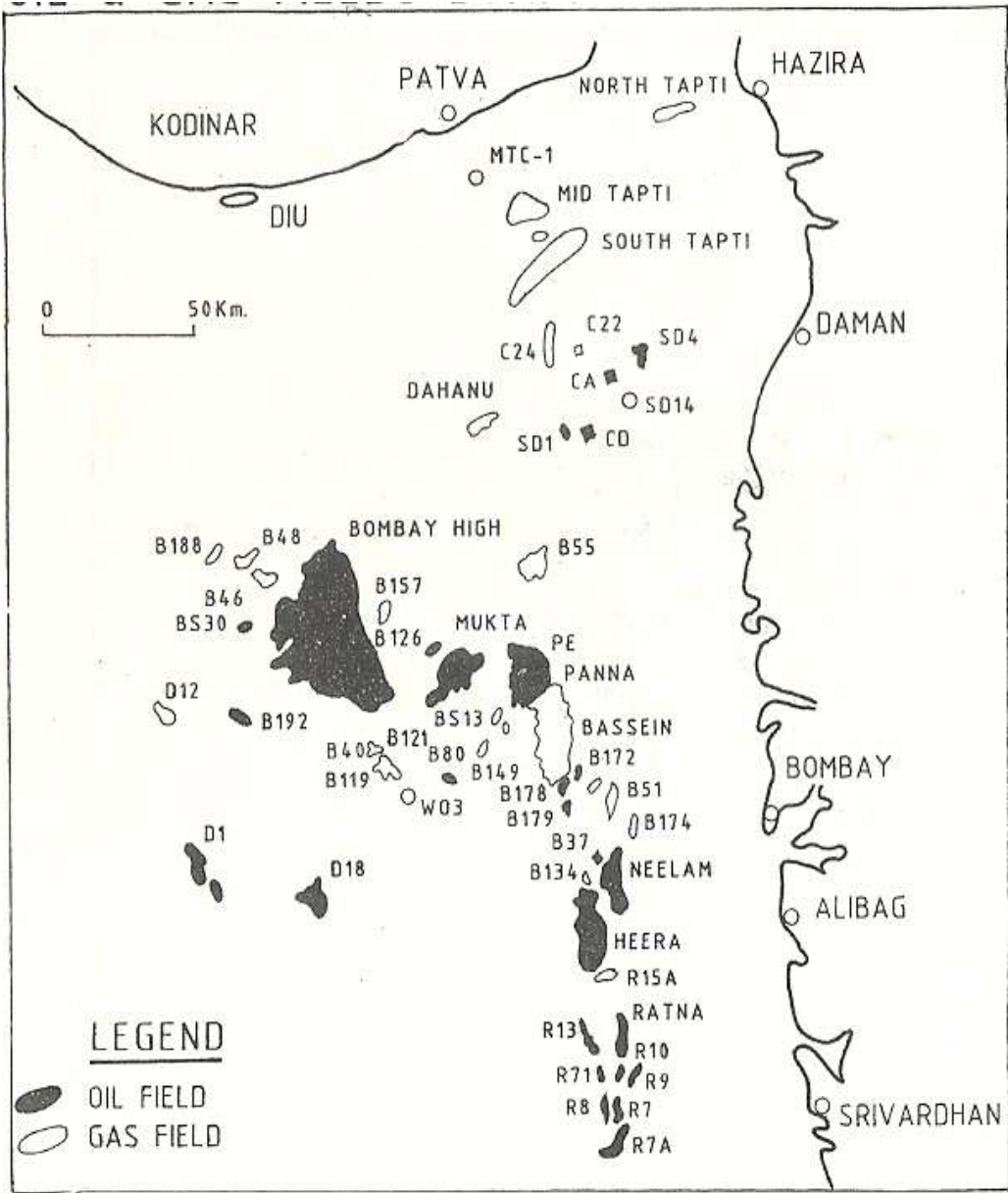
Impregnated Bit

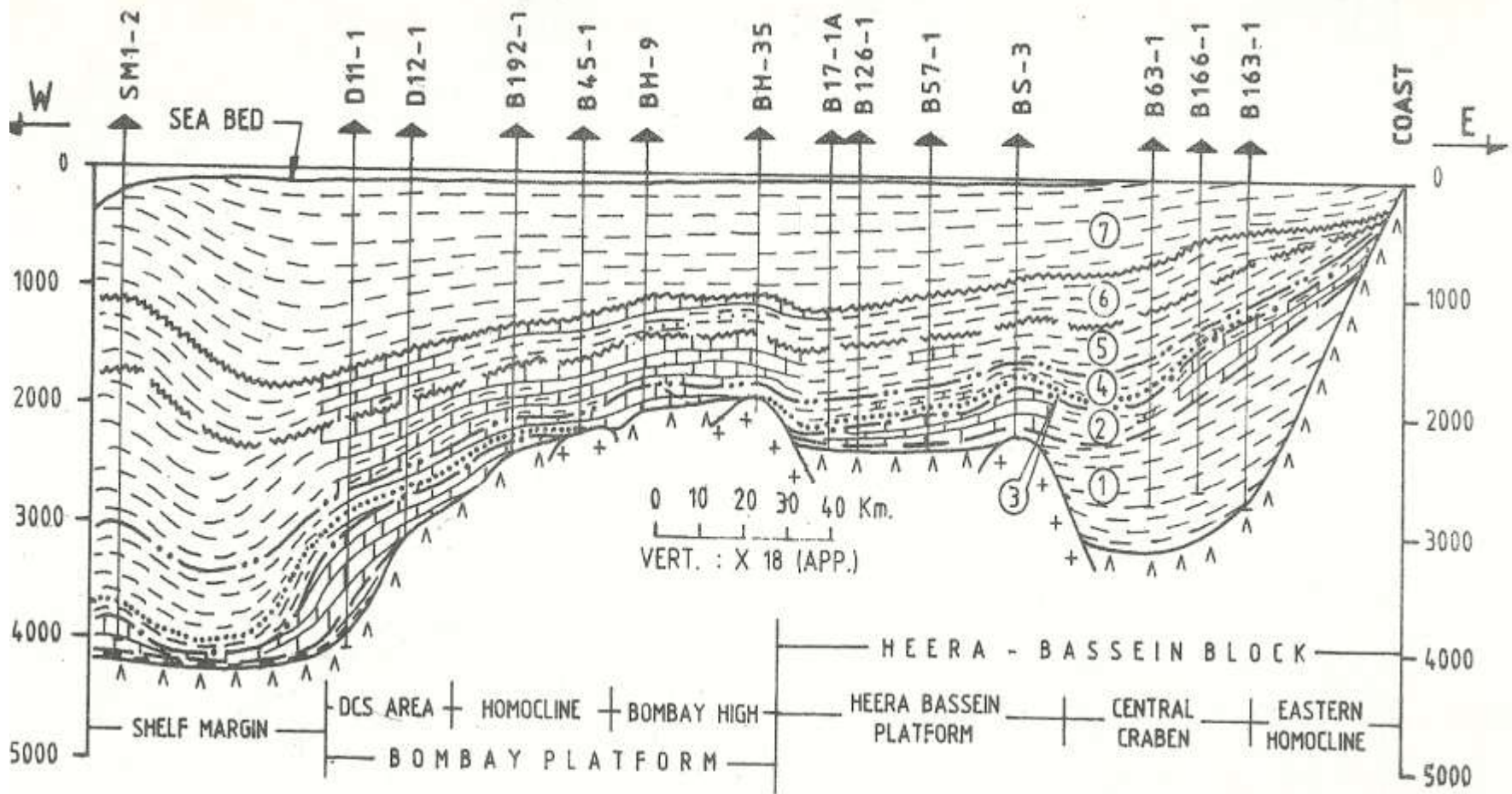
Images courtesy of Hughes Christensen

Bombay high platform



Basin





Section from Mahim coast to Shelf Margin.

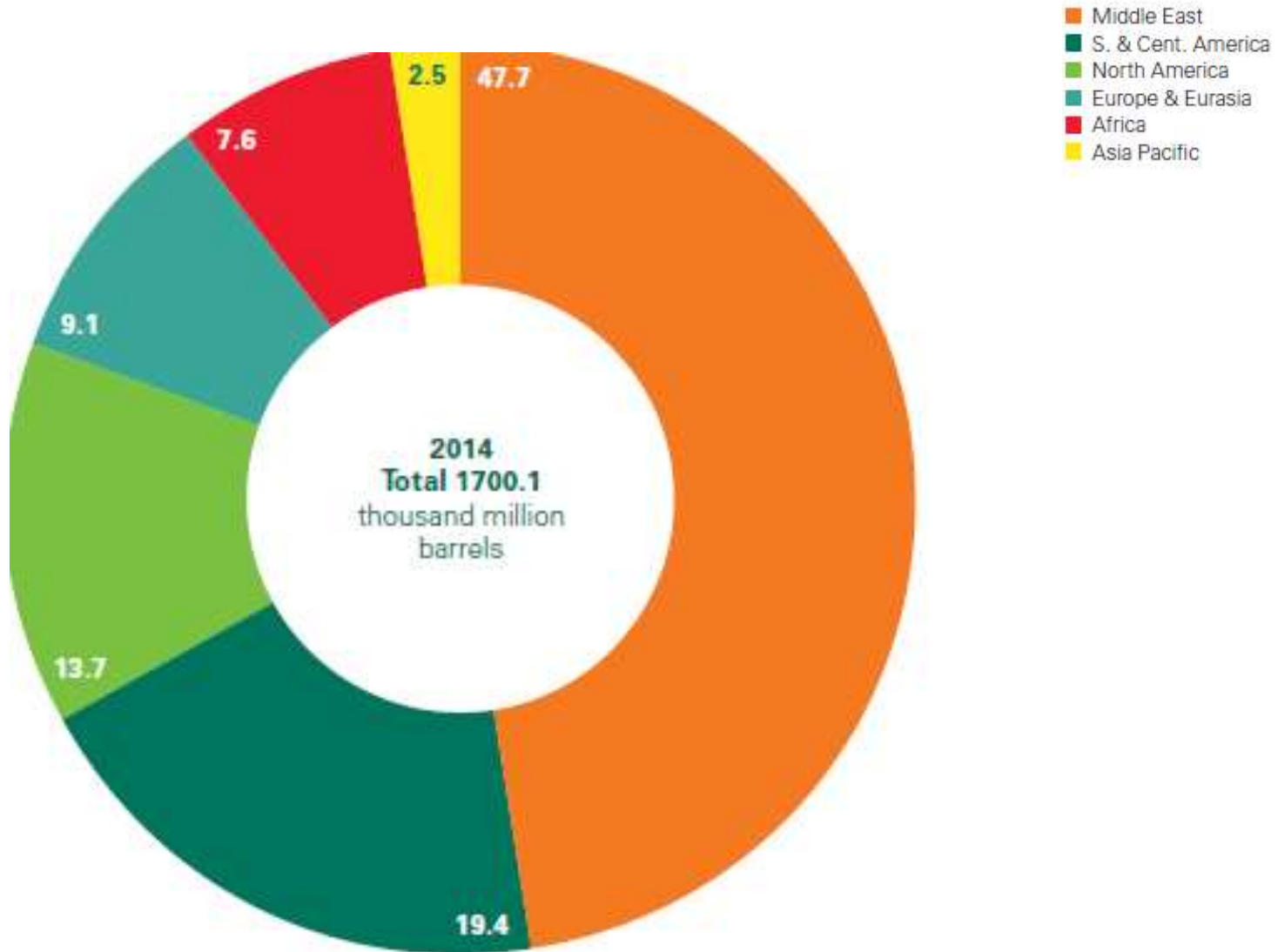
Census 2011

- Around 33 per cent out of over 246 million Indian households do not have access to electricity ; over 90 percent of which are in rural areas.
- Over 45 percent of rural households are not electrified.
- 66 percent of Indian households continue to use fire-wood or animal dung for cooking
- In rural areas 86 percent of the households do not have access to any modern cooking fuels.

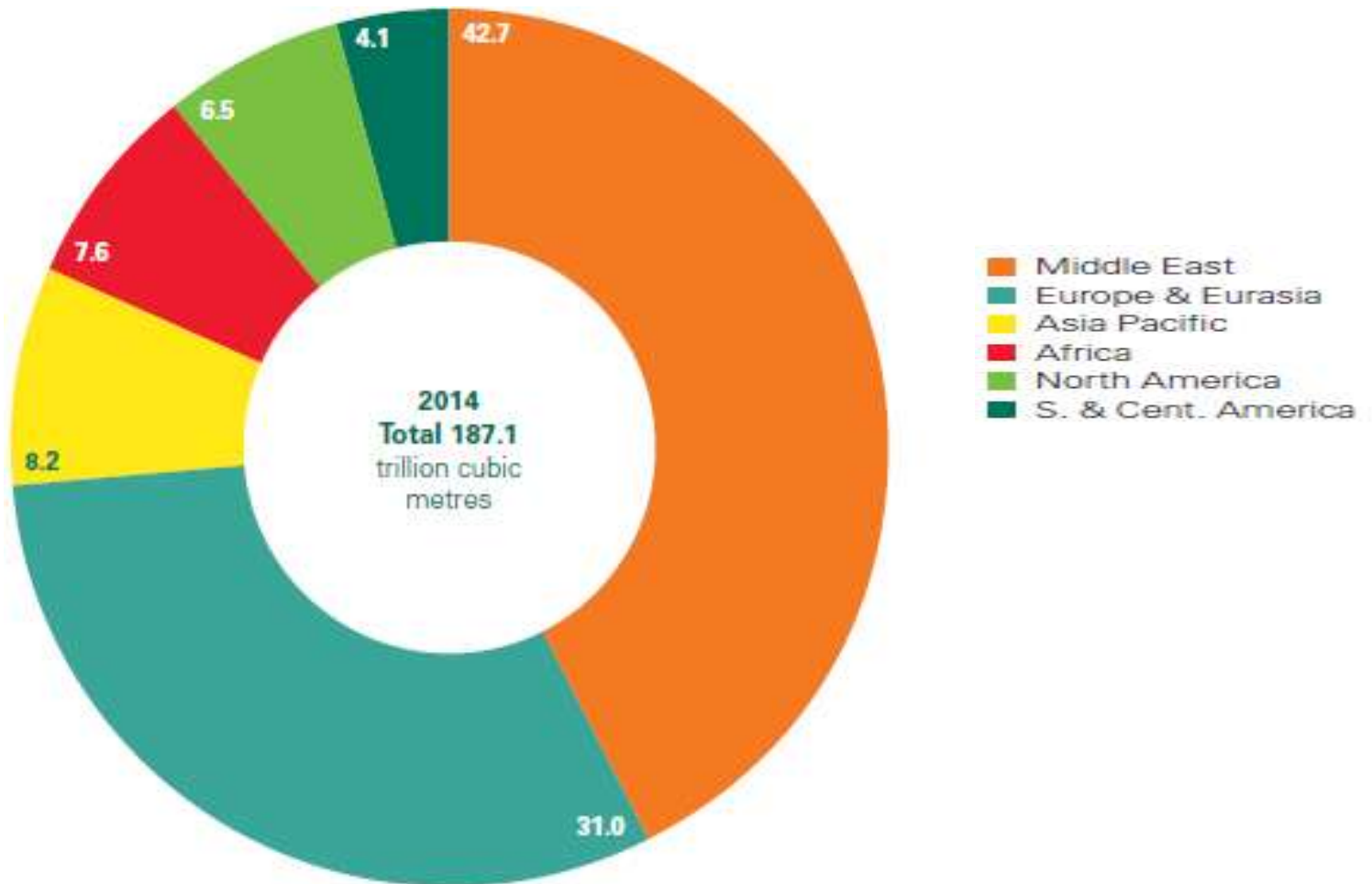
India s energy scenario

- World's fourth-largest energy consumer
- Primary energy demand 621 MTOE
- Proved Reserves;
 - 800 MMt of oil (0.3% world),
 - 1400 BCM of gas(0.8%)
 - 60600 MT of coal (6.8%)
- Oil demand 180 MMT ;produces around 38 MMT.
- Gas demand is over 51 BCM ;produces 32 BCM
- Coal demand is 360 MTOE, produces 282 MTOE

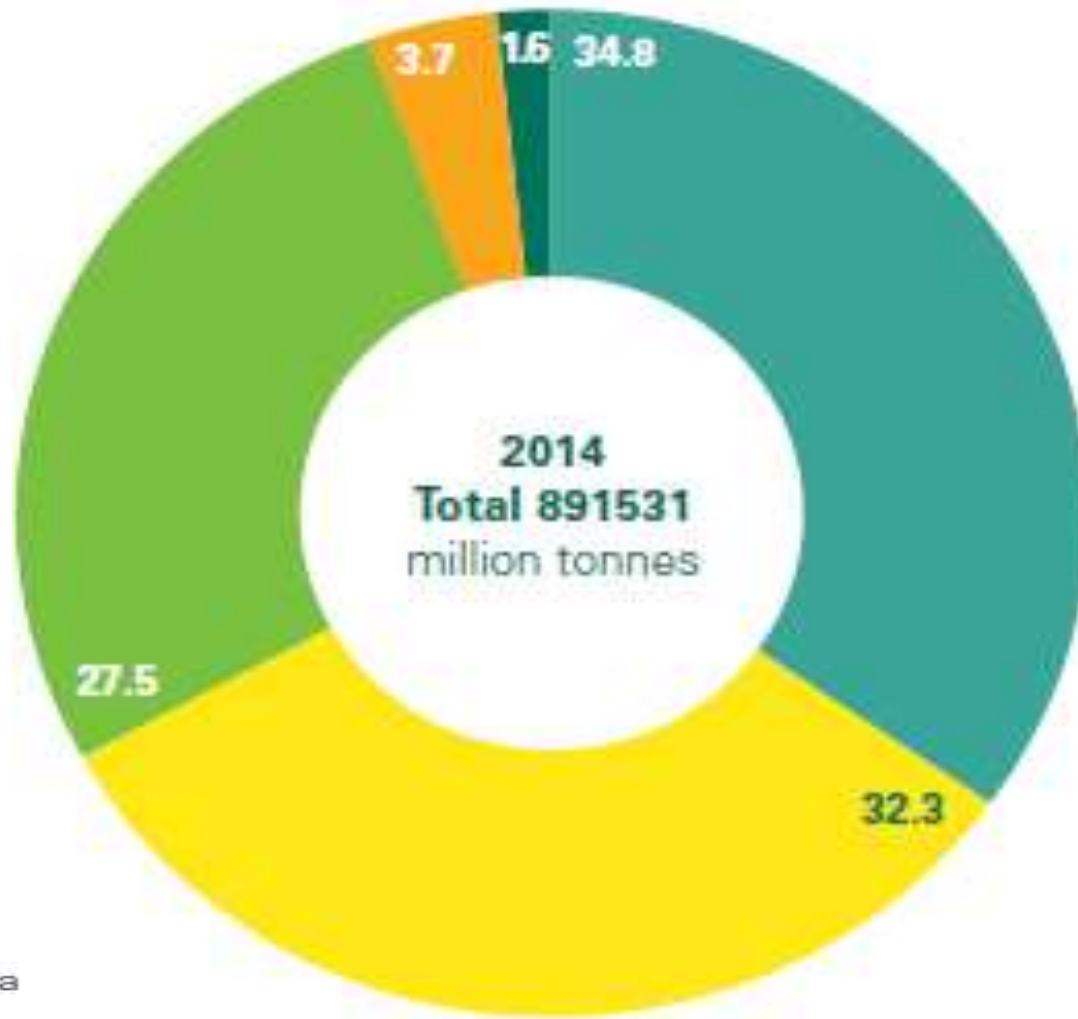
Proved OIL Reserves 2014



Proved Gas Reserves 2014



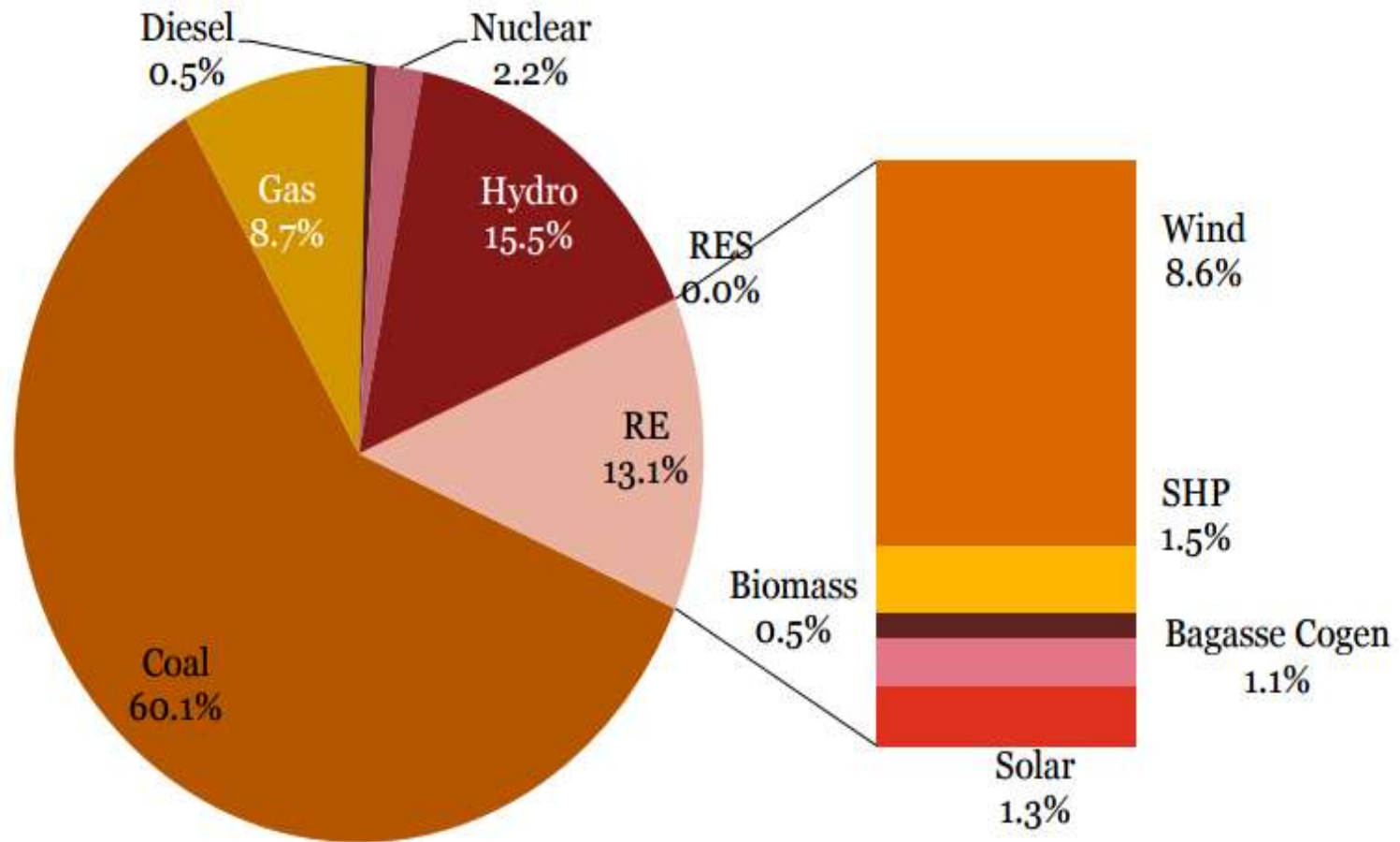
Proved coal reserves 2014

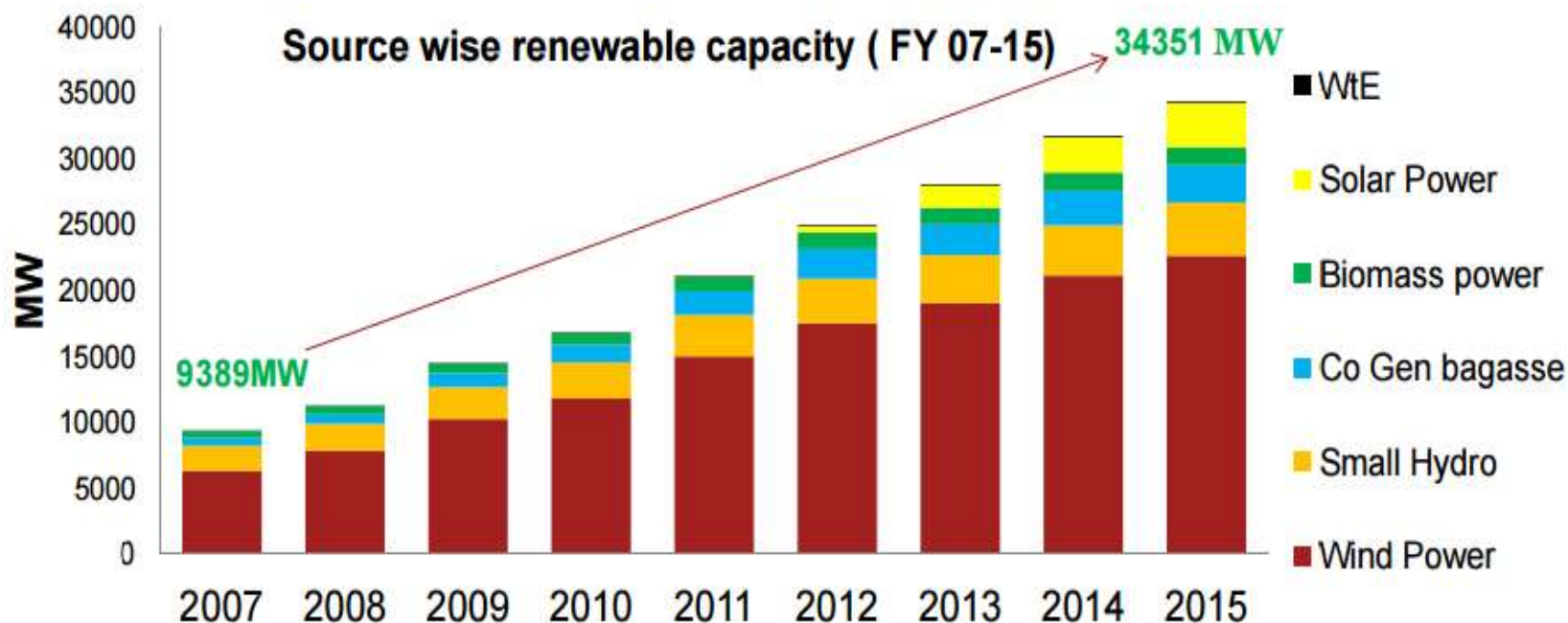


- Europe & Eurasia
- Asia Pacific
- North America
- Middle East & Africa
- S. & Cent. America

Present Power Scenario of India

Total installed capacity of **263.66 GW** and RE capacity of **34.35 GW** (13% of Installed capacity and approximately 7% of electricity produced) (as on March 2015)





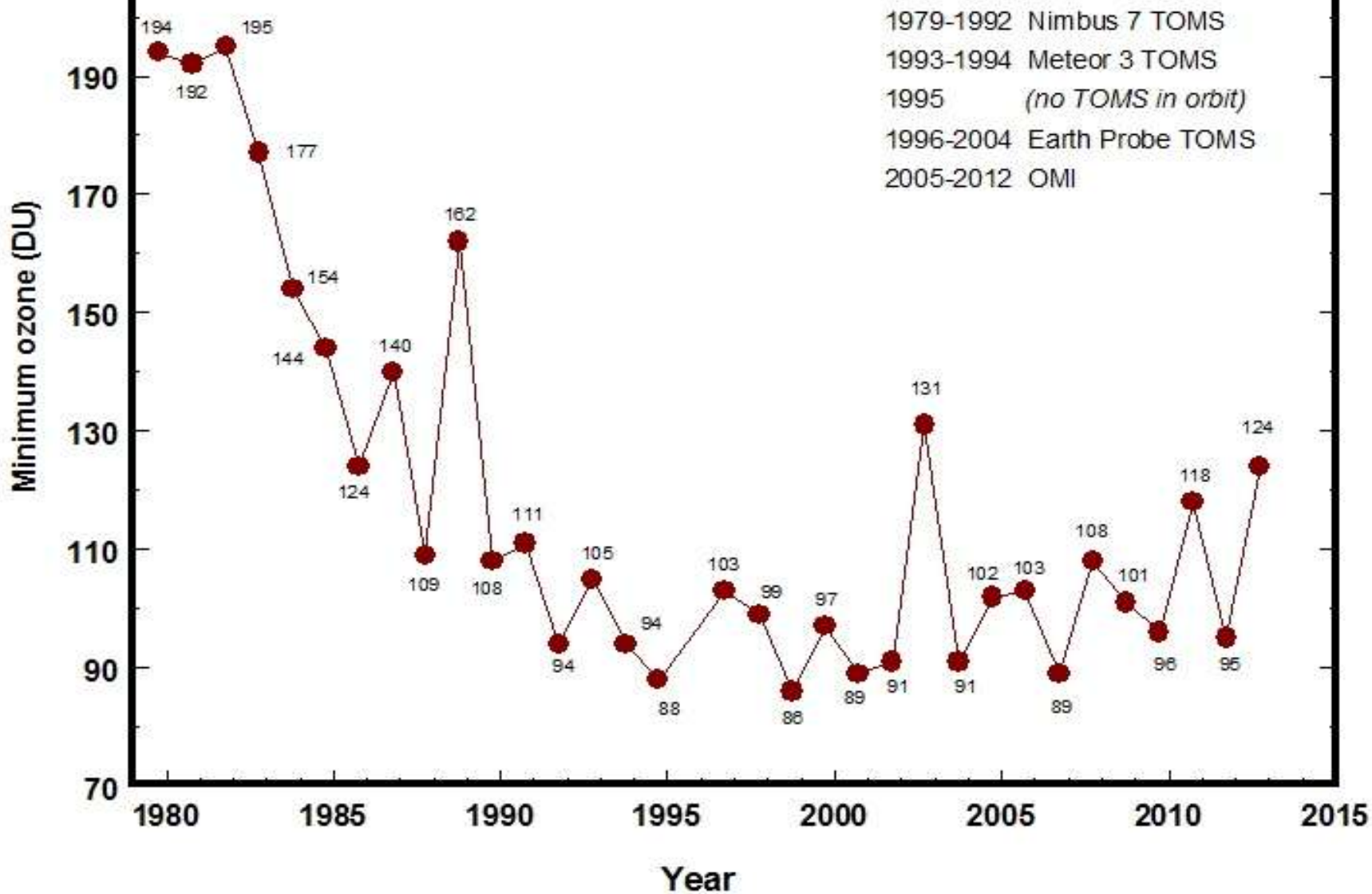
Capacities in MW				
Source	Installed capacity by end of 11 th Plan (March 2012)	Current installed Capacity (March 2015)	Target as per 12 th Plan (March 2017)	Revised Targets till 2022
Solar Power	941	3,383	10,941	1,00,000
Wind power	17,352	22,645	32,352	60,000
Biomass Power	3,225	4,183	6,125	10,000
Small Hydro	3,395	4,025	5,495	5,000
TOTAL	24,914	34351	54,914	1,75,000

Ozone Layer Depletion

- Anthropogenic activities like emission of CFC have created holes in ozone layer which is in the stratosphere (5-25 Km).
- The effect is most in springs in Antarctic (40 %) and Arctic (30%)
- Polar stratospheric clouds formed during winter containing halides in stable CFC reduce ozone to oxygen in the presence of sunlight in springs.
- Reduction is measured in Dobson unit which is the total column of ozone layer and not PPM.
- As per Montreal agreement in 1986 countries are reducing production of CFC and the results are showing.

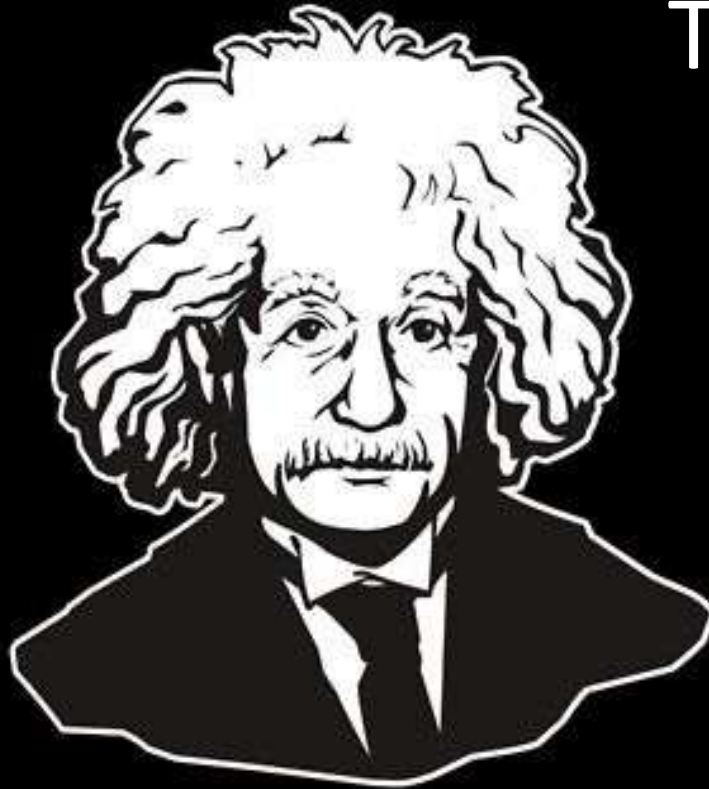
Antarctic ozone minimum (60° - 90° S)

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I have no special TALENTS

Thank You



**I am only passionately
CURIOUS**

- Albert Einstein