

Basin modelling

### Hydrocarbon Seeps

Occurance of oil and gas seeps at various locations in Dailekh distict (mainly at Shristhan, Navisthan and Padukasthan), western Nepal provide clear indication of hydrocarbon in the sub-surface. Production of petroleum at present in the basin of Potwar (Pakistan), Assam (India) and the existence of oil and gas seeps lead us to believe the possibility of hydrocarbon occurrence in this Himalayan country.



### Available Data And Legislation

#### Data Sales Package

PEPP has its own Data Center, which contains geological, geochemical, seismic, gravity and drilling data collected during petroleum exploration works in Nepal. The database

is divided into different Data Sales Packages (DSPs) "A" through "U". The data package "A", named "General report" is a pre-requisite for companies wishing to purchase other data or to lodge a formal bid for exploration acreages. The total price of data packages is US\$ 1,95,000.00

### Petroleum Legislation

The principle law governing the petroleum operations in Nepal is the Nepal Petroleum Act, 2040 (1983), which is supplemented by Petroleum Regulation 2041 (1985) with amendments in 1985, 1989 and 1994. The act grants rights and obligations to contractors such as:

- Right to export entitlements of petroleum product.
- Exemption from all taxes and fees except for a royalty of 12.5% and income tax 30%, annual surface rentals and miscellaneous fees of general application.
- Exemption from custom duties on imported goods
- Foreign currency facilities and right to repatriate funds without restrictions
- Right to employ foreign nationals, and
- Right to use land

### Terms of Production Sharing

The Petroleum Regulation 2041 (1985) has made a provision of "Model Petroleum Agreement" which basically includes all the items to be covered in the form of production sharing contract with provisions of royalty and income tax. An obligation to drill a well is not a mandatory in the Initial exploration period of four (4) years.

### Foreign Investment Policy

Nepal has accorded high priority to encourage foreign investment in the country. With economic liberalization policy of the government and attractive fiscal terms available, Nepal is committed for full co-operation to international oil companies in facilitating petroleum operation in Nepal.

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### PETROLEUM EXPLORATION PROMOTION PROJECT

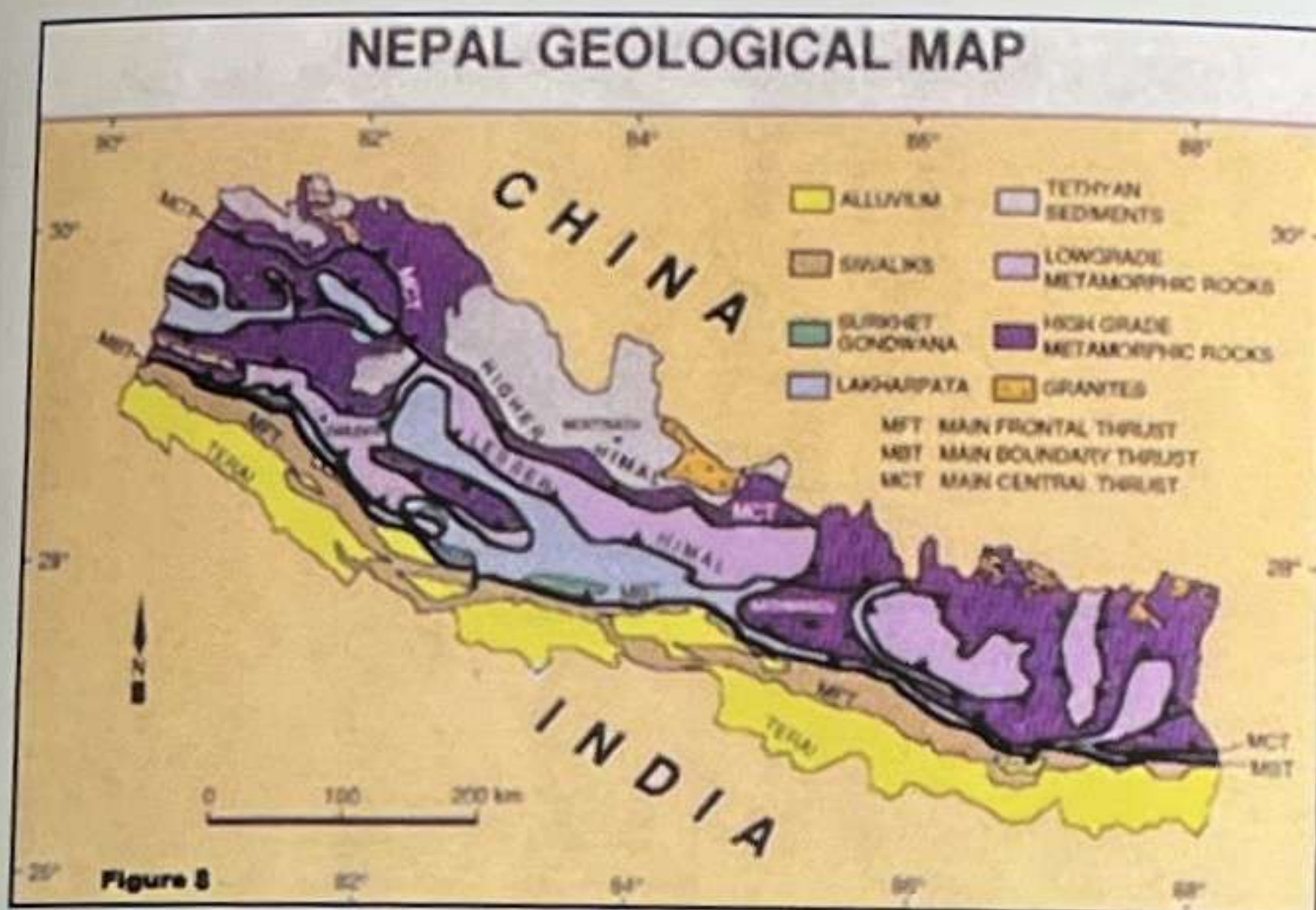
## Introduction

Nepal, a beautiful Himalayan country accommodating majority of the world's highest peaks including Mt. Everest, is situated between India and China. Physiographically, the country can be divided into four parallel zones conforming more or less with the geological zones namely Terai Plain (Indo-Gangetic Plain), Siwalik Range, Lesser Himalaya and Higher Himalaya lying from south to the north. The southern part of the country lies in the foreland of the Nepal Himalaya containing sedimentary basins which are important for hydrocarbon exploration. The Terai plain and Siwalik Range of Nepal have been divided into 10 exploration blocks, each having approximately 5,000 sq. km. area.

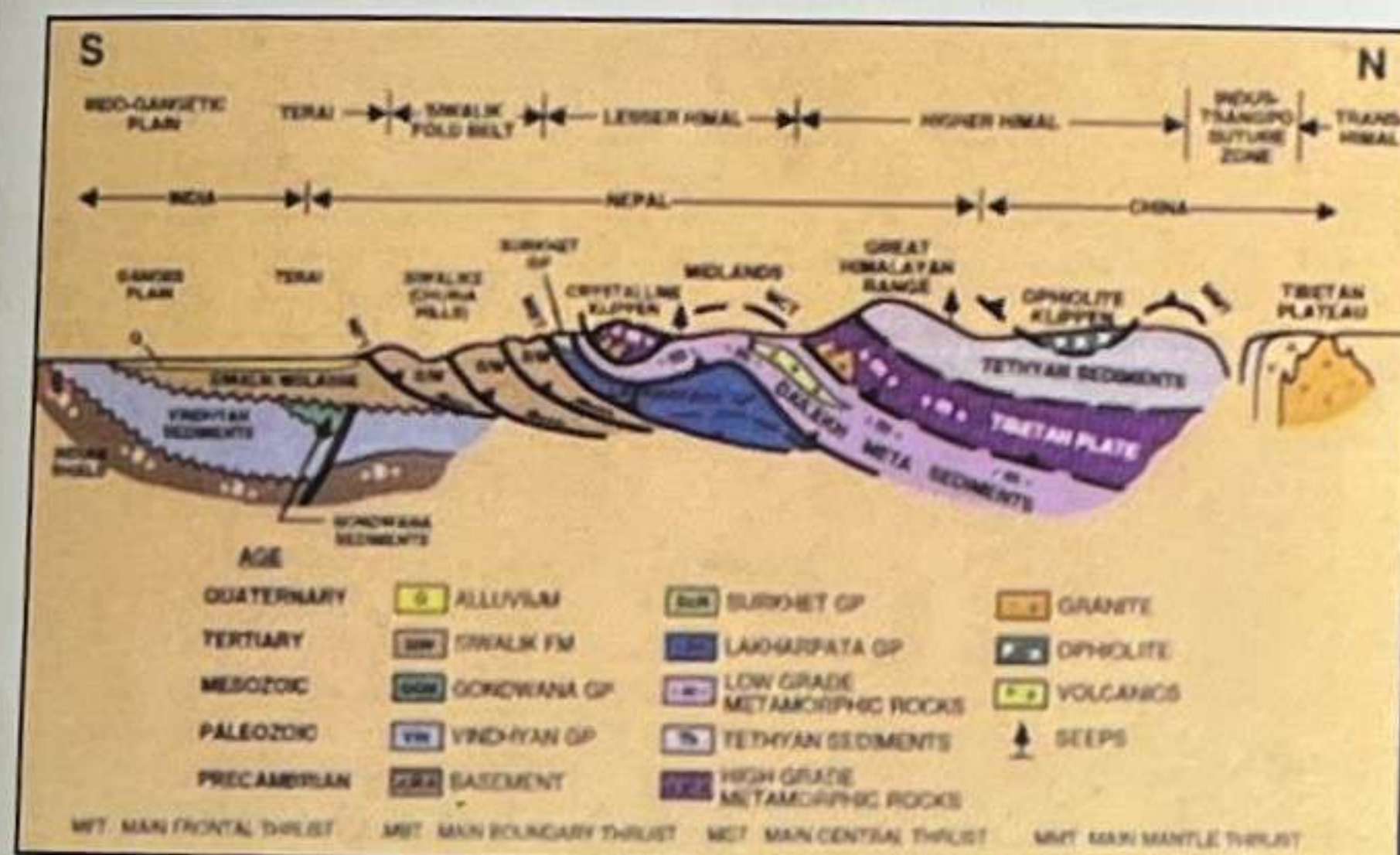
## Exploration Activities

Petroleum Exploration Promotion Project (PEPP) has conducted a series of geological, geophysical, and geochemical surveys in the southern part of Nepal with bilateral and multilateral

- Airborne Magnetic Survey, CGG 48,000 sq. km
- Photo-geological study, hunting Geology and Geophysics Ltd 60,000 sq. km
- Reflection seismic survey, CGG Petro-Canada and shell Nepal 5,253 line km
- Gravity Survey, ELS Consulting Entire Terai Region
- Exploration Well (Block 10, Biratnagar), Shell Nepal 3520 m depth
- Source and Seal Study, Alconsult Inc. Nepal
- Geological Map Publication (10 blocks), PEPP/DMG 50,000 sq. km.



Geological map of Nepal



Schematic cross-section across Nepal

cooperation in the past.

## Terai

Terai is the northern extension of Indo-Gangetic Plain and is composed of thick undifferentiated fluvial deposits of Recent to Quaternary age. It is underlain by thick flat lying sequence of molasse sediments (Siwalik Group), which unconformably

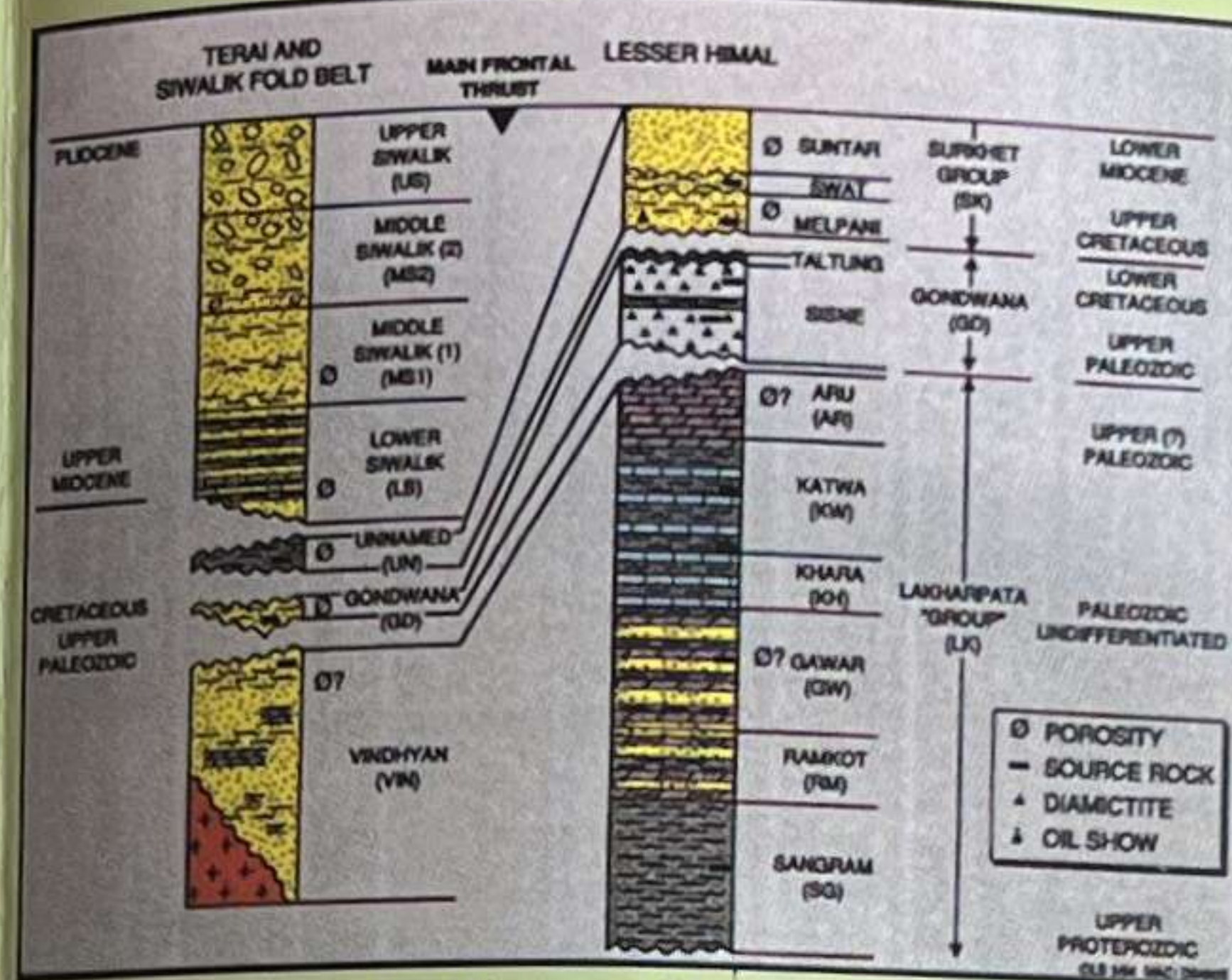


Figure 3. Stratigraphic Diagram of Nepal

overlies the sub-basins, comprised of Proterozoic to early Tertiary rocks.

## Siwalik Group

It consists of Middle Miocene to Lower Pleistocene molasse sediments predominantly sandstone and shale deposited in the foreland basin of the Nepal Himalaya. The Siwalik belt is bounded to the north by the Main Boundary Thrust (MBT) and to the south by the Main Frontal Thrust (MFT).

## Surkhet Group

The Surkhet Group of rocks (Upper Cretaceous- Lower Miocene) is well exposed in western part of Nepal. It is equivalent to the "Unnamed Formation" (Paleogene) found in the subsurface of Indian wells close to the Indo Nepal border. This group of rocks resembles the lithology of oil producing Potwar Basin of Pakistan. The Swat and Melpani Formations of this group contain source and seal potential rock whereas the Sutar Formations has developed reservoir potential rock.

## Gondwana Group

It is exposed in different parts of Nepal with variable thickness and is presumed to occur in the sub-surface, unconformably

overlying the Lakharpata Group of rocks. The age of this group is Upper Paleozoic to Lower Cretaceous. The Sine and Taltung Formations of this group have both source and reservoir potential rock, whereas the Taltung Formation has only reservoir rock potential.

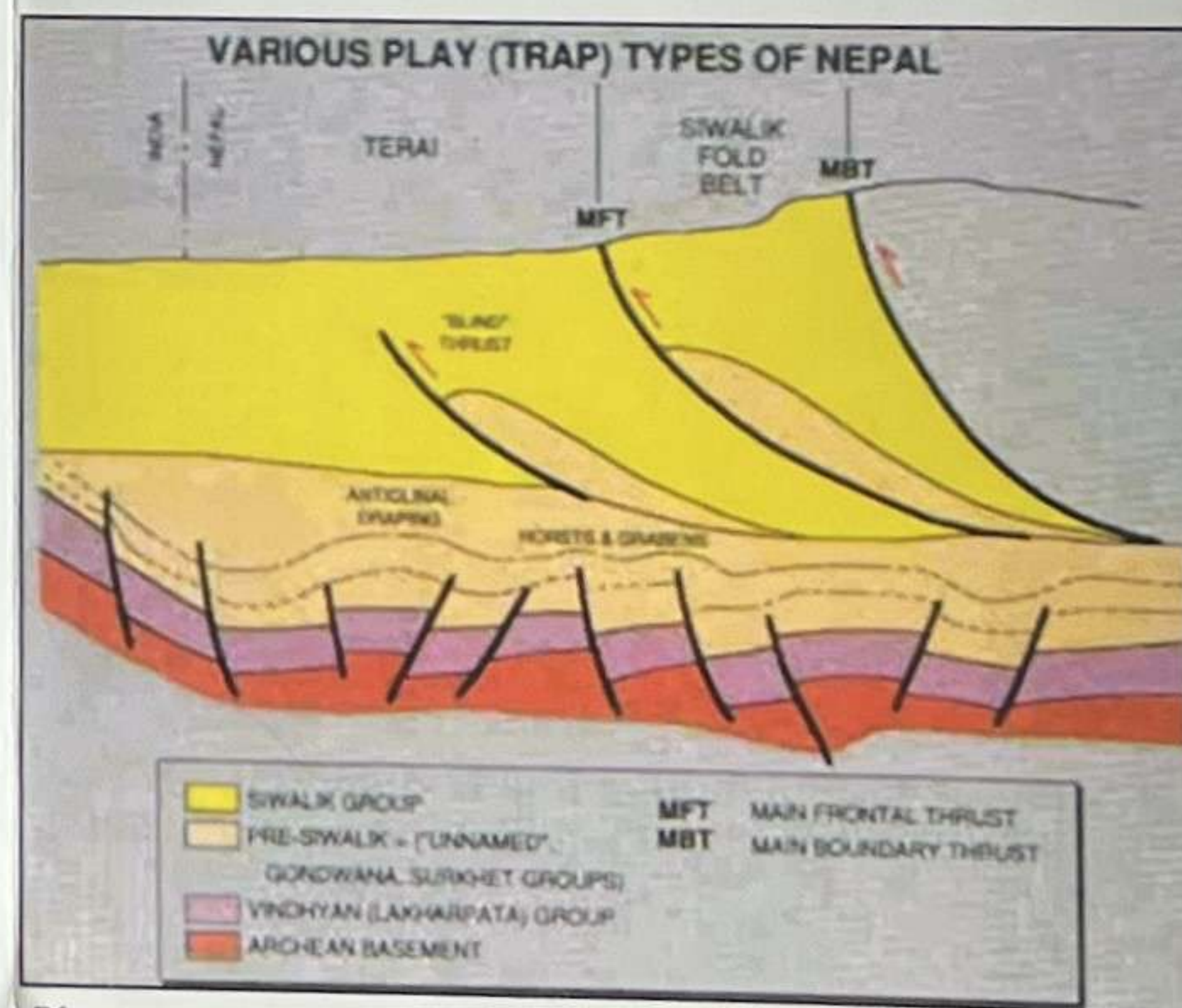
## Lakharpata Group

This Group is exposed along the Main Boundary Thrust (MBT) and is considered equivalent to the Vindhyan Group of India. Rocks of this group are interpreted to occur in the sub-surface and unconformably beneath the Siwaliks and Gondwana rocks. The age of this group is Late Precambrian to Late Paleozoic. The Sangram, Gwar, Katwa and Khara Formations of this group have potential source rock.

## Hydrocarbon Plays

### Source

Potential source rocks are identified in the Lakharpata Group of rocks (Late Precambrian – Late Paleozoic), the Gondwana Rocks (Upper Paleozoic – Lower Cretaceous) and the Surkhet Group of rocks. The shale beds of these groups are found to contain 2 to 20% of Total Organic Content (TOC).



Play concept, western Terai and Siwalik foot-hills

## Reservoir

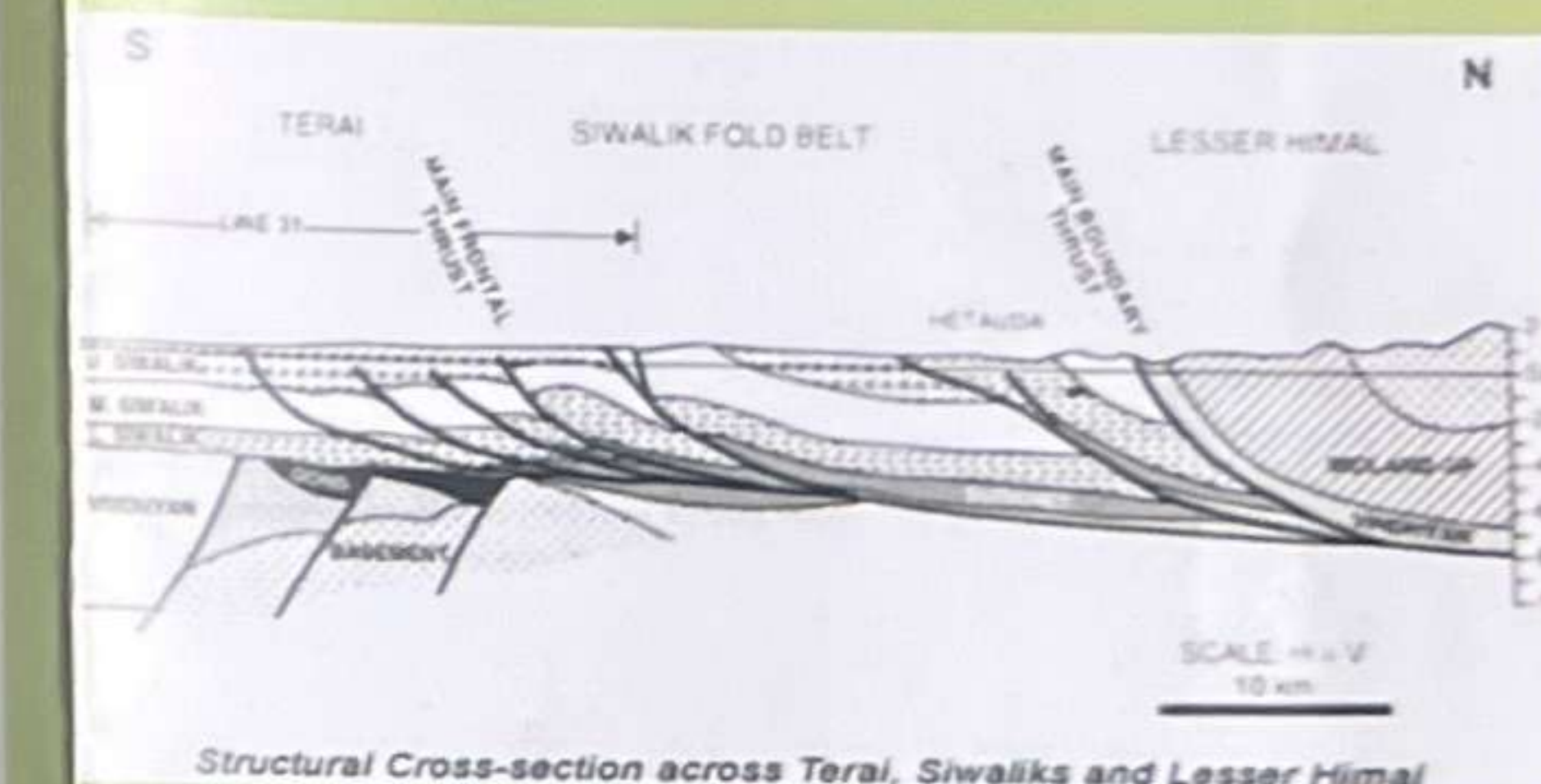
The potential reservoir rock is present in Lakharpata, Gondwana, Surkhet and Siwalik Group of rocks. Siwalik Group particularly contains abundant reservoir type rocks.

## Seal

The potential seal rocks are found in the Lower Siwalik, Surkhet and Gondwana Groups of rocks

## Trap

Structural traps include anticlines and thrust/faults developed



Structural Cross-section across Terai, Siwaliks and Lesser Himal

Structural cross-section across Terai, Siwaliks and Lesser Himalaya

in the Siwalik Fold Belt. The Structural closures are expected associated with basement controlled faults, grabens, edge folds and fault closures, draping over pre-existing high and stratigraphic traps caused by pinch out, facies changes, permeability barriers etc

## Maturity

Source rock maturity basin modeling indicates that Sutar, Swat and Melpani Formations of Surkhet Group and Gondwana Group fall within oil window, whereas the Lakharpata Group falls in the gas window. Good maturations for gas and even oil are expected in the blind frontal thrust-folds beneath the Terai/Siwalik areas.