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GEOLOGICAL SURVEY

Tertiary system and its petroleum potential in the Lunpola Basin, Xizang (Tibet)

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Tertiary System and its petroleum potential in the Lunpola Basin, Xizang (Tibet), China

Summary

A preliminary investigation of the Tertiary stratigraphy and structure in relationship to the generation of petroleum deposits has been done in the central and eastern parts of the Lunpola Basin, Xizang (Tibet), by Xu Zengyu since 1967 (figs. 1, 2, 3, and table 1). Xu is affiliated with the Fourth Geological Brigade of Xizang of the Ministry of Geology and Mineral Deposits. His report is published in "Oil and Gas Geology," Volume 1 and Number 2, pages 153 to 158; the paper is in Chinese with an English Summary. At the present, it is believed that work is in progress throughout the basin.

The Lunpola Basin is an east-west trending faulted basin, bounded by the Bangonghu-Nujiang faulted belt on the north and by the Northern Namukacuo faulted belt on the south (figs. 2 and 3). The east-west length of the basin is about 200 km, and the north-south width is about 20 km. Thus it encompasses some 4,000 square kilometers, which is underlain by oil-bearing Tertiary continental sedimentary rocks.

The Tertiary continental lithofacies of the Lunpola Basin consists of lacustrine deposits of shallow lake and fluvial detrital facies. On the basis of lithology and fossils, the Tertiary sedimentary rocks are divided in ascending order, into the Niubao Formation and the Dingqing Formation (fig. 2 and table 1). Total thickness is about 4,000 m. The two formations are conformable, but unconformably overly the Cretaceous and Jurassic rocks along the basin margin.

The lithologic description and fossil content of the Niubao and Dingqing Formations are given in table 1. The genetic relationship between these two formations and the generation of petroleum deposits is stated also in table 1.

In the Lunpola basin from the north to the south, three second-order structural belts are 1) northern nappe structural belt, 2) central depression belt, and 3) southern gently-folded belt. Locally, areas of structural traps range from 3 to 5 square kilometers and the amount of structural closure is generally high (fig. 3).

As the result of drilling in the basin, the author believed that the characteristics of basin evolution control the development of oil pay zones throughout the basin. Nevertheless the high petroleum potential is confined in the areas of Hongxingliang Pagena, Niubao, and Lunpola-Papashan (fig. 2).

The Hongxingliang area is a narrow area in the central portion of the northern nappe structural belt. It is 20 km long from Diezong on the east to Waxiaodi on the west, with a width of about 1 km. Structural units in this area include the Alikaibai structure and nos. 1, 2, and 3 structural units as well as the Hongxingliang overthrust fault. Oil shows were discovered in 1976.

The Pagena area is located in the central depression belt. Source rocks, reservoir rocks, and capping beds are well developed and preserved. A favorable structural trap is the Hongshanton nose-type structure. Drill hole tests in this area indicate high-oil saturation and good quality of oil.

The Niubao area is confined in the Niubao anticline. Drilling test wells indicates better quality of oil and gas. Asphaltene is high up to 37-46 percent.

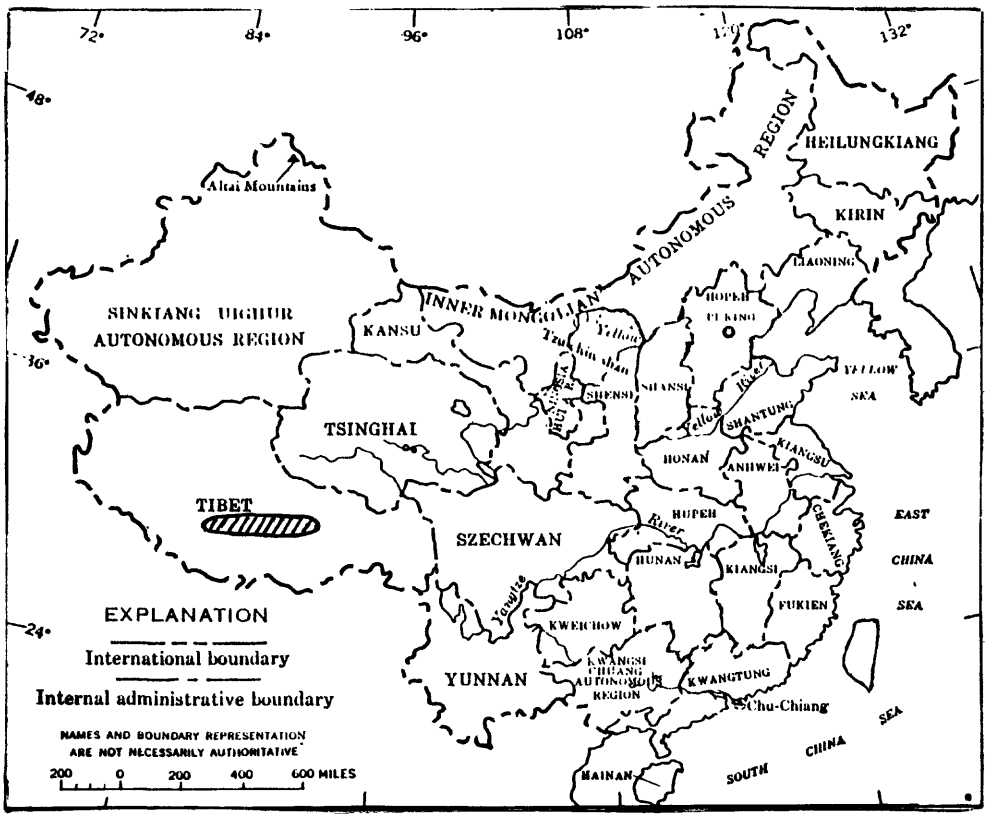
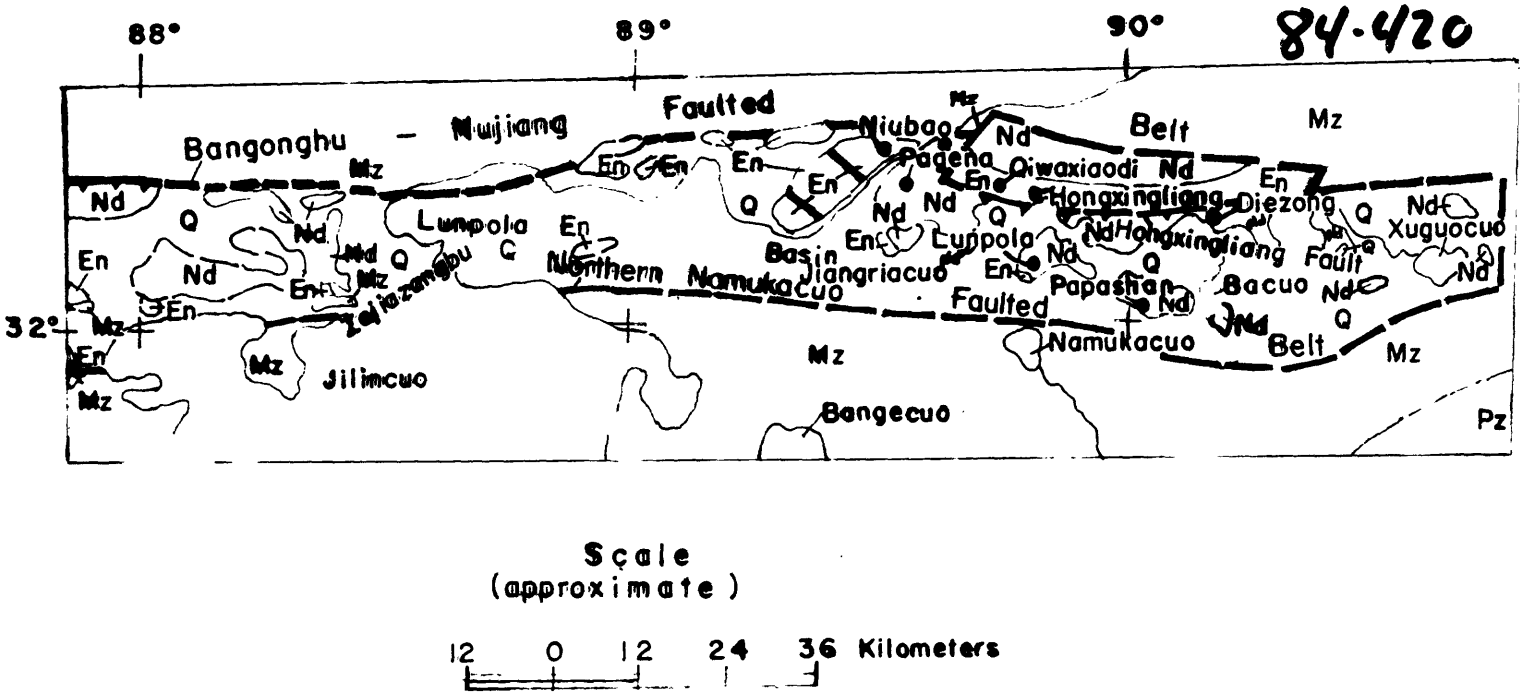


Figure 1.--Index map of China showing location of the Lunpola basin, Xizang (Tibet) (Provincial names are in Wade-Giles spelling) (Modified after K. Y. Lee, 1970; USGS Bulletin 1312-N, fig. 1).

Lunpola basin — 



Scale
(approximate)

12 0 12 24 36 Kilometers

Figure 2. Generalized geologic map of the central and eastern parts of Lunpola Basin, Xizang(Tibet) (adopted from Xu, Zhengyu, 1980; Fig. 1).

Explanation

- Cenozoic
  - Quaternary — Q — Alluvium
  - Tertiary
    - Neogene — Nd — Dingqing Formation
    - Paleogene (Eogene) — En — Niubao Formation
- Mesozoic — Mz — Undifferentiated
- Paleozoic — Pz — Undifferentiated

Geologic contact

Lake and stre.

Thrust fault

Inferred fault

Fault of uncertain type

Inferred basin boundary

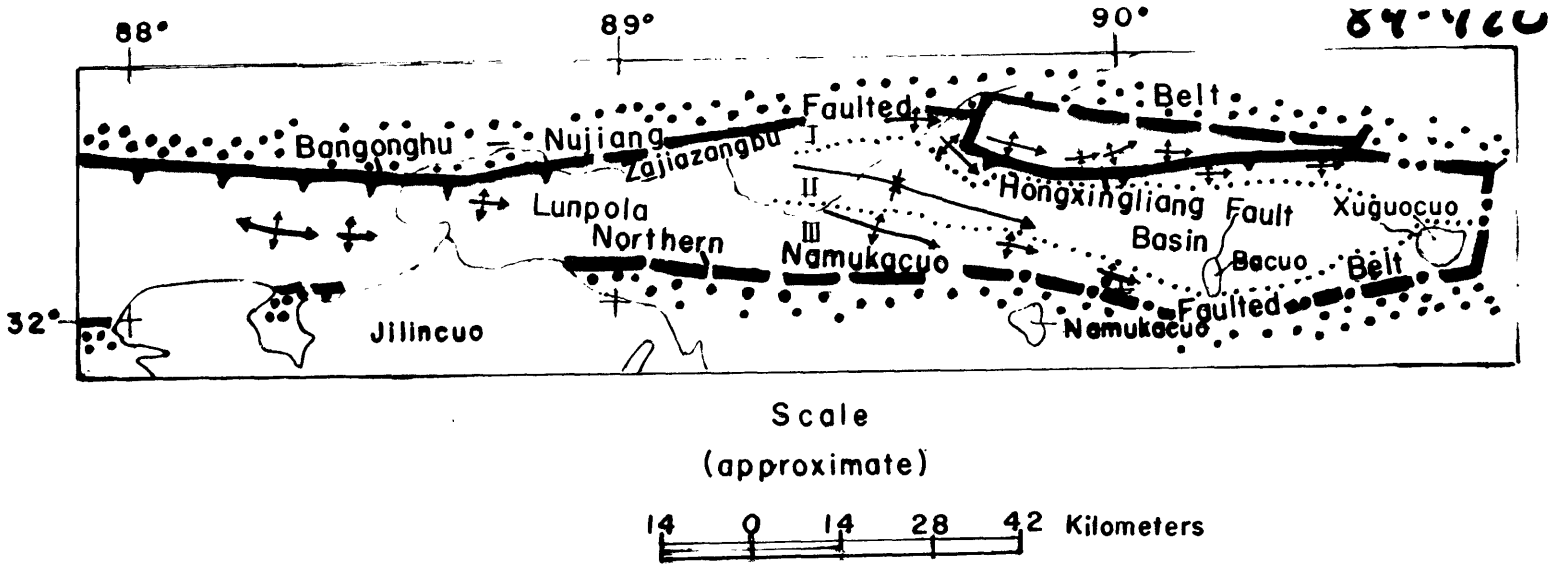


Figure 3. Sketched structural map of the Lunpola Basin, Xizang (Tibet) (adopted from Xu, Zhengyu, 1980; Fig. 2)

Explanation

I. Northern nappe structural belt.

II. Central depressien belt.

III. Southern slope belt.

Anticline

Inferred fault based on airborne magnetic survey.

Lake and stream

Mono-plunging anticline.

Inferred fault based on gravity anomaly survey.

Mono-upwarping syncline.

Boundary of structural units.

Inferred fault

Inferred basin boundary

Thrust fault

Uplifted areas outside the basin.

The Lunpola-Papashan area is located in the southern folded belt in which the Lunpola and Changshan anticlines are well developed. Prospect drilling indicates rich oil layers and generally good physical properties of crude oil.

The physical properties of Tertiary crude oil in the basin consist of high values in specific gravity, viscosity, paraffin, sulfur, and nonhydrocarbon compounds. These properties were formed probably due to a) crude oil experiencing a certain degree of weathering, and b) relatively low maturity of crude oil. It is believed that the relatively low maturity of crude oil is the more important factor in forming the high values of specific gravity, viscosity, and nonhydrocarbon content in the crude oil.

Analyses of three crude-oil samples and 29 rock samples* from the areas of Pagena, Hongxingliang, and Papashan indicate the nickel-porphyrin contents of 195.03, 270.05, and 303.03 ppm from three crude-oil samples of the Hongxingliang area; 50 ppm nickel-porphyrin from 24 rock samples; and nonhydrocarbon and asphaltene ratio averages 26.3 from 27 rock samples of lower and middle members of the Dingqing Formation and the middle member of the Niubao Formation.

*Rock samples are not defined as "surface" or "subsurface."