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Pishin Basin: Status and Prospects

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ABSTRACT

Based on the available surface geological, landsat imagery and aeromagnetic data, Pishin basin is categorized as a Median basin.

The known sedimentary sequence in the basin dates back to Eocene and is dominated by flysch type clastics. The structures on the surface seem complicated. The thickness and lithological composition of the sedimentary fill and reporting of an oil seepage indicate some potential for the occurrence of hydrocarbons in the basin.

INTRODUCTION

The Pishin basin has been previously described and classified under different names e.g. Kakarkhorasan flysch basin (Kazmi & Rana, 1982), Pishin rear depression (Raza et al, 1989) and Katawaz basin and Khojak flysch zone (Bannert et al, 1989). In this paper it is classified as a Median Basin (Riva, 1983) because of its location in the plate margin region (Figure 1).

The present study has intensively borrowed surface geological information from the Colombo Plan Report (1961) and GSP Memoir No.12 (Shah, 1977).

The purpose of this study is to draw the attention of oil companies to Pishin basin which is a true frontier and because of its geology and basin type merits exploration for oil and gas. The objective is achieved by producing a meaningful summary of the geology, basin type and resource potential.

PETROLEUM GEOLOGY

The Pishin basin is located between Chaman transform fault and obducted ophiolitic margin of the Indian plate (Figure 1). It, thus falls in the category of median basins which are producing hydrocarbons in Indonesia, Venezuela, Colombia, Europe, New Zealand and Iran. It has complete resemblance with these basins in the nature of sedimentary fill and structural development (All these basins are dominated by clastic sediments and structural-stratigraphic traps). A comparison with its type is shown in Figures 2a and 2b.

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Stratigraphy

The stratigraphic succession discussed below and shown in a columnar section (Figure 3) is as follows:

Formation	Age
Bostan	Pleistocene
Khojak	Oligocene-Early Miocene
Nisai	Eocene

Nisai formation.— The formation is lithologically dominated by a massive, reefoid limestone of Eocene age (based on larger foraminifera). The subordinate lithology comprises shale with minor local development of sandstone and conglomerate. The formation is about 1200m thick in its type section (North of Nisai Railway Station).

Khojak formation.— The formation forms the main sedimentary fill in the basin. It is subdivided into a lower shale member (Murgha Faqirzai) and an upper sandstone member (Shaigalu). The formation is more than 2400m thick in the basin. The formation has been dated to range from Oligocene to Early Miocene age on the basis of molluscan and foraminiferal fauna.

Bostan formation.— The formation is the youngest stratigraphic unit in the basin deposited in Pleistocene time. It comprises fluviatile clay, sandstone and conglomerate.

Structure

The Pishin basin developed in the plate margin region during Tertiary. Transform movement along the Chaman fault and collision of an island arc and consequent obduction of ophiolites in early Tertiary are the tectonic events influencing the basin. The sediments, mainly clastics, were derived from the growing mountains and Kabul and

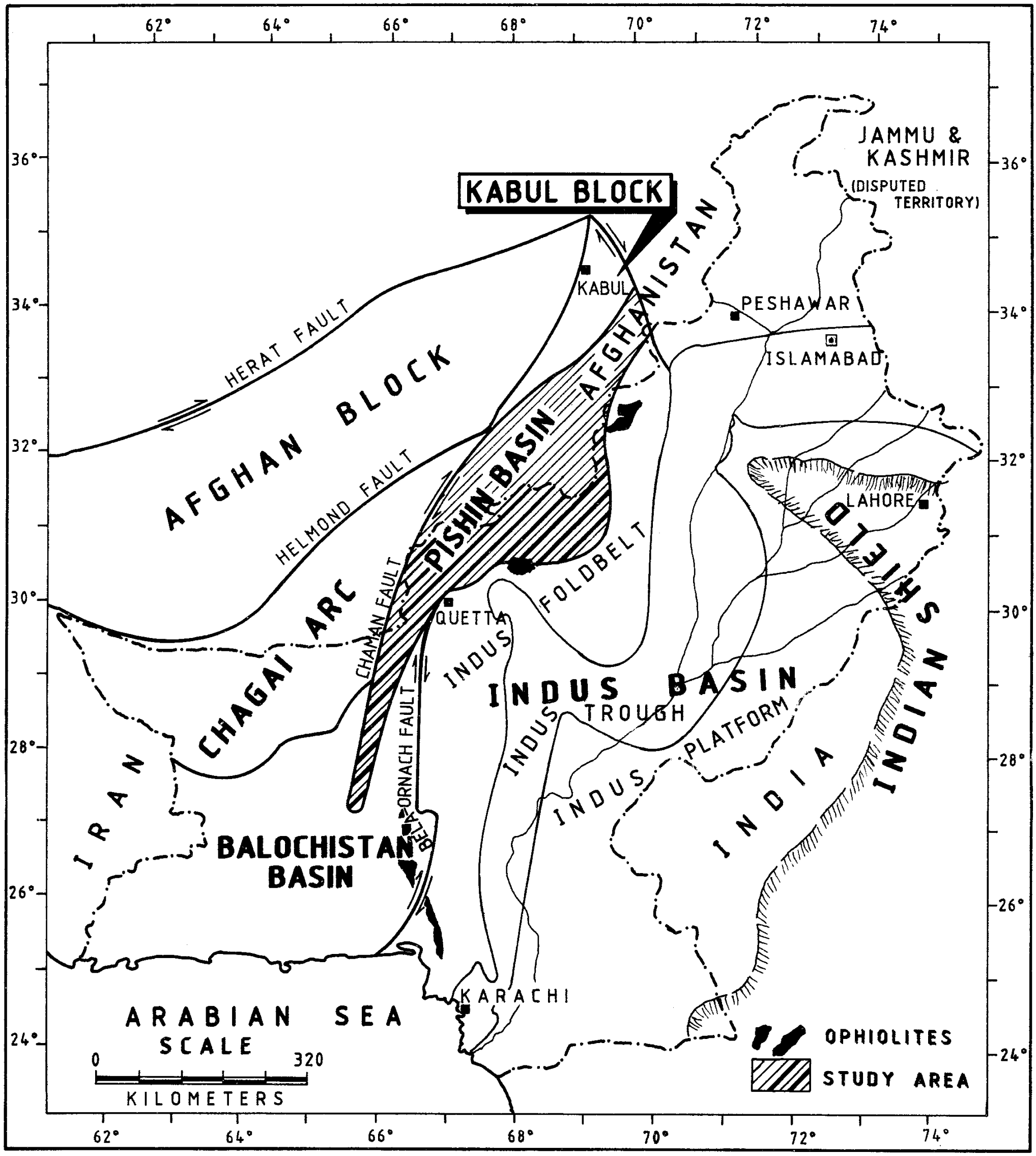

Figure 1— Location of study area with regional tectonic setting.

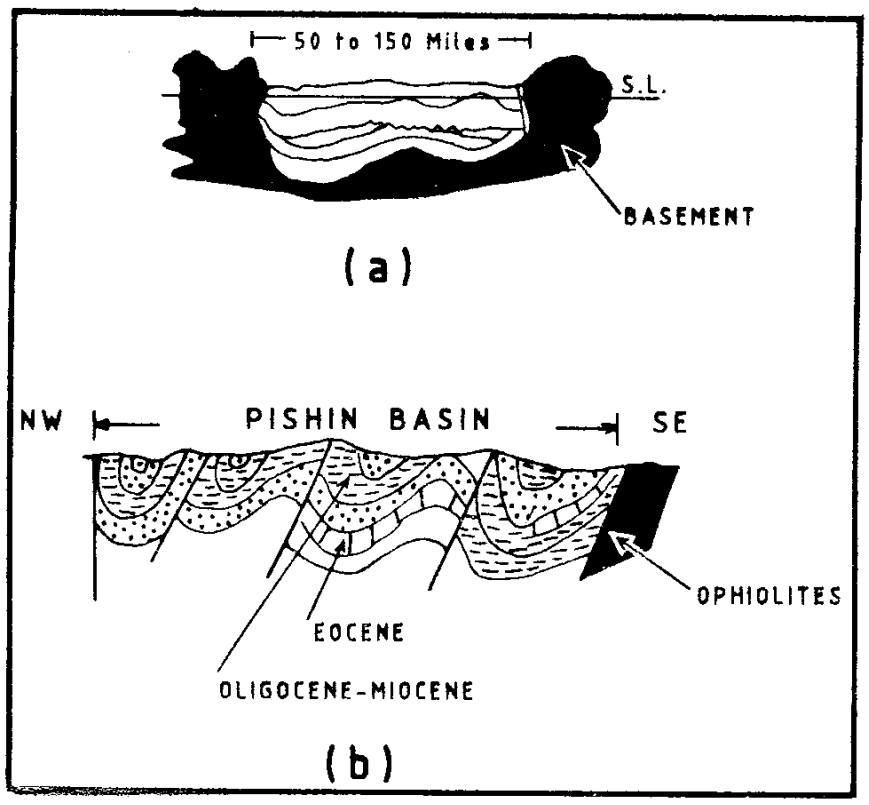

Figure 2— Basin profile (b) in comparison with its type (a).

Afghan blocks. The flysch type sediment fill (Figure 4) was moulded into narrow, sharp, often faulted and elongated anticlines and comparatively open synclines (Figures 2, 5) during Quarternary collision phase. The general trend of the folds and faults is arcuate and parallel to the sinuate foldbelt (Figure 5).

Prospects

The Pishin basin contains an estimated thickness of 4000-6000 metres of sedimentary rocks which is adequate for the generation and accumulation of oil and gas. The basin according to its tectonic setting can be classified as an Extracontinental Median Basin. Examples of the median basins which are productive can be found in Indonesia, Australia, New Zealand, Colombia, Venezuela and Eastern Europe. Geothermal gradients in median basins range from normal to high (Riva, 1983). Dark grey shales of Murgha Faqirzai are most likely candidate for source rock, but it has to be substantiated by future geochemical work. Reservoirs should not be difficult to find. Sandstones of Shaigalu member are potential reservoirs. Additionally, reefoid carbonates of Eocene age might also prove productive reservoirs if fed by an older source. The trapping system could be the stratigraphic-structural combination as is the case in many of the producing median basins (Figures 6a and c). Rapid sedimentation and late compression could have produced sharp anticlines flanking wide synclines with possibilities of development of additional stratigraphic traps as is the case with the structures bordering Kulanch syncline in Makran (HDIP-ICST, 1985).

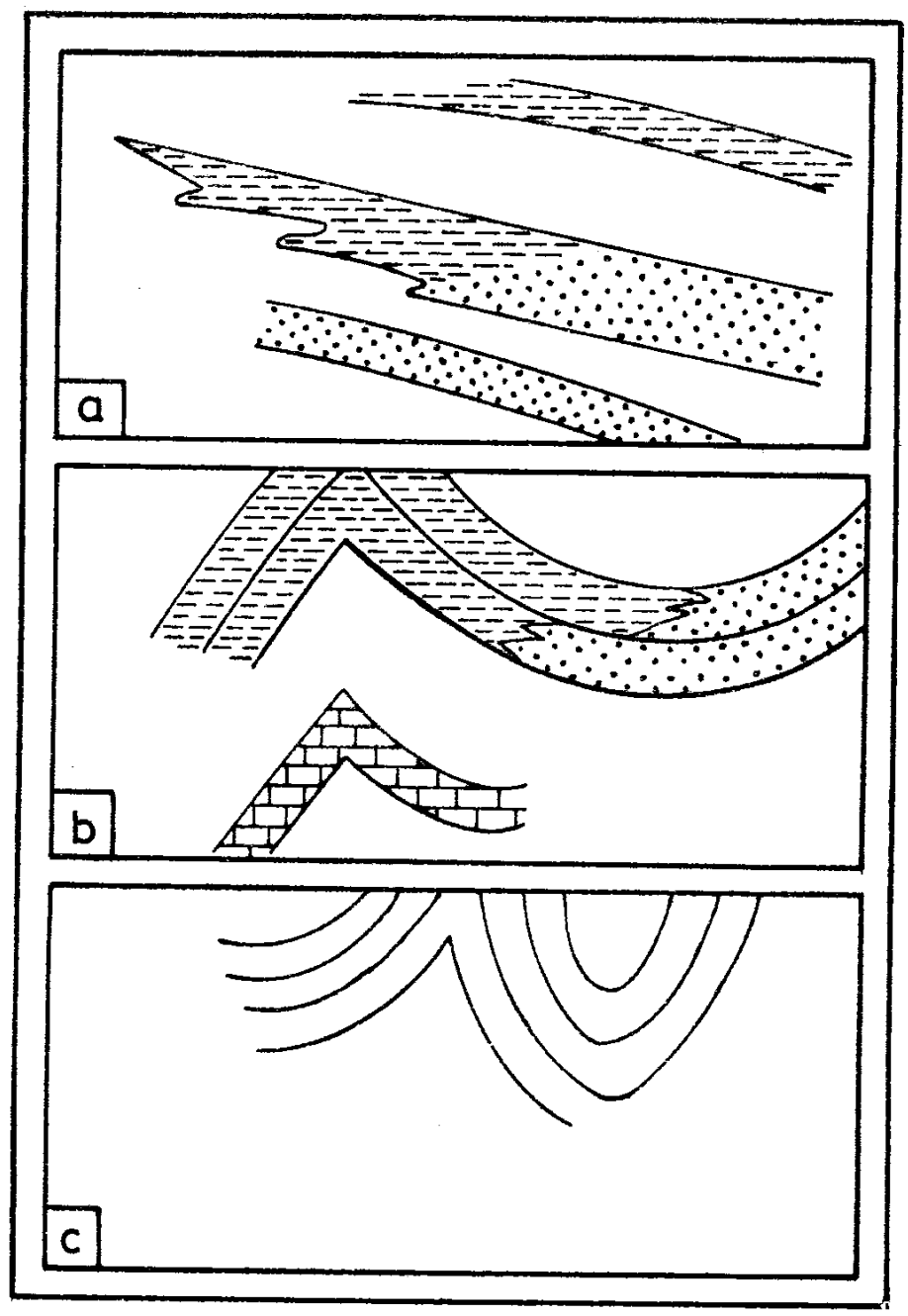

Figure 6— Play types in the area (a and b: stratigraphic, speculative; c: structural, actual).

Resource Potential

Petroleum upto 300,000 barrels of oil-equivalent per cubic mile of sediments has been discovered in some median basins but the finds in average basins have ranged from 20,000 to 60,000 barrels per cubic mile (Riva, 1983). Since the status of Pishin basin is of frontier category as yet, the following assessment of the potential resource is made on the least level, that is 20,000 barrels per cubic mile.

Volume of sediment:	40,000 cu mi.
Conservative recovery:	20,000 barrels per cu mi.
Potential resource:	40,000 x 20,000 = 800 million barrels of oil or gas equivalent.
Percentage of oil and gas:	50/50.
Potential oil:	400 million barrels.
Potential gas:	2.4 TCF.

AGE	LITH-OLOGY	FORMATION	ENVIRONMENT
RECENT		ALLUVIUM	SURFICIAL
PLEISTOCENE		BOSTAN	FLUVIATILE
OLIGOCENE - E.MIOCENE		KHOJAK FORMATION: SHAIGALU MEMBER	MARINE
		KHOJAK FORMATION: MURGHA FAQIRZAI MEMBER	MARINE
EOCENE		NISAI	MARINE

Figure 3— Columnar section showing stratigraphy.

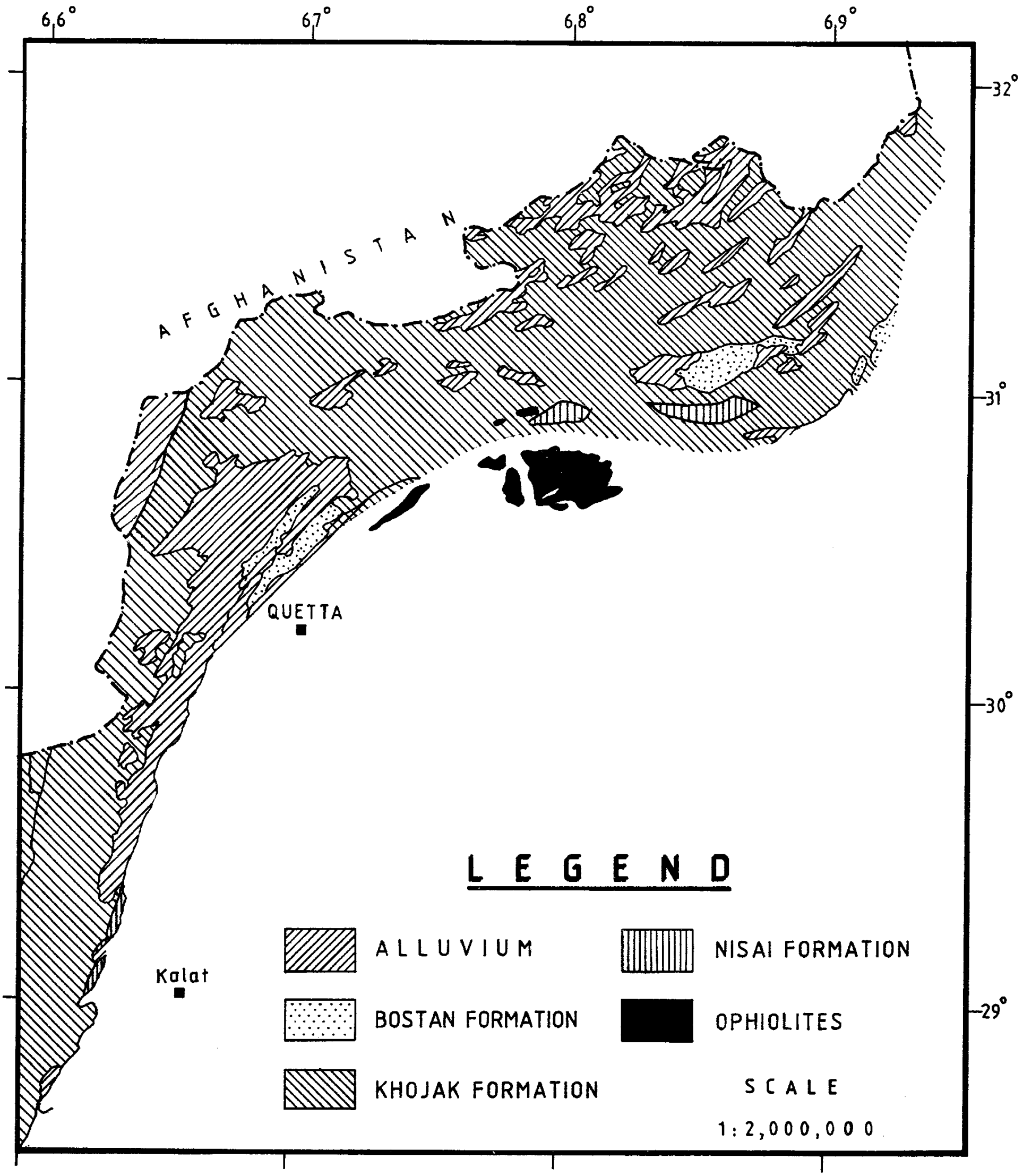

Figure 4— Geological map of the area.

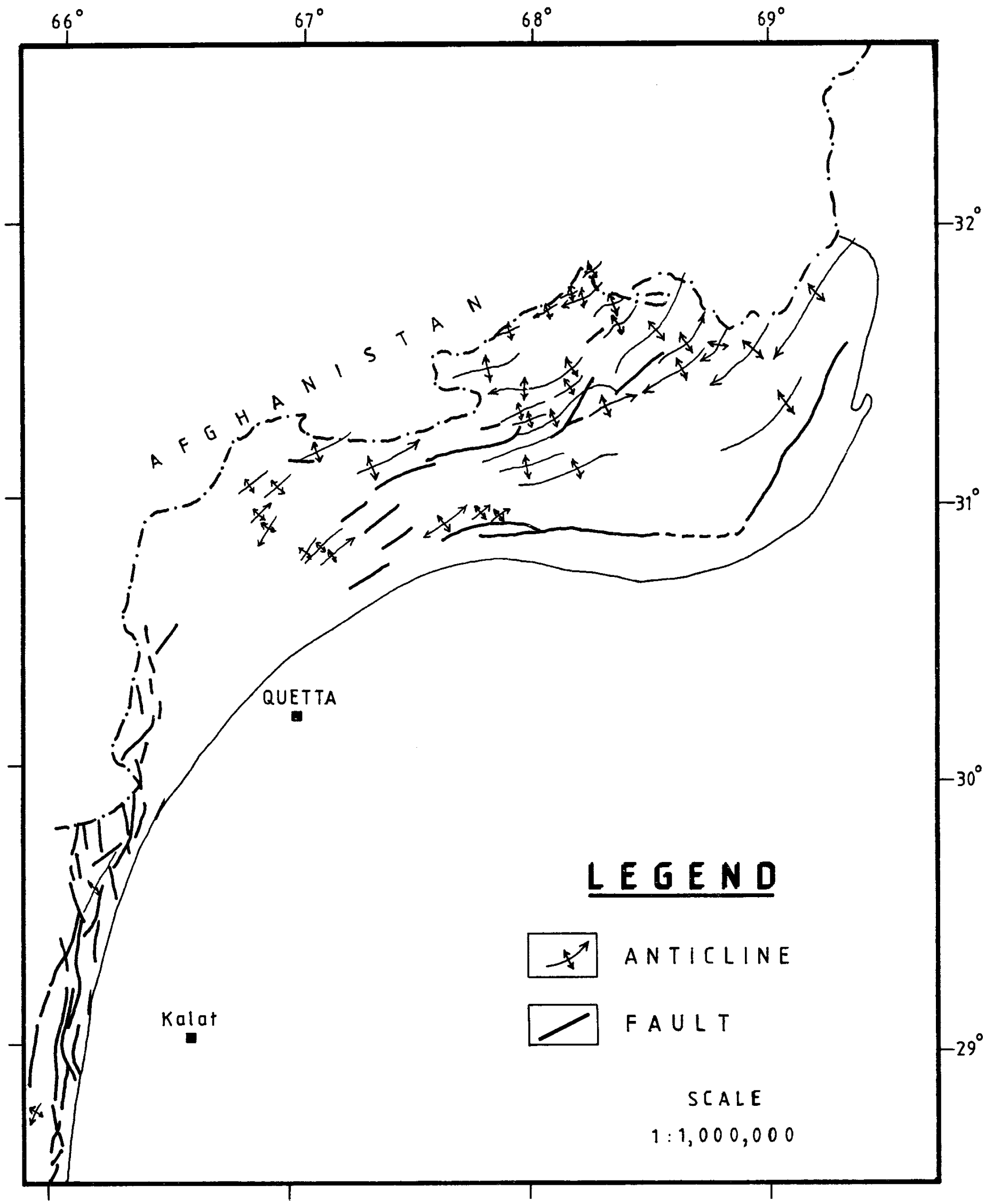

Figure 5— Surface structural map of the area showing anticlines and faults.

CONCLUDING REMARKS

Attention of the oil companies is drawn through this paper to the petroleum possibilities of hither-to unexplored and unrecognized Pishin basin which is a median basin located between the ophiolitic belt and Chaman fault.

Pishin basin is a Tertiary basin with thick sedimentary fill comprising dominantly clastics. By analogy, it should have normal to high geothermal regime and combined stratigraphic-structural traps.

The potential resource estimated by volumetric yield method is about 400 million barrels of oil and 2.4 TCF gas, giving 50 percent share to both in view of the frontier status of the basin. However, considering the tectonic setting and sedimentary pattern, it is more gas-prone than oil.

REFERENCES

Bannert, D., A. Cheema and A. Ahmad, 1989, Interpretation of LANDSAT-MSS Imagery of the Sulaiman and Kirthar Mountain Ranges in Western Pakistan, HDIP-BGR internal report, p. 7.

Hunting Survey Corporation, 1961, Reconnaissance geology of part of West Pakistan, A Colombo plan cooperative project, Toronto.

HDIP-ICST, 1985, Makran project report no. 1 : Kandasol-South Kulanch composite prospect, unpub. rep.

Kazmi, A.H., and R.A. Rana, 1982, Tectonic map of Pakistan: Pakistan Geological Survey, scale, 1:2,000,000.

Raza, H.A., R. Ahmed, S. Alam, and S.M. Ali, 1989, Petroleum zones of Pakistan, PJHR, v.1, no.2, p. 1-19.

Riva, J.P., Jr., 1983, World petroleum resources and reserves: Boulder, Colorado, Westview Press, 355 p.

Shah, S.M.I., ed., 1977, Stratigraphy of Pakistan: Pakistan Geological Survey Memoir 12, 138 p.