Q/1. Qadir, A. & Ahmad, T., 1979. Petrology of south area, Kaghan valley, NWFP. Pakistan. M.Sc. Thesis, Punjab University, Lahore, 179p.

Key words: Petrology, Kaghan valley.

Q/2. Qadir, S.A., 1965. Geology of Hazara area. M.Sc. Thesis, Punjab University, Lahore, 36p.

Key words: Geology, structure, Hazara.

Q/3. Qadri, A.I., 1985-87. Geology and structure of Doarian Khojaseri area Neelum valley District Muzaffarabad Azad Kashmir, Pakistan. M.Sc. Thesis, University of Azad Jammu & Kashmir, Muzaffarabad, Pakistan, 116p.

About 130 sq. km Doarian, Dudhnial, Khoja-Seri area a part of Neelum valley (Azad Kashmir) has been mapped at a scale of 1:50,000. The area is characterized by high relief and v-shaped valleys. The rocks of the area are metamorphic of lower Pre-Cambrian, injected by later intrusions of igneous bodies, granites with some basics. Regional metamorphism and accompanying penetrative deformation post-dates the granite intrusions, because the granite itself is involved in the deformation. Field evidences and laboratory studies favour magnetic origin for the granitic bodies. The area is tectonically highly disturbed being involved in Himalayan orogeny. For petrographic analysis thirty thin sections were studied. Petrogenesis of the rocks of the area is interpreted. Major and minor structures of the area are described. Geological history of the Project area is worked out in comparison with adjoining areas of Punjab Himalayas and northern peninsular India. Economic minerals found in the area are listed.
Key words: Geology, structure, Neelum valley, Azad Kashmir.

Q/4. Qadri, S.A.A., 1990. Shallow seismic reflection studies in Latambar area District Bannu (NWFP) to map the weathered and sub-weathered zones and to establish a velocity-lithology relationship. M.Sc. Thesis, University of Azad Jammu & Kashmir, Muzaffarabad, Pakistan.

The object of the survey carried out in Latamber area was to map the low velocity zone in the project area and to establish a velocity-lithology relationship. Seven seismic cross profiles were shot, adopting a reverse shooting technique. In all 27 refraction spreads each with spread length 270m were observed. Time distance graphs were prepared for obtaining true velocities, depths and dip. The results so obtained have been tabulated and presented in the form of Isovelocity and Isopach maps. Integrating the available geological information with the interpreted velocity depth models, a possible relationship between the velocity and lithology has been established. The velocity in the weathered layer ranging from 300- 950 m/sec, indicates the Alluvium/loose weathered material composed of sand, silt and clay. Its thickness varies from 1 -8 meters. The velocity range of sub-weathered layer from 1000- 2400 m/sec exhibits the presence of sandstone with varying amount of clay and degree of compactness. Its thickness ranges from 11- 38 meters. The velocity below the sub-weathered layer picked at some locations ranging from 2400-3800 m/sec shows the presence of Sandstone/Limestone with varying percentage of clay which is relatively more compact.
Key words: Seismic reflection, Bannu.

Q/5. Qaiser, M.A., Akhtar, S.M. & Khan, A.H., 1970. Rodingite from Naranji Sar, Dargai ultramafic complex, West Pakistan. Mineralogical Magazine 37, 735-738.

The rodingite described here (which has been sold locally as 'jade') occurs at Naranji Sar (71~ 46' E., 34 ~ 28' N.), a hill south of the village of Mena, about 20 miles west of Dargai (with which it is connected by a jeep road), Malakand. The hill forms part of the northern edge of the Dargai ultramafic complex, consisting

mainly of peridotites such as harzburgite and dunite, the latter enveloping bodies of chromite. In addition, gabbroic rocks are found in places along the northern and eastern contacts with the metasediments (northward dipping phyllites, chlorite schists and, on the north side, talc schists), into which the ultramafic rocks are intruded. Within both the peridotites and gabbros intense serpentinization or chloritization or both is found locally. The rodingite occurs in strings of ovoid lenses, individually up to 2.5 m long and 0.7 m wide, in the altered gabbroic areas, at Naranji Sar trending nearly east-west, to the north and Musa Mena on the east.
Key words: Ultramafics, metasediments, rodingite, metasomatism, Naranji sar, Dargai.

Q/6. Qaiser, M.A., Akhtar, S.M. & Khan, A.H., 1972. Rodingite near Musa Mena, Malakand, West Pakistan. Journal of Earth Sciences, Leeds 8, 197-204.

Petrography and geochemistry of a rodingite are given. The rock comprises grossular, idocrase, serpentine, and some altered orthopyroxene.
Key words: Rodingite, ultramafics, metasomatism, Dargai, Malakand.

Q/7. Qaiser, M.A., Alauddin, M., Akhtar, S.M. & Khan, A.H., 1980. Talc-chlorite rocks in Attock slates. Pakistan Journal of Scientific and Industrial Research 23, 53-57.

Dark grey to whitish rocks from Attock Cherat, previously described as low grade soapstone, were found to contain talc with a subordinate amount of chlorite (penninite). Other impurities are quartz, calcite, dolomite, magnesite and pyrite. The mineral assemblage has in all probability resulted from magnesium containing solution of hydrothermal origin acting on illite of the slate.
Key words: Talc, clay, slates, Attock-Cherat.

Q/8. Qaiser, M.A., Alauddin, M., Chaudhry, M.A. & Khan, A.H., 1982. Mica from Mego Katz, Loe Shilman, Khyber Agency, North West Frontier Province. Pakistan Journal of Scientific and Industrial Research 25, 59-60.

Chemical, X-ray, and differential thermal analysis data are presented for Mica from Mego Katz, Loi Shilman, Khyber Agency. This mica has been identified as phlogopite with subordinate amounts of calcite and quartz. Its application for the manufacture of fire - resistance board, high temperature heat insulation bricks and decorative tiles were also studied.
Key words: Minerals, mica, Loe Shilman, Khyber Agency.

Q/9. Qaiser, M.A., Ali, M.K. & Khan, A.H., 1967. Mineralogy of some asbestos from Northwest Pakistan. Pakistan Journal of Scientific and Industrial Research 10, 116-120.

Chemical, X-ray, differential thermal analysis and thermogravimetric data are presented for asbestos from Charsadda Tehsil, Khyber and Mohmand Agencies. Asbestos from Charsadda area was identified to be chrysotile, Khyber and Mohmand minerals were tentatively grouped with tremolite-anthophyllite asbestos. Poor strength of fibers limits their commercial utilisation.
Key words: Mineralogy, asbestos, Charsadda, Khyber Agency, Mohmand Agency.

Q/10. Qaiser, M.A., Ali, M.K. & Khan, A.H., 1968. Study of some indigenous mineral by DTA. Pakistan Journal of Scientific and Industrial Research 11, 23-25.

Thermal characteristics of clays, asbestos, talc, bauxite, calcite, magnesite, and dolomite have been presented.
Key words: Minerals, clay, asbestos, magnesite.

Q/11. Qaiser, M.A., Ali, M.K. & Khan, A.H., 1970. Mineralogy of clay deposits near Bagh (33° 45’ 30” N, 72° 11’ 40” E), Campbellpur District, Rawalpindi Division. Pakistan Journal of Scientific and Industrial Research 12, 483-487.

X-ray, DTA, thermobalance and chemical analyses data have shown that Bagh clays are composed of kaolinite with subordinate amounts of diaspore, haematite and rutile (or anatase). The leaching of alkaline earths from ferruginous carbonate rocks resulted in the formation of brown laterites. Further weathering of laterites under restricted conditions gave rise to bleached clays.
Key words: Mineralogy, clay deposits, Attock.

Q/12. Qaisar, M.A., & Khan, A.H., 1969. Mineralogy of Asbestos from Kurram Agency. Pakistan Journal of Scientific and Industrial Research, 12(2), 163

Further information not available.
Key words: Mineralogy, asbestos, Kurram Agency.

Q/13. Qaiser, M.A., Siddiqi, F.A., Ahmad, N. & Hussain, A., 1990. Mineralogy & chemistry of Eocene shale from Margalla Range, near Islamabad, Pakistan. Abstracts, First SEGMITE Conference on Industrial Minerals, Peshawar, p.6.

Key words: Mineralogy, geochemistry, shale, Eocene Margalla, Islamabad.

Q/14. Qamar, B., 1988. Paleoenvironment and provenance study of Patala Formation, Kohat and Samana Ranges, N.W.F.P. M.Sc. Thesis, University of Peshawar, 72p.

Key words: Paleoenvironment, provenance, Patala shale, Samana Range, Hangu, Kohat.

Q/15. Qamar, M.I. & Naseer, M.A., 1972. Geology and petrology of Aligram–Kabal area, Swat. M.Sc. Thesis, Punjab University, Lahore, 55p.

Key words: Petrology, Swat.

Q/16. Qamar, N.A., 1974. Field report on geology and petrology of Dir (Toposheet No. 38 M/16). M.Sc. Thesis, Punjab University, Lahore.

Key words: Petrology, Dir.

Q/17. Qasim, M., 1990-91. Structure, stratigraphy and petrography of the western limb of the Hazara-Kashmir syntaxis, Garhi Habibullah-Shinkiari area, Northern Pakistan. M.Sc. Thesis, University of Azad Jammu & Kashmir, Muzaffarabad, Pakistan, 105p.

The Garhi Habibullah-Shinkiari area lies along the western limb of the major northwest plunging antiformal structure known as the Hazara-Kashmir syntaxis. The 293 Km^2 area has been mapped in this study. The western limb of the Hazara-Kashmir syntaxis has been divided into four fault-bounded tectonostratigraphic zones. These are named as the Muzaffarabad-Balakot zone, the Garhi Habibullah-Abbottabad zone, the Panjal zone and the Mansehra zone. These zones belong to different tectonic and stratigraphic provinces which have been juxtaposed during the Himalayan thrusting.
The Muzaffarabad-Balakot zone lies to the east of Main boundary fault. This zone constitutes late Proterozoic to Cenozoic sequence. This sequence is involved in the Muzaffarabad-Balakot southwestward overturned anticline. The late Proterozoic Dogra formation forms the core of the Muzaffarabad-Balakot

anticline. The Dogra formation is unconformably overlain by the early Cambrian Muzaffarabad formation. The Ordovician (?) Yadgar formation disconformably overlies the Muzaffarabad formation. The Yadgar formation is unconformably overlain by the Paleocene-Eocene sequence which includes the Hangu Formation, Lockhart Formation, Patala Formation and Margala Hill Limestone. This was followed by the late Eocene Kuldana and Miocene Murree molasses. The most of the Paleocene to Miocene sequence along the overtuned limb of the Muzaffarabad-Balakot anticline is faulted.
The Garhi Habibullah-Abbottabad zone lies between the Main boundary fault and Garhi Habibullah fault. This zone is involved in the Garhi Habibullah syncline. The Cambrian Abbottabad group lies in the core and Hazara formation along the limbs of the anticline. In the Garhi Habibullah syncline, the late Proterozoic Hazara formation is unconformably overlain by the Cambrian Abbottabad group of rocks. The Jurassic sequence has been eroded from the core of the syncline due to later Himalayan uplift.
The Panjal zone lies between the Garhi Habibullah fault and Panjal fault. The Panjal zone includes the late Proterozoic to Triassic rocks which are involved in the Tarkot anticline and Doga syncline. In this zone the Carboniferous Chushal formation unconformably overlies the late Proterozoic Hazara formation and grades into the Permo-Triassic Panjal formation. These rocks are metamorphosed up to lower green schist facies metamorphism. The Mansehra zone lies west of Panjal fault. It includes the late Proterozoic Hazara and Tanol formations and intrusive Cambrian Mansehra granite. The grade of metamorphism varies from chlorite-grade in the south to staurolite-grade in the north. The Panjal and Mansehra zones are intruded by Permian mafic dikes and sills of basalts and dolerites. These basalts and dolerites are fresh but at places show weak Himalayan metamorphic effects. The sedimentary, metamorphic and igneous rocks of these zones are classified by petrographic studies. The rocks of these zones have been affected by multiple pre-Himalayan and Himalayan deformational events. Four deformational events have been recognized as D1, D2, D3 and D4 deformations. D1 Hazara deformation is restricted to the late Proterozoic sequence. D2 deformation produced a barrovian type metamorphism which produced lower-green schist to amphibolite facies metamorphism in the Panjal and Mansehra zones. The effect of D2 deformation is weak or absent in Garhi Habibullah and Muzaffarabad-Balakot zones. D3 deformational event produced southeast-directed folds and thrusts in Mansehra, Panjal and Garhi Habibullah zones. Whereas D3 deformational event in the Muzaffarabad-Balakot zone produced southeast-directed folds and thrusts. The backsteepening and late extensional folding in all of the four zones occurred in the later phase of D3 deformation. However, the D4 deformational event is related to the northwest plunging antiformal and synformal structures which are related to the formation of the Hazara-Kashmir syntaxis.
Key words: Structure, stratigraphy, petrography, Hazara-Kashmir Syntaxis.

Q/18. Qasim, M., 1999-2000. Structure, stratigraphy and petrography of Aghar, Gulpur and Nar areas, District Kotli, Azad Jammu & Kashmir, Pakistan. M.Sc. Thesis, University of Azad Jammu & Kashmir, Muzaffarabad, Pakistan, 134p.

The geological and the structural mapping of Aghar, Gulpur and Nar areas of about 200 square kilometers was carried on the scale 1: 50,000 using the Toposheet No.43 G/15 of Survey of Pakistan. Then it was enlarged to the present scale 1: 18750. The lithostratigraphic units exposed in the area are mainly sedimentary in nature and range in age from Upper Miocene to Pliocene. These units are the Nagri Formation (Upper Miocene) and the Dhok Pathan Formation (Pliocene) of Siwalik Group of rocks. The Siwaliks are the molasse sediments which were derived from the upthrusted mountain ranges of the Himalayas and adjoining foredeep area. The rocks of the area have been deformed during the two phases of deformation named as D1 and D2. D1 deformational event is related to F1 folds. F1 folds are the major anticlines and synclines of the area. These are Barali Anticline, Gulpur Syncline and Nar Anticline. F2 folds are formed during the second phase of deformation D2 due to change in plunge of F1 folds. About fifty rock samples were collected from different localities of the project area out of which twenty samples were selected for the petrographic studies. Tectonically, the Siwaliks lie in Sub-Himalayas and the project area is situated on the southern side of the Himalayan region, where the Siwaliks are deposited in the foreland basin. This foreland basin was formed in association with the collision of the Indian and Eurasian plates.

Key words: Structure, stratigraphy, petrography, Kotli, Azad Kashmir.

Q/19. Qayum, A.K. & Haq, I., 1980. Stratigraphy and structure of Gandili, southeast of Kohat District, North West Frontier Province. M.Sc. Thesis, University of Peshawar, 81p.

Key words: Structure, stratigraphy, Kohat, NWFP.

Q/20. Qayyum, M., 1982-84. Geology and petrotectonic study of Shino-Kaghan-Batal Area, Kaghan valley, District Mansehra, Pakistan. M.Sc. Thesis, Punjab University, Lahore, 191p.

Key words: Petrology, tectonics, Kaghan valley, Mansehra.

Q/21. Qayyum, M. & Lawrence, R.D., 1998. Leading edge of the Himalayan thin-skinned thrust system in Pakistan: the Salt Range. Geological Bulletin, University of Peshawar 31, Abstract Volume, 13th Himalayan-Karakoram-Tibet International Workshop, 154-155.

The 180 km, ENE trending Salt Range is the leading edge of the progressive, south migrating Himalayan thrust front. The presence of a basal salt layer is manifested by the very narrow cross-sectional taper (<1o) and great width (150 km N-S) of the overthrust wedge. Integration of approximately 450 km of seismic reflection data with available surface geologic, magnetostratigraphic, and exploration well data delineate different tectonic features in the Salt Range. These data reveal a concealed duplex structure under the roof sequence, help to determine the footwall and hangingwall geometries of the leading edge at successive evolutionary stages, estimate the lateral extent of a basement normal fault, constrain the ages of different structural features, and define lateral variations in the deformational style within the leading edge. We suggest an out-of-sequence evolutionary model of the Salt Range.

The newly interpreted, concealed duplex structure is the earliest structure of the Salt Range formed during 9-7 Ma. It evolved along a décollement that first ramps within the Salt Range Formation and then across the platform sequence to follow shady horizons of the overlying Murree Formation. The northern ramp is localized in the central Salt Range due to the development of the basement normal fault, around 7 Ma, in the north of concealed duplex structure. It is offset 15 km farther south along a lateral ramp in the western Salt Range, and is entirely within the sedimentary sequence. In the eastern Salt Range, however, it continues within the sedimentary sequence beyond the end of the basement normal fault and then changes into an oblique ramp. The development of basement normal fault interrupted the southward progradation of the thrust wedge. A thick salt pad, formed between 5-6 Ma on the down-thrown side, allowed the thrust wedge to ramp over the northern ramp at about 5 Ma. The topography, newly built by the ramping, resisted the southwards progradation of the thrust wedge and caused further out-of-sequence thrusting in the north. This was followed by the major horizontal translation of the thrust wedge over the roof sequence flat started about 2 Ma. A 13o of counter clockwise rotation has occurred along the northern ramp and the concealed duplex structures.

Key words: Structure, thin-skinned thrusting, Salt Range, Potwar, Himalaya.

Q/22. Qazi, M.A. & Khan, I.H., 1984. Technical feasibility using local iron ore resources of iron & steel manufacture. Abstracts, First Geological Congress, Lahore, 66-67.

Key words: Feasibility, iron ore, steel.

Q/23. Qazi, M.S., Zada, G. & Wahab, 1997. Structural analysis of area north and north east of Bannu, District Bannu, N.W.F.P. M.Sc. Thesis, University of Peshawar, 53p.

Key words: Structure, Bannu basin.

Q/24. Qazi, S.A., 1992. Subsurface investigations using seismic refraction technique for Ghazi Gariala Hydropower Project. Abstracts, First South Asia Geological Congress, Islamabad, 60-61.

Key words: Seismology, seismic reflection, structure, hydropower, Ghazi.

Q/25. Qazi, T.N., 2000. Geographic information system (GIS) and groundwater management. In: Abstract volume, 3rd South Asia Geological Congress (GEOSAS-III), Shams, F.A., Choudhry, M.N., Hassan, Mahmoodul, Kamran, M., and Rashid, S. (Eds.), Lahore, 108-109.

Key words: GIS, groundwater.

Q/26. Quade, J. & Cerling, T.E., 1995. Expansion of C4 grasses in the late Miocene of northern Pakistan: evidence from stable isotopes in paleosols. Palaeogeography, Palaeoclimatology, Palaeoecology, 155, 91-116.

Stable-isotopic, clay-mineralogic, and bulk-chemical analyses were conducted on paleosols of the Neogene Siwalik sections in northern Pakistan in order to reconstruct floodplain environments over the past □ 17 Ma. The stable carbon isotopic composition of soil carbonate (mean δ13C (PDB) = -10.2%) and associated organic matter (mean δ13C (PDB) = −24.1%) in paleosols representing 17− ∼ 7.3 Ma reveal that floodplain vegetation was dominated by C3 plants. At 7.3 Ma, a shift toward more positive carbon isotopic values began, signaling the gradual expansion of C4 grasses onto the floodplain. From 6 Ma to present, carbon isotopic values for paleosol carbonate (mean δ13C (PDB) = +0.6%) and organic matter (mean δ13C (PDB) = −14.4%) are uniformly enriched in 13C, indicating the presence of nearly pure C4 grassland.
The scarcity of kaolinite and abundance of smectite and pedogenic carbonate in most paleosols suggest that rainfall in the region remained 1.0–1.25 m/yr or less for the entire 17 Ma of record. Paleosols in the lower portion of the section lack organic A horizons but have reddish B horizons often containing secondary iron-oxide nodules. Leaching depths of soil carbonate in these older paleosols are typically greater than those in the Plio-Pleistocene part of the section, where organic A horizons are common, and B horizons are markedly more yellow. The combined evidence suggests that the mature paleosols in the pre-7.3 Ma part of the record are dominantly calcareous Alfisols or Mollisols that once underlay nearly pure C3 vegetation, perhaps trees and shrubs, while calcareous Mollisols underlying C4 grassland dominate the upper part of the record.
The carbon- and oxygen-isotopic trends in the paleosol record in Pakistan are also evident in the diet of fossil mammals, and in paleosols from Nepal, thus demonstrating that these paleoenvironmental changes in floodplain vegetation may be continent-wide. Local effects, such as the development or intensification of the Asian Monsoon driven by uplift of the Tibetan Plateau, may have led to the expansion of C4 grasses. If, however, the expansion of C4 grasses proves globally synchronous, then a larger scale cause, such as a marked decrease in CO2, may be the driving mechanism.
Key words: Stable-isotope, clay, mineralogy, Siwalik, Floodplain, Miocene.

Q/27. Quade, J., Cerling, T.E., Barry, J.C., Morgan, M.E., Pilbeam, D.R., Chivas, A.R., Lee-Thorp, J.A. & Van der Merwe, M.J., 1992. A 16 Ma record of paleodiet using carbon and oxygen isotopes in fossil teeth from Pakistan. Chemical Geology 94(3), 183-192.

The Siwalik Sequence of northern Pakistan contains a 16-Ma record of paleosol carbonate and fossil teeth from which a record of paleovegetation can potentially be reconstructed and compared. The carbon isotopic composition of paleosol carbonate and organic matter from Siwalik strata reflects a major paleoecological change on the floodplains of major rivers beginning ∼7.3 Ma ago. By 6 Ma C3-dominated plant communities, probably composed of mostly trees and shrubs, were displaced by nearly continuous C4

grassland. We find that the carbon isotopic ratios in herbivore tooth enamel reflect this dramatic ecologic shift. Carbonate in enamel older than 7 Ma averages −11‰ in δ13CPDB, consistent with a largely C3 diet. Enamel from the Plio-Pleistocene averages +1.9‰ in δ13C, similar to the value displayed by modern C4 grazers. Analysis of post-burial carbonate cements, and the concordance with isotopic evidence from paleosols argues strongly against major isotopic alteration of the enamel, while coexisting bone may have been altered early in burial. This study confirms that enamel apatite is useful for paleodietary reconstruction much further back in the geologic record than was previously thought.
Key words: Carbon isotopes, paleosole, fossil teeth, Siwaliks, Himalaya.

Q/28. Quade, J., Cerling, T.E. & Bowman, J.R., 1989. Development of Asian monsoon revealed by marked ecological shift during the latest Miocene in northern Pakistan. Nature 342, 163-166.

Carbon isotopes from soil carbonate1–4 and soil organic matter5,6 yield palaeoecological information because the carbon in the soil carbonate forms in isotopic equilibrium with local soil CO2 (refs 1, 7), the isotopic composition of which is in turn determined by local plant cover. Siwalik Group sediments in northern Pakistan contain a well exposed palaeosol record spanning the past 18 Myr. Here we report on stable-carbon-isotope results from associated pedogenic carbonate which indicate a dramatic ecological shift from C3- to C4-dominated floodplain biomass beginning 7.4–7.0 Myr ago. The earlier C3 floodplain biomasses were probably mainly composed of trees and shrubs, whereas C4 grasslands dominated in the Plio-Pleistocene. Oxygen isotopes also exhibit a shift in the latest Miocene, probably corresponding to a major climate change which may have induced the forest-to-grassland transition. This dramatic ecological shift in the latest Miocene may mark the inception or a marked strengthening of the Asian monsoon system.
Key words: Paleoecology, monsoon, Miocene.

Q/29. Quade, J., Roe, L., DeCelles, P.G. & Ojha, T.P., 1997. The late Neogene $^{87}Sr/^{86}Sr$ record of lowland Himalayan rivers. Science 276, 1828-1831.

Fossil shells and paleosol carbonate from ancestral Himalayan river deposits provide a $^{87}Sr/^{86}Sr$ record of lowland Himalayan river water during the late Neogene. Reconstructed $^{87}Sr/^{86}Sr$ river values increased sharply in the late Miocene, probably marking the beginning of exhumation of high-$^{87}Sr/^{86}Sr$ metalimestones, more in the central than in the western Himalayas. These results imply that the marine $^{87}Sr/^{86}Sr$ record may not be a proxy for silicate weathering or consumption of atmospheric CO_2 resulting from that weathering.
Key words: Himalayan rivers, Hydro geochemistry, $^{87}Sr/^{86}Sr$, isotopes, Uplift.

Q/30. Quintavalle, M., Tongiorgi, M. & Gaetani, M., 2000. Lower to Middle Ordovician acritarchs and chitinozoans from northern Karakorum mountains, Pakistan. Rivista Italiana de Paleontologia e Stratigrafia 106, 3-18.

The lower Vidiakot section (Chitral, Pakistan) com- prises the lower part (Yarkhun Formation and base of the Vidiakot Formation) of the terrigenous complex transgressively overlying the crystalline basement of Northern Karakorum. From this section, 8 of 15 samples contain moderately abundant and poorly preserved acritarchs and rare, badly preserved chitinozoans. Three different palynological assemblages have been distinguished which are referable to the chronological interval early Arenig-earliest Llanvirn.
The presence of Arbusculidium, Coryphidium, and Striatotheca in most samples confirms the palaeogeographic attribution of the Northern Karakorum Terrane to the northern Gondwana margin (Lower to Middle Ordovician Mediterranean acritarch Palaeo- province). Refined correlation with other areas and with the previously studied Ishkarwaz section (upper Yarkhun Valley, Chitral) enables the authors the Yarkhun Formation to be dated as early Arenig (British lower nitidus graptolite Zone) to latest Arenig (uppermost graptolite hirundo Zone). The base of the overlying Vidiakot Formation is here correlated with the uppermost hirundo-lowermost artus graptolite Zones (latest Arenig-earliest Llanvirn).

Key words: Palaeontology, Ordovician, Karakoram.

Q/31. Quittmeyer, R.C., Farah, A. & Jacob, K.H., 1979. The seismicity of Pakistan and the relation to surface faults. In: Farah, A. & DeJong, K.A. (Eds.), Geodynamics of Pakistan, Geological Survey of Pakistan, Quetta, 271-284.

The historical and modern seismicity of Pakistan and its vicinity is examined in terms of its relation to mapped surface faults. There are found to be three categories into which the seismicity may be classified: 1) earthquakes with large source dimensions that are associated with faults on the basis of either surface rupture of a mapped fault or aftershock area or focal mechanism that defines a trend that is consistent with a mapped fault; 2) narrow, elongate zones of earthquakes that may be related to movement along a single, continuous fault or a group of similarly oriented smaller faults; 3) diffuse activity that is not clearly related to any individual fault. The seismicity of this last category may in some places be the result of the scatter of epicentral locations of earthquakes occurring along shallow-dipping thrust faults. The seismic activity also defines portions of the Indus basin as seismically active even though no surface faults are mapped there.
Care must be employed when using only documented seismic activity to evaluate seismic hazards within Pakistan. The seismic record may be short when compared to recurrence interval for large earthquakes. Geologic evidence of recent fault movement, and geodetic measurements, will help alleviate this deficiency of the seismic record.
Key words: Seismicity, structure, Pakistan.

Q/32. Quittmeyer, R.C. & Jacob, K.H., 1979. Historical and modern seismicity in Pakistan, Afghanistan, NW India and SE Iran. Seismological Society of America, Bulletin 69, 773-823.

Please consult the preceding account for additional information.
Key words: Seismicity, Pakistan, Afghanistan, India, Iran.

Q/33. Quraishi, A.A. & Imam, S.A. 1960. Report on manganese showings of Galdanian, Hazara District, West Pakistan. Geological Survey of Pakistan Information Release 15.

Ferruginous rock containing very little manganese is present in the Galdanian Valley, situated about ten miles northeast of Abbottabad. The iron-manganese rock extends discontinuously over two miles with an average thickness of ten feet. The iron mineral is haematite, and in the weathered portion there is a local abundance of limonite. Manganese is found in the oxide form. Neither iron nor manganese is in suitable concentration for economic exploitation.
Key words: Manganese, Abbottabad, Hazara.

Q/34. Qureshi, A., 1981-83. Lithostructural mapping of Mansehra Susal and Matial Area District Mansehra with special reference to structural studies. M.Sc. Thesis, Punjab University, Lahore, 109p.

Lithostructural mapping with preliminary structural studies have been made of Mansehra, Khaki, Rihar area district Mansehra at a scale, of 1:1000. An attempt has been made to delineate the boundaries of igneous and metamorphic rocks precisely. Physiographic/Stratigraphic studies and various structural contour diagrams have been drawn to determine axis of minor folds. Orientation of joints has been determined with the help of Rose diagram. Thin sections have been studied to determine different phases of deformation. Attempt has been made to analyse the strain with Flinn's and Ram say's plots.
On the basis of microscopic and mesascopic analysis it has been tried to interpret the structure and macroscopic scale. On the basis of Kinematic Studies, structure of the area is interpreted.
Key words: Lithostructure, mapping, Mansehra.

Q/35. Qureshi, A.A. & Abdullah, S.K.M., 1960. Report on manganese-iron deposit of Churagali, Hazara District, West Pakistan. Geological Survey of Pakistan, Information Release 19, 6p.

Key words: Manganese, Iron, Churgali, Hazara.

Q/36. Qureshi, A.A., Bangash, M.A., Khattak, N.U. & Akram, M., 1996. Study of radioactive minerals from Loe Shilman Carbonatite Complex. The Nucleus, Special volume on Radioactivity, 3(4), 71–74.

The Loe Shilman Carbonatite Complex is the western extremity of a 200 km long Alkaline Belt which extends from Mansehra to Pak-Afghan border in an arcuate fashion around Peshawar valley. The complex is mainly composed of carbonatites with subordinate amount of related alkaline rocks with uranium, niobium and rare earths in ppm range and apatite in % age range. The techniques of alpha-autoradiography, XRD and XRF have been used to locate and identify the radioactive minerals in the Carbonatite. The radioactive mineral has been identified as betafite of primary origin which occurs as small black grains having somewhat parallel alignment; in addition a minor phase of pyrochlore has also been identified.
Key words: Radioactive minerals, Loe Shalman, Khyber Agency.

Q/37. Qureshi, A.A., Butt, K.A. & Khan, H.A., 1990. Fission track dating of carbonatite complexes of Pakistan. Abstracts, 2nd Pakistan Geological Congress, Peshawar, p.44.

Fission track dating on the zircon and apatite from Loe Shilman and Sillai Patti carbonatite have revealed that the carbonatite activity in this area took place in the Mid Tertiary (≈30 Ma). The younger fission track age of 19.09 ± 0.19 Ma on apatite from Loe Shilman 21.8 ±0.4 Ma on apatite from Sillai Patti represent the time of a later thermal episode.
Key words: Carbonatites, fission track dating, Pakistan.

Q/38. Qureshi, A.A., Butt, K.A. & Khan, H.A., 1991. Emplacement time of Silai Patai carbonatite, Malakand, Pakistan, from fission track dating of Zircon and apatite. Nuclear track Radiation Measurement 18, 315-319.

Based on fission track dating of zircon and apatite, the emplacement history of Silai Patai carbonatite has been traced. It has been estimated that the carbonatite was emplaced along the thrust plane associated with the Indian-Eurasian plate collision during the Oligocene period followed by some thermal/tectonic episode during Early Miocene. This negates the previous proposal that all carbonatites found in Pakistan are a part of a 200 km long alkaline province associated with the rifting of Peshawar Valley during Late Cretaceous or Early Tertiary.
Key words: Carbonatite, Silai Patai, Collision, Oligocene, Malakand.

Q/39. Qureshi, A.A. & Jan, M.Q., 1977a. The ultramafic and high-grade metamorphic rocks near Jijal, Indus Valley, Swat. 24th Pakistan Science Conference, Islamabad, H1-H2.

Briefly describe the ultramafic rocks and high-grade mafic rocks from Jijal area. Further information is given in the following.
Key words: Ultramafics, metamorphism, petrology, Jijal, Indus Kohistan.

Q/40. Qureshi, A.A. & Jan, M.Q., 1977b. The ultramafic and high grade metamorphic rocks near Jijal, Indus Kohistan, Northwest Pakistan. Accademy Nazionale Lincei, Series VIII, 63, 259-268.

The Jijal area is occupied by ultramafic and mafic rocks metamorphosed in the granulite facies conditions. These rocks occur in the hanging wall of the Indus suture. The paper gives details of petrography, optical data for clinopyroxenes, and major element analyses of eight samples. The ultramafic rocks comprise diopsidite, websterite, peridotites, and dunite. The mafic consist of garnet-clinopyroxene-plagioclase-quartz granulites, but there also are large bodies of garnet-rich rocks (garnetites) and hornblendites (commonly garnetiferous).
Key words: Ultramafics, granulites, petrology, Jijal, Indus Kohistan.

Q/41. Qureshi, A.A. & Khan, H.A., 1992. Emplacement history and genetic relationship of various carbonatite complexes of Pakistan. Abstracts, First South Asia Geological Congress, Islamabad, p.32.

In Pakistan, carbonatites are exposed at Naranji Kandao, Sillai Patti, Loe-Shilman, Jambil, Tarbela, Jawar and Jandai. The Loe Shilman, Jawar, Sillai Patti, Jandai and Jambil carbonatites represent Tertiary Alkaline silicate carbonatite magmatism in the Peshawar Plain Alkaline Igneous Belt. The Naranji-Kandao and Tarbela carbonatites belong to Late Paleozoic carbonatite magmatic activity.
The carbonatites are associated with distinct alkaline silicate magma associations. The Loe-Shilman potassic silicate suite comprise of biotite-rich alkali lamprophyres, gabbros and syenites. The Sillai Patti carbonatites are associated with alkaline ultramafic-mafic rocks. In Loe Shilman the evolution of carbonatites follows the general trend of differentiation of the order of crystal fractionation from calcite to dolomite and siderite. Loe-Shilman and Sillai Patti carbonatites as well as many of the African Rift carbonatites have a similar Sr-Nd isotope patterns (Tilton et. al., 1998). The lithospheric source for the carbonatites was probably transported within the Indo-Pakistan Plate after the breakup of Gondwanaland to the Himalayan collision zone.
Key words: Carbonatite, Silai Patai, collision, Oligocene, Malakand.

Q/42. Qureshi, A.A. & Khan, I.H., 1971-72. The ultramafics and highgrade metamorphic rocks near Jijal, Indus Kohistan, Swat. Part 1: Geology and Petrography. M.Sc. Thesis, University of Peshawar, 1-72.

An area of 28 sq. miles near Jijal in Indus Kohistan (Swat) has been mapped and detailed petrography is presented. It is occupied by ultramafic rocks in the south and metamorphic rocks in the north. The former mainly consist of clinopyroxenites with local patches of dunite and peridotites. The latter are represented by the garnet gneisses and related rocks, and are at the southeastern fringe of the upper swat hornblendic groups. The clinopyroxenites are mainly composed of diopside with minor serpentine, enstatite and olivine. Peridotites and dunites also contain clinopyroxene and serpentine, in some up to 50%. Some dunites are free of pyroxene. The rocks show widespread selective serpentinization.
The garnet gneisses contain epidotized plagioclase, garnet, hornblende and/or pyroxene, with muscovite their major constituents. Towards the south near the contact with ultramafics, these come poor in feldspar and very rich in garnet and pyroxene or hornblende. Such rocks are non-gneissose granoblastic. The rocks show amphibolite grade of metamorphism, however, hornblende granulite facies conditions are locally indicated by the presence of hypersthene.
Detailed studies of clinopyroxene and garnet in the ultramafics and gneisses, and their structural relationship suggest that they may not be genetically related. The ultramafics are apparently emplaced along a faulted contact between the gneisses and the schistose group. No contact metamorphic effects noted in the schists suggest that the emplaced ultramafic mass had lower temperature. The area investigated does not have much economical potential, however, garnet and building stone is of some importance.
See further information in the following.
Key words: Ultramafic-mafic rocks, high grade metamorphism, petrology, Jijal, Indus Kohistan.

Q/43. Qureshi, A.A. & Khan, I.H., 1971-72. The ultramafics and high-grade metamorphic rocks near Jijal, Indus Kohistan, Swat. Part 2: Chemistry and Pathogenesis. M.Sc. Thesis, Peshawar University, 72-107.

This thesis presents a preliminary geological map of the Jijal-Duber-Pattan area of the Indus Kohistan. The principal lithologies can be divided into a southern ultramafic part (peridotites and pyroxenites) and a northern high-grade part (metagabbros, ultramafic lenses). Petrographic details have been given for various rocks, along with (in Part 2) chemical analyses of the major elements in some rocks.
Key words: Ultramafics, metamorphism, chemistry, petrogenesis, Jijal, Indus Kohistan.

Q/44. Qureshi, A.A., Khattak, N.U., Chaudhry, M.N. & Khan, H.A., 1999. Thermo tectonic history of Loe Shilman carbonatite complex, NW Pakistan, based on fission tract dating of apatite and other radiometric ages. Geological Bulletin, Punjab University 33 & 34, 105-110.

The Peshawar Plain Alkaline Igneous Province (PAIP) consisting of alkaline granites, syenites, gabbros, albitites, carbonatites etc., occurs in the north of Peshawar Plain in an arcuate fashion. It stretches from Loe Shilman near Pakistan-Afghanistan border up to Tarbela through Warsak, Sillai Patti, Shewa-Shabazgarhi, Koga and Ambela. The Loe Shilman Carbonatite Complex comprises of sill like bodies emplaced along thrust plain of an east-west trending and northerly dipping fault zone in Paleozoic to Pre-Cambrian metasedimentary rocks. This paper presents the use of fission track age of apatite as paleotemperature indicator and its significance in the recognition of the emplacement time and tectonometamorphic history of the Loe Shilman Carbonatite Complex in combination with other radiometric ages.
The K-Ar date of3.00±2.00 Ma on biotite and V-Pb date of 30.00 Ma on calcitic indicate that the Loe Shilman rocks were emplaced during the Oligocene times. The fission track age of 18. 87±1.33 Ma on apatite from Loe Shilman, estimated by us, represents a time during the post-metamorphic uplift history of the area, when these rocks passed through the 115°C isotherm, corresponding to a depth of about 3.5 km from their present position, if a paleogeothermal gradient of 30 °C per km is assumed to have prevailed. Based on present work, in combination with other available ages, we support the idea of emplacement of the complex in the Oligocene in contradiction with the earlier view of emplacement of these rocks in the Permo-Carboniferous.
Key words: Carbonatite, tectonics, Loe Shalman, Khyber Agency.

Q/45. Qureshi, A.A., Khattak, N.U., Karim, T. & Waheed, S., 2000. Geology and economic significance of the Loe-Shilman carbonatite complex, Khyber Agency, Pakistan. Geologica 5, 133-144.

The Loe-Shilman Carbonatite Complex consists of carbonatites, syenites, quartz-rick granitoids and gabbroic rocks emplaced along a faulty zone. The complex is the western extension of a 200 km long Alkaline Belt found in the north of the Peshawar Plain. The rocks in the north of the complex are mica schists and limestones of Paleozoic age while those in the south are slates/phyllites and some lime stones of Pre-Cambrian age. The carbonatitic rocks at Loe-Shilman are composed mainly of calcite and/or dolomite with amphibole, mica, pyroxene, pyrochlore/betafite and some ore.
In general, the carbonatites are one of the major sources of Rare Metals (Nb, Y, V, La, Ra, etc.), Earth Elements (REEs), apatite and some other minerals/elements. Uranium is sometimes present in these rocks and is recovered as by-product. Studies were carried out to look into the possibility of existence of these materials in commercially exploitable amounts in the carbonatites. There are reasonable concentrations of some Rare Metals (Nb-upto 3100 ppm, Y-upto 205 ppm, V-upto 890 ppm, and La-upto 588 ppm), REEs (Ce-upto 2900 ppm, Pr-upto 268 ppm, Nd-upto 394 ppm, Sm-upto 70 ppm), apatite (average more than 15%) and U3O8 (average 200 ppm). Due to various unique and special applications of Rare Metals, REEs and uranium in metal and nuclear industries and those of apatite as a source material for fertilizer and chemical industries, the Loe-Shilman carbonatites have a special importance.
Key words: Carbonatite, economic geology, Loe Shilman, Khyber Agency.

Q/46. Qureshi, A.A., Majid, C.A., Akram, M., Hussain, M.A., Mateen, A., Khattak, N.U., Javed, M., Hussain, S.S., & Khan, H.A., 1997. Characterization of emerald from Gujar Kili, Swat, Pakistan. The Nucleus, 34 (1–2), 57–63.

The green gem variety of beryl family having Cr as coloring agent is known as emerald. Thirteen emerald occurrences are known from Northern Pakistan which are located exclusively in ophiolitic melange of Indus Suture zone. The ophiolitic rocks are source of Cr which colors the beryl to make it emerald. Studies have been carried out for the characterization of emerald from Gujar Killi, a locality in Swat. The emerald is of high quality green to deep green variety. In general it has high Mg, Fe, Cr, V and low Al values as compared to average composition of the emeralds. Two mineralogical phases were identified in the Gujar Killi samples namely beryl and chrysoberyl on the basis of XRD studies. The Cr does not substitute any element rather it is present as an impurity in the crystal matrix. A new etchant (19N NaOH boiling) to reveal fission tracks in 45 minutes is reported.
Key words: Gems, emerald, Swat.

Q/47. Qureshi, A.A., Mateen, A. & Karim, T., 1993. Chemical characterization of carbonatite from Loe Shilman, Khyber Agency, Pakistan. Abstract volume 2nd All Pakistan Science Conference, Aitchisons College, Lahore.

Loe Shilman carbonatite samples were chemically analyzed for major elements in order to classify the carbonatites. On the basis of chemical characteristics the carbonatites were classified into three categories. Calico-Carbonatites: In these rocks the CaO: CaO+MgO+Fe_2O_3+MnO ratio is greater than 0.8. Magnesio-Carbonatites: In these rocks CaO: CaO+MgO+Fe_2O_3+MnO ratio is less than 0.8. Ferro-Carbonatites In these rocks CaO: CaO+MgO+Fe_2O_3+MnO ration is less than 0.8 and MgO is < FeO+Fe_2O_3+MO.
Key words: Carbonatite, chemistry, Loe Shalman, Khyber Agency.

Q/48. Qureshi, A.A., Mateen, A., Majid, C.A., Karim, T., Mehmood, K. & Khan, H.A., 1994. Analysis of a highly radioactive sample from the Northern Pakistan. The Nucleus, 31(1&2), 73–75.

A highly radioactive sample collected from the extreme upper part of Chitral, in the northern Pakistan, has been analyzed using alpha autoradiography, petrography and X-ray Diffraction techniques. The sample contains about 50% magnetite, 1% uraninite along with quartz, anorthite, garnet, ilmenite, thuringite wurtzite, tremolite, etc. The exact location of the sample is not known but the sample is of interest due to its high iron and uranium contents.
Key words: Geochemistry, radioactive minerals, Northern Pakistan.

Q/49. Qureshi, A.H., Haq, A. & Faruqi, F.A., 1974. Fusion study of Rajdhawari Feldspar. Pakistan Journal of Scientific and Industrial Research, 17(2), 71–75.

Key words: Minerals, feldspar.

Q/50. Qureshi, A.W., 1985. General geology of area of Kohat quadrangle, Shakerdara town, Kohat. M.Sc. Thesis, University of Peshawar, 68p.

Key words: Geology, mapping, Shakardara, Kohat.

Q/51. Qureshi, A.W., 1993. Sedimentology of Murree Formation (Rawalpindi Group) in Kohat-Potwar area. M.Phil. Thesis, University of Peshawar.

Key words: Sedimentology, Murree Formation, Kohat-Potwar.

Q/52. Qureshi, A.W. & Tanoli, S.K., 1992a. Lithofacies and tectonic setting of the Murree Formation, Kohat area, Pakistan. Abstracts, First South Asia Geological Congress, Islamabad, p.61.

Key words: Tectonics, lithofacies, Murree Formation, Kohat.

Q/53. Qureshi, A.W. & Tanoli, S.K., 1992b. Early molasse sediments (Murree Formation) in Pathan Algad, southern Kohat. Geological Bulletin, University of Peshawar 25, 85-93.

Of the southern most exposures of the Murree Formation in Kohat those of the Pathan Algad are considerably thick. These consist of interbedded maroon sandstone and red clay with subordinate conglomerate. The conglomerates within the formation are intrabasinal and lag in nature while conglomerate at base of the formation consists of reworked limestone clasts of the underlying Kohat Formation. Two main sand-bodies, one SBI starts at 13m level and is 21m thick and second SB2 at 52 level ranging 2-4m in thickness, were observed. These sand-bodies consist of main channel, point bar, and chute bar deposits. Interbedded sandstone and clay facies which overlie the composite sandstone facies represent levee or crevasse splay deposits. The red clay was deposited in flood plain areas out of suspension. As a whole the Murree Formation in this area displays typical meandering river deposits. Our analysis suggests that the Pathan Algad area lied the margin of the Murree river system where only occasionally the main river flowed. Additionally, there may be a considerable age difference between the exposures in Pathan Algad and those at Dhok Maiki, the stratotype in Potwar area.
Key words: Sandstone, clay, conglomerate, molasses, Murree Formation, Kohat.

Q/54. Qureshi, F.A., 1992-94. Sedimentary petrology of Early Cretaceous Lumshiwal Formation and Eocene Margala Hill Limestone and Lithostructure mapping of Dhamtaur area, Southern Hazara, Pakistan. M.Sc. Thesis, Punjab University, Lahore, 213p.

A comprehensive study of Geology and structure of Dhamtaur area is presented along with special constraints on the sedimentology of Lumshiwal Formation of Early Cretaceous and Margalla Hill Limestone of Early Eocene. Large-scale (1:10000) geological mapping of a small segment of the Lesser Himalaya in the Dhamtaur area is presented. The lithostratigraphic unit range from Upper Paleocene to Precambrian, Hazara Formation being the oldest. Structurally the area comprises NW-SE trending major anticlinorium. The folds are tight to isoclinal and opposing southeast and northwest vergence on the two sides of the core formation. Some anticlines show plunge tot the southeast direction. Almost all faults have vergence parallel to the folds developed in the core on the two sides of the main anticlinorium. Most are reverse faults although some may be of the normal type. Faulting appears to be dipslip to oblique slip and in general involves a maximum displacement of few hundred meters.
A detailed study of sedimentary petrology/sedimentology of Lumshiwal Formation of Early Cretaceous and Margalla Hill Limestone of Early Eocene has been carried out. The object was to study the petrography environment of deposition and diagenesis of the above said formations.
The section of Lumshiwal Formation from Karlan Bazar at Abbottabad Nathia Gali Road, is medium to thick bedded glauconite sandstone. This formation is divided into twenty microfacies. The microfacies overlying Chichali Formation is poor in glauconite and are mainly quartz and carbonate cemented quartz arenites. The other microfacies are mainly quartz; glauconite and carbonate cemented, well to very well sorted, and mature to supermature quartz arenites. The maximum development of glauconite is from central to upper. Upper horizons selectively cemented with flint.
Key words: Sedimentary petrology, Lumshiwal Formation, Margala, Cretaceous, Eocene, Hazara.

Q/55. Qureshi, J.A., 1997-98. Geological mapping of Rawalakot area with special emphasis on engineering characteristics of geo-material. M.Sc. Thesis, University of Azad Jammu & Kashmir, Muzaffarabad, Pakistan, 42p.

Geological mapping of Rawlakot area is prepared on the scale 1:12,500 and the total area of investigation is about 100 sq. km. Present work shows that the strength of the geomaterial which is studied for the mineralogical composition of the aggregate of the Murree Sandstone. Los Angle value, crushing value, impact value, specific gravity, water absorption, flakiness index and elongation index were performed according to ASTM standards and the parameters of the strength of material were deduced according to the mineralogical assembly of the Murree sandstone. It was seen that the percentage of quartz and cementing material like calcite in favourable conditions provide strength to the material and the deletrious material like clays due to its swelling potential damages the material when in contact with water. Reserves of the Murree Sandstone as geomaterial of different localities were also estimated for the quarry purposes
Key words: Mapping, engineering properties, Rawlakot, Azad Kashmir.

Q/56. Qureshi, K.A., Pasha, M.K. & Khan, A.A., 1992. Stratigraphic and structural evolution of Kala-Chitta Range, Punjab, Pakistan. Abstracts, First South Asia Geological Congress, Islamabad, p.61.

Key words: Stratigraphy, sedimentology, Mesozoic, Kalachitta.

Q/57. Qureshi, M.A., 1988-90. Geology and structure of Langrial-Bolda Area District Abbottabad. M.Sc. Thesis, Punjab University, Lahore, 83p.

Large scale geological map at a scale 1:10,000 of Langrial Bodla area is presented along with a complete record of Precambrian to Eocene rock units specially exposed in the area. On the basis of field observations and petrographic studies the depositional environments of rock units have been interpreted. Geological subsurface structures are described and illustrated with the help of cross sections. Almost all-major structures follow the general trend NE-SW, and is NW verging to upright. The major Nathiagali Fault is a high angle fault separating basement and the cover domain. The economic potential of limestone of various rock units, laterite, slates and aggregates have been discussed.
Key words: Mapping, Precambrian, Eocene, Abbottabad.

Q/58. Qureshi, M.A., Baig, M.S. & Munir, M.H., 1997. Reconnaissance microfacies analysis of the Upper Jurassic Samana Suk Formation, northern Hazara, Pakistan. Geological Bulletin, Punjab University 31 & 32, 145-151.

Key words: Reconnaissance, Jurassic, Samana Suk Formation, Hazara.

Q/59. Qureshi, M.I., 1985-87. Electrical resistivity survey for groundwater potentials in Masal Talao, Amir Khan Talao, Khachar Talao and Haji Talao, District Peshawar. Institute of Geology, Punjab University, Lahore, M.Sc. Thesis, 1-47.

Electrical resistivity survey in Masal Talao, Amir Khan Talao, Kachar Talao and Haji Talao (District Peshawar) was carried out in collaboration with Hydrogeology Directorate WAPDA Peshawar. The main purpose of the survey was to determine hydrogeological features such as depth to the bedrock, nature and thickness of aquifers, the quality of groundwater, and to select suitable sites for tubewell installation in the project area.
According to resistivity survey and drilling data the entire area is underlain by low resistive clay with occasional gravels. The overlying alluvium is composed of alternating layers of gravels and clays. Ground water appears to be quite fresh in the entire project area. Water table depth is from 13m to 40m in the area under investigation.

In the project area, twenty-seven probes were carried out. After interpreting the data, the V.E.S. No. 95, 93,51,40, 15 and 17 have been selected for the test drilling, however other probe sites also indicate the presence of aquifers in the a area but of varying thickness.
The entire area appears to be favorable for tubewell installation, however the yield of water depends upon the nature of aquifers may range from half cusec to one and half cusec in the project area.
Key words: Geophysics, resistivity, groundwater, Peshawar.

Q/60. Qureshi, M.J., Tariq, M.A. & Abid, Q.Z. (Eds: Raza, S.M., Hussain, A. & Khan, S.H.), 1993. Geological Map of Pakistan. Geological Survey of Pakistan, Geological Map Series, Scale 1:1,000,000.

Key words: Maps.

Q/61. Qureshi, M.K.A., 1968. A report on the geology of Nawansher Giah area, Hazara. M.Sc. Thesis, Punjab University, Lahore, 86p.

Key words: Mapping, geology, Abbottabad.

Q/62. Qureshi, M.K.A., 1980. Copper showings in Warchha Sandstone and Sardhai Formation, Salt Range. Contribution to Geology of Pakistan, 1, 61-85.

The sampling of Warchha Sandstone and Sardhai Formation was carried out during 1972-73, in order to find out any possible economic mineral deposit.
The copper contents are sporadic and scanty, and present study is not successful to locate deposit of commercial potential. Nevertheless, the studies may be continued in adjoining parts to see, if any portion contains values higher than the one recorded during this survey.
Key words: Mineralization, copper, Warchha sandstone, Sardhai Formation.

Q/63. Qureshi, M.K.A., 1984. Carbonate microfacies in Samana Suk Formation at Azizabad section Hazara District, North West Frontier Province. Abstract, 1st Pakistan Geological Congress, Lahore, p59.

Key words: Carbonate, microfacies, Samana Suk Formation, Hazara.

Q/64. Qureshi, M.K.A., 1997. Stratigraphical and sedimentological studies of the Mesozoic rocks of the Kala Chitta Range, Northern Pakistan. Ph.D. Thesis, Punjab University, Lahore.

The present research deals with the stratigraphical and the sedimentological studies of the Mesozoic Rocks of the Kala Chitta Range, Northern Pakistan, based upon an extensive field work and detailed laboratory analyses, This study is the first comprehensive version on the depositional environments and the microfacies analysis of the dominantly carbonate shelf deposits. Standard microfacies have been identified among the carbonate succession, whereas the constituent minerals and elements in the siliciclastic rocks, most conspicuously of the Datta Formation (Lower Jurassic), have also been recognized by means of XRD, DTA and chemical analyses for the paleoenvironmental interpretation.
Age diagnostic Early Triassic ammonites from the Mianwali Formation and the planktonic foraminifers from the Upper Cretaceous Kawagarh Formation have also been recorded and illustrated. In addition, palynological data of different formations has been incorporated for the first time from the Kala Chitta Range.
Stratigraphic correlation with Hazara, Kohat, Salt Range, Trans Indus Range and Balochistan Basin has been attempted. New data about the structural framework of this linear fold -thrust belt has also been presented.

Key words: Stratigraphy, sedimentology, Mesozoic, Kalachitta.

Q/65. Qureshi, M.K.A., Butt, A.A. & Sheikh, R.A., 1994. The Kala Chitta foreland fold and thrust belt, Northern Pakistan. Journal of Nepal Geological Society 10, Abstract Volume, 9th Himalaya-Karakoram-Tibet Workshop, Kathmandu, Nepal, 104-106.

The present structural framework of the Kala Chitta Range evolved through movement between two detachment surfaces. The Precambrian Attock Slates acted as a basal detachment surface above which large-scale horizontal compression took place to produce the main structural framework of the Kala Chitta Range. The Middle Eocene argillaceous Kuldana Formation behaved as the upper detachment surface giving rise to blind thrusts which were later exposed due to the vigorous erosion of the overlying folded Miocene strata. Despite the severe tectonic activity, strata older than the Triassic are not exposed in the Kala Chitta Range, which appears that these may not have been deposited at all. However, the Precambrian Attock Slates are believed to underlie the Mesozoic rocks because of the intervening position of the Attock Slates between the Kala Chitta Range and the Attock-Cherat Range.

In the Kala Chitta Range, the Triassic to Eocene rocks are repeated constantly in compressed folds and thin sheets. Interpretation of a regional decollement (Cotter, 1933) rooted in the Attock Slates and responsible for the major overthrusting, has proved to be of the fundamental significance for later researchers who are actually substantiating Cotter's concept in one way or the other (i.e. Lehner, 1947; Wadia, 1957; Gansser, 1964; Crawford, 1974; Lillie et al., 1987). The sedimentary veneer has glided and deformed over this surface and the Attock Thrust and the Main Boundary Thrust (MBT) represent the "splays off" of this detachment surface. Late Cenozoic movement along these thrusts has uplifted the Attock-Cherat and the Chitta-Margala Hill Ranges.

Apart from the movement over this basal decollement surface, the Kala Chitta fold-thrust belt has evolved by blind thrusting merging with a continuous upper detachment surface. The Middle Eocene Kuldana Formation is believed to have played the role of an upper detachment surface. This view is supported by the fact that the Kuldana Formation and the overlying molasse deposits which are well exposed all along the southern borders of the fold-thrust belt are not repeated in any of its internal folds. The presence of the Pre-Kuldana Formation deposition (i.e. Margala/Patala/Lockhart) in the footwall of almost all the exposed thrusts, regardless of which formation comprises the hanging wall, also provides a strong evidence that the Kuldana Formation has served as the upper detachment surface. This consistency shows that successive thrusts emplaced at the outer edge of the foothills flattened along a common upper detachment surface formed by the Kuldana Formation.

The recognition of the basal and the upper detachment surfaces gives a distinctive character to the deformational style of the Kala Chitta fold-thrust belt. The sequence of events describing briefly the changes in structural style with different erosion levels, and the development of blind thrusts beneath a continuous upper detachment at all stages of deformation are modelled. It was revealed from the model that the internal deformation of the Kala Chitta Range predates its ramping towards south over the MBT. However, the basement uplift to some extent, might have also been responsible for the initiation of thrusting in the Kala Chitta and the adjoining areas.

During its tectonic history, the Kala Chitta Thrust belt suffered a number of deformational phases. However, in a very generalized sense, the most effective and prominent are three distinct and partly overlapping phases. The first being a north-south trending compressional phase resulting in generally east-west trending fold axes and fault planes. The second NE-SW trending phase formed cross folds and duplex structures, while the third phase resulted into the thrusting and ramping of the whole Kala Chitta belt over the MBT in the south. The overall configuration of the Range indicates that during the final phase of thrusting over the MBT, differential block movement took place, the western block lagged behind in southward movement and much thrusting developed in its extreme northern part (Chhoi-Chak Jabbi area). On the other hand, the eastern block moved ahead towards south, developing extensive thrusting towards its south (Fatehjang-Mahura area). The major faults include the MBT, the Samul Pani-Chak Dalla Thrust, the Ghora Mar-Chak Jabbi Thrust, the Chhoi-Dunga Kas Thrust and their splays and offshoots.

Key words: Paleoenvironment, tectonics, structure, Kalachitta fold and thrust belt.

Q/66. Qureshi, M.K.A., Hassan, M. & Butt, A.A., 1992. Paleoenvironments and tectonic style of the Kala Chitta fold and thrust belt, Northern Pakistan. Regional Postgraduate Training Course in Plate Tectonics, Punjab University, p.41.

Structural modelling of the Kala Chitta range has been attempted after having completed its geological mapping on 1:50,000 scale. The structural style of the Kala Chitta Range is believed to represent an example of a foreland-fold and thrust belt geometry after incorporating the structural entity of its northerly neighbour of the Attock-Cherat Range.
The present structural framework appears to have evolved though movement between two detachment surfaces. The Precambrian "ATTOCK SLATES" are believed to have acted as a basal detachment above which large scale horizontal compression has taken place to produce the main structural framework of the Kala Chitta Range. The middle Eocene argillaceous KULDANA FORMATION appears to have behaved as the upper detachment surface giving rise to blind thrusts which were later exposed due to the vigorous erosion of the overlying folded Miocene strata. The major individual structures are illustrated through a number of Cross Sections as a support to the proposed structural modelling.
Key words: Paleoenvironment, tectonics, Kalachitta fold and thrust belt.

Q/67. Qureshi, M.K.A., Kausar, A.B. & Khan, K.M., 1983. Geology of Surghar and Shinghar Ranges (topographic sheet No. 38 O/8), Mianwali and Kohat Districts. Geological Survey of Pakistan, Information Release 186.

Key words: Tectonics, stratigraphy, geology, Mianwali, Karak, Kohat.

Q/68. Qureshi, M.S., Khan, M.A., Sheikh, S.A. & Khan, N.A., 1989. Geotechnical characteristics of soil of Kundal Shahi Atthmuqam area, Azad Kashmir. Kashmir Journal of Geology 6 & 7, 133-146.

The paper deals with the physical characteristics of the soils to evaluate the behavior with respect to bearing capacity and competency to install hydel-power project and other civil engineering works in Kundal Shahi Atthmuqam are of Azad Kashmir. Other physical characteristics of the soils which decide the relative merits and demerits have also been investigated in addition to the field characteristics. The observed parameters shows variations in the samples but a limited range are well within the ASTM specifications. It appears feasible to utilize the localities for civil engineering works.
Key words: Geotechnical, soil, Azad Kashmir.

Q/69. Qureshi, N.H., 1961a. Coal resources of Pakistan. Natural Resources, University of Karachi 1, 47-50.

Along with others, this paper briefly describe the coal resources of the area of the present work.
Key words: Hydrocarbons, coal.

Q/70. Qureshi, N.H., 1961b. The mining of chromite in Pakistan. Proceedings, CENTO Symposium on Chrome Ore, Ankara, 54-60.

Key words: Ultramafics, chromite, mining.

Q/71. Qureshi, N.H., 1962a. Economic aspects of coal in Pakistan. Proceedings, CENTO Symposium on Coal, Zonguldak, 1961, 29-46.

Key words: Hydrocarbons, coal.

Q/72. Qureshi, N.H., 1962b. Industrial mineral and rocks of West Pakistan: Review of mining activities. Proceedings, CENTO Symposium on Industrial Rocks and Mineral, Lahore, 34-49.

Key words: Mining, industrial rocks.

Q/73. Qureshi, R.M., Hasany, S.M., Javed, T., Sajjad, M.I., Shah, Z., Rehman, H., Mateen, A. & Fritz, P., 1994. Isotopic and chemical characterization of coal in Pakistan. In: Ahmed, R. & Sheikh, A.M. (eds.), Geology in South Asia--I. Proceedings of the First South Asia Geological Congress, Islamabad, 1992. Hydrocarbon Development Institute of Pakistan, Islamabad, 300-304.

Key words: Organic geochemistry, isotopes, coal.

Q/74. Qureshi, R.M., Hussain, S.D., Ahmad, M., Sajjad, M.I., Aravena, R. & Fritz, P., 1992. Special variation of tritium and Carbon-14 in shallow ground waters of Peshawar valley. Abstracts, First South Asia Geological Congress, Islamabad, p.61.

Key words: Groundwater, hydrochemistry, contamination, Peshawar.

Q/75. Qureshi, S.A., 1972. Geology of Dir–Bibiore area, Dir with special emphasis on Bibiore Granodiorite and Mixed Zone., M.Sc. Thesis, Punjab University, Lahore, 75p.

Key words: Granodiorite, Plutonic rocks, Dir.

Q/76. Qureshi, S.N., Ahmed, S., Khwaja, A.A., MonaLisa, & Naseem, S., 2000. Gravity modeling and seismicity of the area between Bannu and Kohat. Abstracts, Third South Asia Geological Congress, Lahore, p.82.

A part of active Himalayan fold-and-thrust belt has been investigated along a 131 km long gravity profile (Bannu to Kohat) by gravity modelling. Good agreement exists between the observed and calculated gravity values. The basement dips gradually towards North from about 9 km under Bannu to about 11 km below Kohat.

In this area of blind and emergent faults, variations in Bouguer anomaly coincides well with the known faults like Latamber, Bahadur Khel and Tappi. Other similar Bouguer anomaly variations suggest the presence of blind faults beneath the molasses and/or platform rocks at Domail, Khurram, Banda Daud Shah, Lachi and Gada Khel. Isostatic behavior reveals a local deficit of mass conditions between Latambar-Tappi area.

Seismically the area is active. Three events of Mb = 4.9 to 6.0 from Banda Daud Shah, Lachi and Shadikhel confirm the existence of faults. Their focal mechanism solutions are discussed.

Key words: Seismicity, gravity modeling, Bannu, Kohat.