GEOLOGICA
International Journal of Earth Sciences

OCTOBER 2024

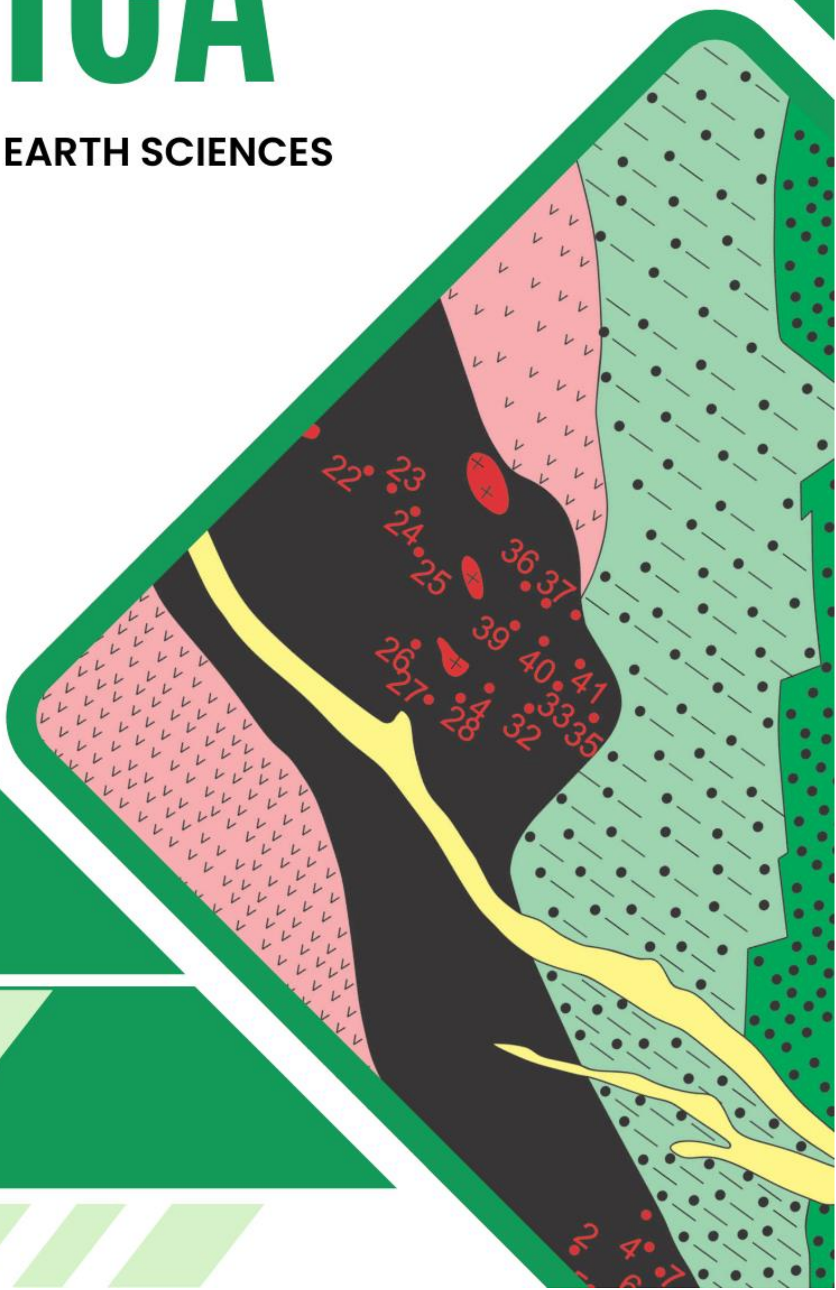
VOLUME 10 NUMBER 1

ISSN 1025-2541

ISSN 3006-967X

GEOLOGICA

AN INTERNATIONAL JOURNAL OF EARTH SCIENCES



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ISSN:
1025-2541
eISSN:
3006-967X

Hussain S.B., Khalid A., Ali M., Hussain S.K., Qayyum A., Ahmad S., Rehman G., Khalid S., Khan M.Z., Haider, S.Khan S., 2024. Structural Analysis of Makori Anticline, Banda Daud Shah, Kohat Basin, Khyber Pakhtunkhwa, Pakistan. Geologica v. 10, Article No. 1, Page 1-21.*
https://geologica.gov.pk/

GEOLOGICA
An International Journal of Earth Sciences

Structural Analysis of Makori Anticline, Banda Daud Shah, Kohat Basin, Khyber Pakhtunkhwa, Pakistan

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Abstract

Makori Anticline is one of the most important structures of the northeastern Kohat Fold Thrust Belt (KFTB). The purpose of this research work is to understand the structural kinematics of Makori Anticline within the Kohat Fold and Thrust Belt integrating surface data and construction of balanced cross sections. Geological map and cross sections of the study area indicate that the area has been deformed in a thin-skinned manner. East-west trending anticlines, synclines and thrust faults defined the area. The core rocks within the prominent anticlines and hanging wall stratigraphy of Banda Daud Shah and Zanka Ghar Faults indicate a shallow level detachment probably at the base of Bahadur Khel Salt. The attitude data collected on the fold limbs suggest a dominant south facing that is coherent with facing of Banda Daud Shah and Zanka Ghar Faults, and is a consequence of the compressional. Based on the forelimb and back limb geometry of the anticlinal folds several low angle imbricate splays from this basal detachment are interpreted. The deformation event in the region postdates the deposition of late Miocene to Pleistocene Siwaliks indicating that the age of compressional deformation is post- Pleistocene.

Keywords: Structural evolution; Balanced cross section; Thrust kinematics; Detachment; Detachment folding; Restored section.

Introduction

The field area is located east of Banda Daud Shah Town, which is located in the Central Kohat Plateau (Fig. 1) The Kohat Plateau is part of the foreland fold and thrust belt of Himalayan orogenic belt in North Pakistan (Fig. 1). This plateau represents a typical foreland fold and thrust belt and is about 100 km south of the main foothills of the Himalayan range. The plateau clues about the southern progression of the Himalayan deformation. Previous structural interpretation for the tectonic evolution of the region implies the propagation of foreland fold and thrust belt along blind and partially emergent thrust faults from an upper detachment at the base of the Eocene sequence underlain by passive roof duplex geometry within the Mesozoic rocks (Abbasi & McElory, 1991; McDougal & Hussain, 1991). An alternative interpretation was proposed by Pivnik et al. (1992; 1993), suggesting transperssional deformation instead of compressional deformation. According to them the Kohat Plateau is characterized by narrow anticlinal hills, which are cored by high angle reverse faults converging to a single strike-slip zone at depth. They believed that virtually every anticlinal structure within the plateau is a pressure ridge representing the surface expression of a positive flower structure at the depth.

According to Ahmad (2003), the Kohat

Plateau is a well-defined south progressing compressional domain and has evolved as a result of imbricate splays form a regional basal devolvement and is characterized by two decollement levels. The deeper one is at the interface of the crystalline basement of sedimentary cover and the second decollement lies at the base of Patala-Panoba sequence and the Lockhart Formation. Due to the presence of upper decollement there is a structural disharmony between the exposed Eocene sequence and the ongoing outcropping Paleocene-Cambrian sequence. Kohat Plateau is bounded to the north by the Main Boundary thrust and to the south by the Surghar Range Thrust and Trans-Indus Range thrust (Fig. 1). The Kalabagh fault defines the southeastern boundary of the Plateau. This fault was described as a lateral ramp structure by Butler et al., (1987) and a strike-slip fault by Mc Dougall and Hussain
(1991). A number of East-West trending thrusts branch out from this lateral ramp in the vicinity of Shakardara. (Mc Duogall and Hussain, 1991; Abbasi and McElory, 1991). Sercombe et al., (1994a) studied the compression and transpression related deformation in the Kohat plateau is attributed to Ahmad et al., (2003) by publishing a geological map of the plateau at 1: 100,000 scale. Ahmad et al., (2003) defined the Kohat Plateau as a south progressing compressional domain and is a pure foreland fold and trust belt of the Himalayan orogeny. The study area has a rugged topography because of the thick exposure of molasse sediments. The mollase sequence of the area is characterized by an alternate succession of shale and sandstone and the easy erosion of shale has produced alternate gullies between sandstone ridges. Despite extensive research on the tectonic evolution of the Kohat Plateau, critical gaps remain in understanding the structural relationship between exposed Eocene formations and underlying Mesozoic and Paleozoic strata. Previous studies have interpreted thrust and transpressional deformation, yet the specific role and geometry of detachment tectonics within this region are still underexplored. High-resolution mapping and cross-sectional analysis are needed to quantify the tectonic shortening across thrust faults and clarify the influence of detachment faults on deformation patterns. Therefore, this research aims to produce an updated geological map at a 1:50,000 scale, construct geological cross-sections using Petex Midland Valley Move, and assess detachment tectonics to refine the model of structural evolution for the Kohat Plateau.

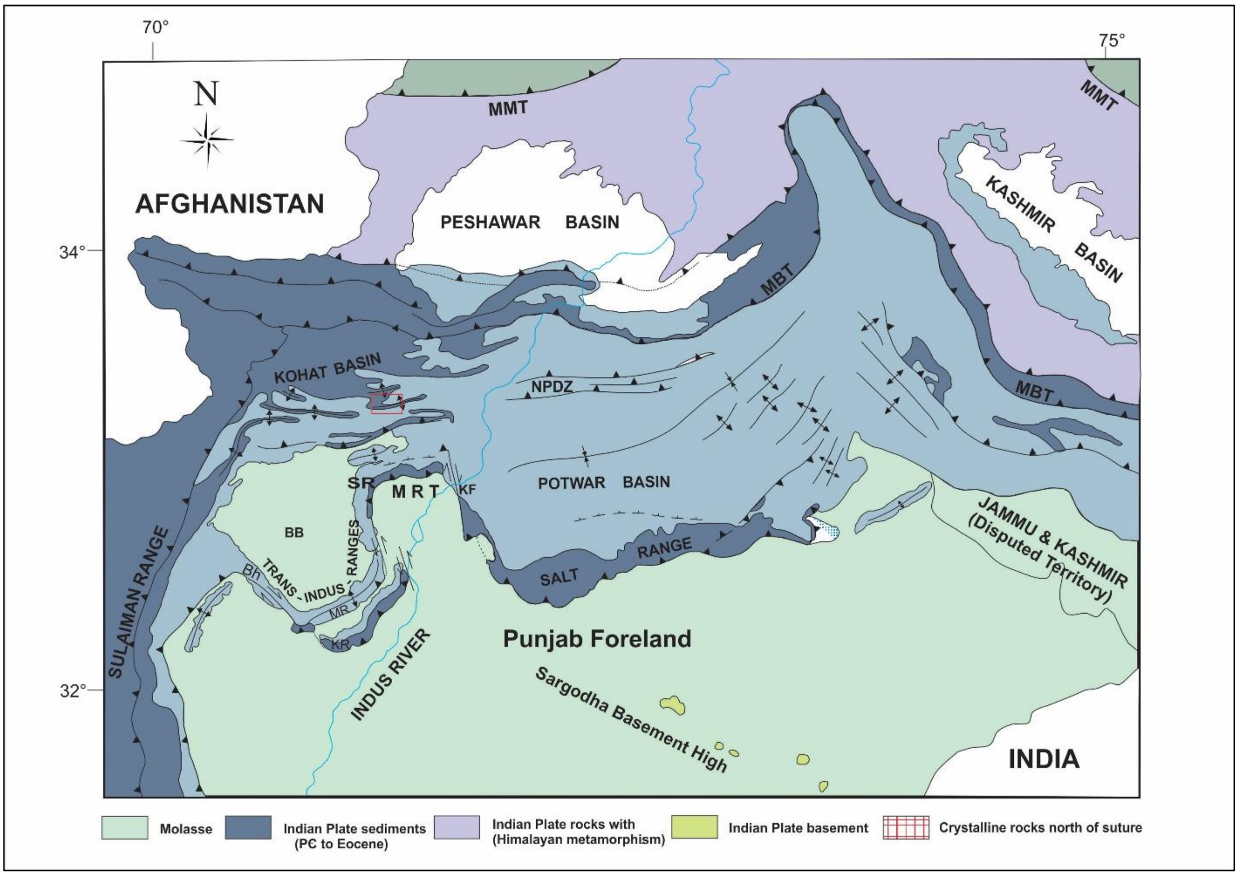

Fig. 1 Generalized Geologic Map of the NW Himalayan Foreland Fold and Thrust Belt (modified after Kazmi and Rana, 1986). The Inset shows the location of study area. MMT: Main Mantle Thrust, MBT: Main Boundary Thust, KF: Kalabagh Fault, NPDZ: Northern Potwar Deformed Zone, KR: Khisor Range, BB; Bannu Basin, KRT: Mianwali Reentrant, MR: Marwat Range, BH: Bhittani Range.

Methodology

Extensive geological fieldwork was conducted to thoroughly study the area, with this research project largely based on data collected during field investigations. An updated geological map at a 1:50,000 scale was created, along with balanced cross-sections constructed using the Petex Midland Valley Move suite. The fieldwork involved detailed stratigraphic and structural data collection to document fold geometries, fault orientations, and detachment levels, particularly within the Makori Anticline and surrounding areas. Orientation data from fold limbs and fault planes were systematically recorded to analyze structural kinematics and assess the role of thin-skinned tectonics in regional deformation. This dataset facilitated the creation of balanced cross-sections, providing detailed subsurface visualizations and quantification of tectonic shortening.

Geological Setting

The study is located in the central Kohat Plateau which lies in the Northwestern apex of the Himalayan foreland fold and thrust belt of the North Pakistan. The Himalayan orogeny resulted from the continent-continent collision of the Eurasian and Indian plates once the plate of the earth's crust carrying the Indo Pakistan continent was separated from the mother Gondwana about 130Ma ago and started northwards drift (Johnson et at., 1976). As a result, the

Neo-Tethys that was located between the Indian continent in the south and Asian Plate in the north started shrinking. This shrinkage was facilitated by the consumption of the Neo-Tethys, opening up of Indian ocean behind, the transform motion along Owen fracture Zone located towards southwest of the Indo-Pakistan Sub-continent and Ninety East Ridge located towards southeast of Indo-Pakistani Sub-continent (Fig. 1). During the closure of the Neo-Tethys intra-oceanic subduction generated major tectonic features. Four tectonic features delineate the tectonomorphic terrains of the North Pakistan;

1. The Main Karakoram Thrust (MKT) that separates the southern Eurasian plate from the Kohistan Island Arc.
2. The Main Mantle Thrust (MMT) separates Kohistan Island Arc form the northern Indian Plate (Fig. 1).
3. The Main Boundary Thrust (MBT) separates the Hill ranges and Hazara Himalayas in the north from the deformed foreland basin in the south.
4. The Salt Range Thrust, Surghar Range Thrust and the Khisor Range Thrust form the southern boundary of the deformed foreland basin in Pakistan along which Mesozoic rocks are thrusted over the undeformed Punjab foreland basin.

The Kohat fold and thrust belt is the western most deformed part of the Himalayan foreland basin which rims the entire Himalayas with an east-west trend from Ganges delta in the east up to Kohat area in the north Pakistan and changes to north-south orientation in the vicinity of Bannu depression stretching up to Karachi. The Main boundary thrust lies north of the Kohat plateau whereas the left lateral Kurrum Fault flanks the right lateral Kalabagh Fault (Fig. 1).

Stratigraphy

The Kohat Plateau is underlain by a complex assemblage of shale, limestone, gypsum and sandstone of Eocene age and is unconformably overlain by the thick alternating sequence of the Molasse sediments. In the study area the oldest rocks belong to Eocene age which include Bahadur Khel salt and Jatta Gypsum at the base followed upward by shelf sediments of Kuldana and Kohat formations. These units are unconformably overlain by Molasse sediments of Miocene to Pliocene age, which includes Rawalpindi and Siwalik groups.

The stratigraphic description and terminology regarding the rock units are based on the work of Meissner et al., (1974), Shah et al (1977), and wells (1984) and is improved by the data collection during the present field work.

The Central Kohat plateau consists of the Eocene-Pleistocene sedimentary rocks, including limestone, gypsum, sandstone, shale and conglomerate. The facies record of the central Kohat plateau suggests that it was a restricted evaporite basin at the beginning of Eocene, evolved to an early terrestrial foreland basin followed by an open-marine basin and finally developed into a fully developed terrestrial foreland basin in the Miocene.

The Eocene rocks of the basin belong to Chharat Group which is represented by a thick evaporite sequence namely Bahadur Khel Salt and Jatta Gypsum at the base. This evaporite sequence is conformably overlain by Kuldana Formation which mostly consists of reddish clays and is occasionally interbedded with sandstone (Fig. 3A). The Kuldana Formation mostly forms gullies due to its soft nature. The Kuldana Formation is conformably overlain by Kohat Formation. Light gray limestone is the most prominent member however greenish gray shale is also present in the lower part (Fig. 3). The top of Kohat Formation is marked by an unconformity that represents the end of marine sedimentation and the onset of fluvial sedimentation (Molasse Stratigraphy) in the region (Fig. 2). Molasse sediments consist of Rawalpindi Group (Murree & Kamlial formations) and Siwalik Group (Chinji, Nagri, Dhok Pathan & Soan formations) (Fig. 3). The Murree Formation is not developed in the central Kohat Basin.

Structural Analysis of Area

The Kohat Plateau with reference to the structural geology has been debatable since 1991 and a number of publications have documented the structural styles and evaluation of the central Kohat (Sercombe et al. 1998 Ahmad, 2003). The earliest model for the structural style of the Kohat plateau implies thin-skinned deformation with a deeper level detachment at the base of the entire sedimentary package with crystalline basement and shallow level detachment at the base of the Eocene evaporates (Abbasi and McElroy, 1991). According to this model the Eocene cover is deforming above a passive roof-duplex within Mesozoic and older rocks. Another model presented in the same year implies low angle imbricate thrusts from a basal decollement that is migrating southwards (McDougal and Hussain, 1991). Later Sercombe et al., (1994a) and Ali et al., (1997) came up with new model for the tectonic evolution of the region. According to this model the Kohat Plateau is a complex terrain consisting of strike-slip and contractile features and the majority of the early Cenozoic rocks exposed in the Kohat Plateau crop out in the cores of anticlines that formed as detachment folds and pressure ridges above complex positive flower structure. A very prominent structure in the Central Kohat Plateau namely, Banda Daud Shah range and the eastern termination of Manzalai Ghar and western terminus of the Dan Faqir anticline are selected for detailed structural analysis in order to understand the surface and subsurface geometries of these structures and the role of evaporates in their evolution.

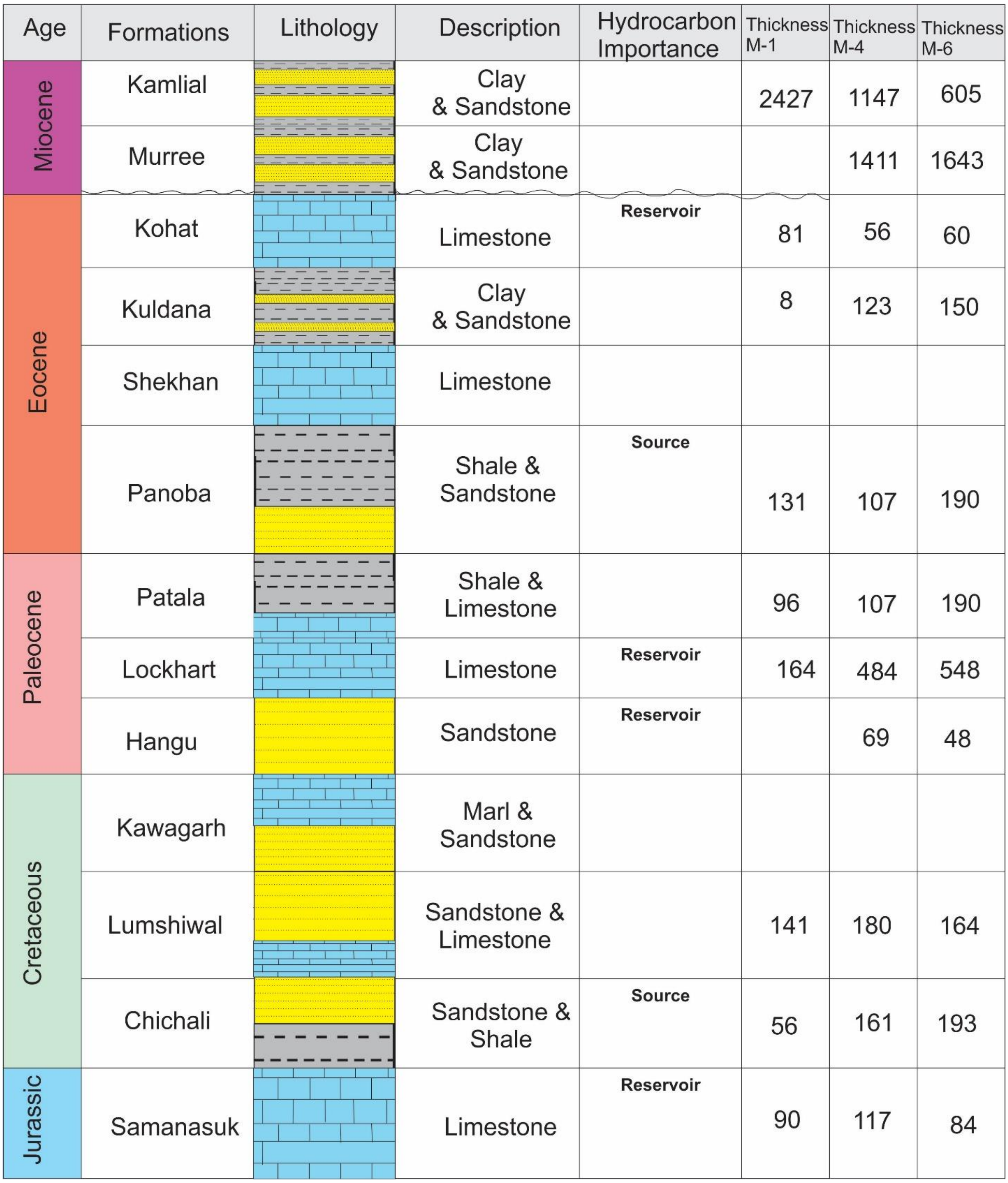

Fig. 2 Generalized stratigraphic chart of the Kohat Basin. Formation thickness for nearby wells was added as well.

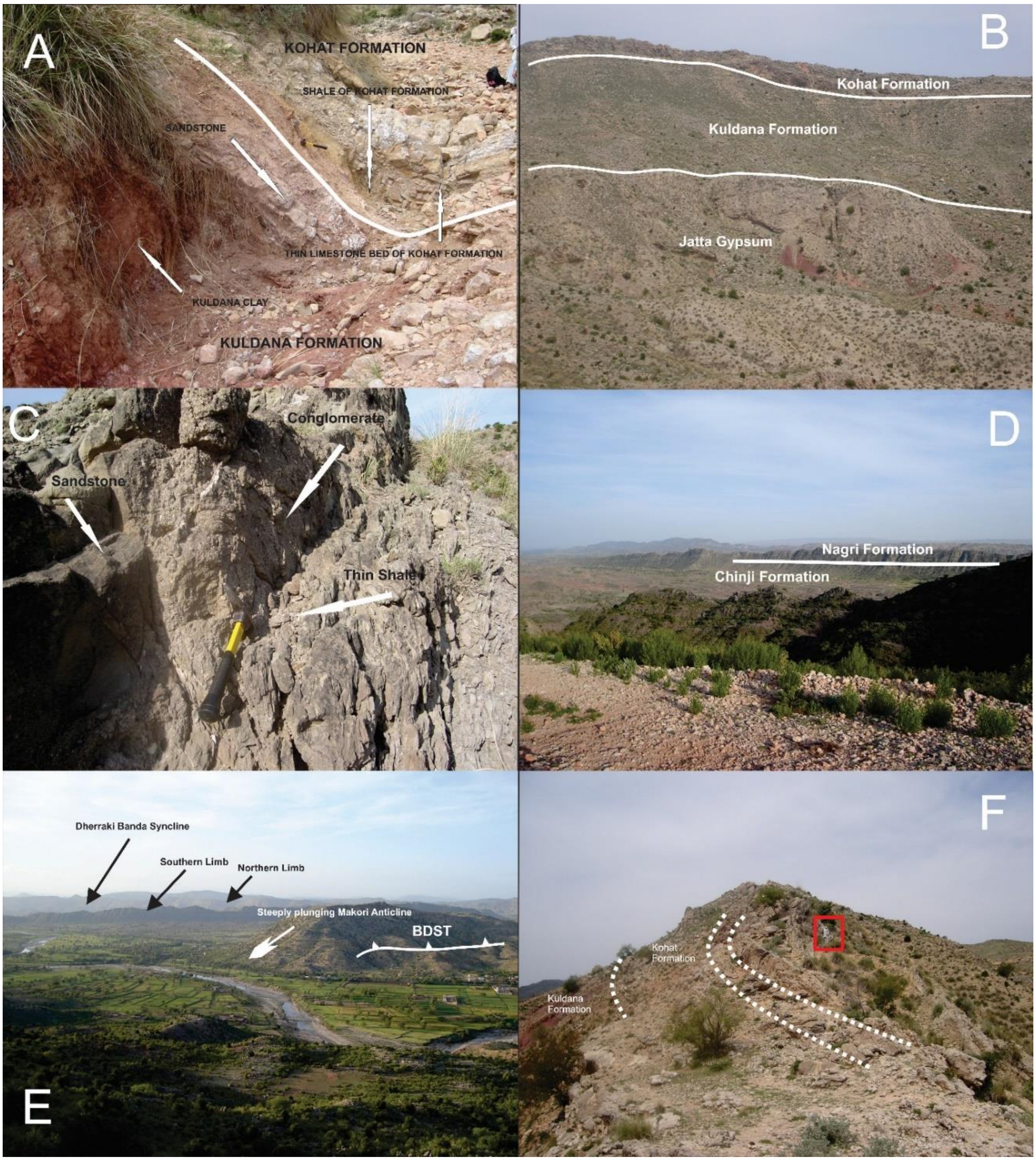

Fig. 3 Field Pictures showing various lithological units.

(A) Shale and thin bedded limestone at the base of Kohat Formation and sandstone of Kuldana Formation exposed in the core of Makori Anticline, Dharangi village.

(B) Contacts between Jatta Gypsum, Kuldana and Kohat Formations at the northern limb of Makori Anticline, to the south of Makori village.

(C) Conglomerate, sandstone and shale of Kamlial Formation in the southern limb of Makori Anticline, to the east of Dharangi village.

(D) Contact between Chinji and Nagri Formations in the foothills of Makori Anticline, southeast of Banda Daud Shah.

(E) Steeply plunging Makori Anticline, Banda Daud Shah Thrust and Dherraki Banda Syncline exposed in the Banda Daud Shah area and Dherraki Banda respectively.

(F) Overturned beds of Kohat Formation in the southern overturned limb of Makori Anticline.

Map Description

Several prominent fold structures and thrusts were mapped and detailed attitude data was collected on fold limbs. These structure include:

- Makori Anticline (MA)
- Eastern terminus of Manalai Ghar Anticline (MGA)
- Western terminus of Dan Faqir Anticline (DFA)
- Pir Mela Syncline (PMA)
- Dherakki banda syncline (DBS)
- Banda Daud Shah Trust (BDST)
- Zanka Ghar Thrust (MGT)
- Dherakki Banda Thrust (DBT)

In the study area the stratigraphic sequence from the Jatta Gypsum up to the Nagri formation is folded into a series of approximately east-west trending, parallel anticlines and synclines (Fig. 4). The anticlines and thrusts mostly expose the early Cenozoic rocks whereas the synclines expose at the top of the Nagri Formation.

Folds

The folded packaged of the study area can be divided into two major groups

i. Fault Bounded folds

These are the folds lying in the hanging wall of thrust faults, which are the folded packed of the western terminus of the Makori anticline in the hanging wall of the Banda Daud Shah Thrust, the eastern terminus of the Makori Anticline in the handing wall of the Zanka Ghar Thrust.

ii. Sub Crop Fault Bounded Folds

Independent folded package which are not surgically related to the thrusts namely, Dan Faqir Anticline, Manzalai Ghar anticline and the Central part of the Makori Anticline.

Following are major anticlines and synclines of the study area.

a. Makori Anticline

This structure lies to the south of the Makori and Ahmadi Banda and is named as Makori anticline after the name Makori village. At some places the northern flank of this anticline is occupied by a couple of anticline and syncline within the Kamlial Formation followed by north dipping stratigraphic sequence of Kohat & Kuldana formations whereas the Jatta Gypsum lies in the core. The stratigraphy of the southern limb is same as that of the northern limb. The attitude data collected over the northern limb ranges from 45-60^0 whereas the southern limb is mostly overturned. The axial trend of the fold is mainly East-West and changes to northeast-southwest at the eastern terminus. To the south of the Makori it is cored by Jatta gypsum and gradually becomes younger in the west suggesting a decrease in the structural uplift of the anticline decreases rapidly and it plunges into the subsurface (Fig. 3A, B; Fig. 4). The foothills of this anticline in the south near the Dharangi are occupied by lower Siwalik Group rocks i.e. Chinji Formation these rocks are characterized by almost east-west trending parallel folds and becomes northeast-southwest near Zanka village (Fig. 3D)

b. Manzalai Ghar Anticline

It is one of the prominent anticlinal structures of the concerned area, named after the major topographic high of the region. The northern flank is occupied by a steeply north dipping Kamlial Formation. The overall stratigraphic sequence of the northern limb of Kuldana Formation, Jatta gypsum and Bahadur Khel Salt in the core. The southern flank is similar to that of the northern flank, but in the study area the northern flank is interrupted by a thrust, therefore, the sequence is disturbed and the northern flank is constituted by Kamlial Formation alone as the structure is near to its termination. The attitude data collected along the northern limb of the Manzalai Ghar, ranges from 45-65^0 whereas that of its southern limbs exhibits steep dip of 70. The axial trend of the fold in the study area is almost east-west. To the west of the study area the core is constituted by the Bahadur Khel salt and gradually becomes younger in the east suggesting a decrease in the structural relief of its core strata. To the south of the Banda Daud Shah the structural uplift of the anticline decreases rapidly and it plunges into the Siwalik group rocks west of the Bannu Kohat road the foothills of the Manzalai Ghar anticline in the south are occupied by lower Siwalik group; The Chinji and Nagri formations (Fig. 4). These rocks are characterized by east-west trending parallel folds.

c. Dan Faqir Anticline

This anticline is named after the Dan Faqir Ziarat which is the major topographic high of the region. The northern flank of this anticline is occupied by stratigraphic sequence of Chinji, Kamlial, Kohat and Kuldana formations, whereas Jatta Gypsum lies in the core. The stratigraphy of the southern limb is similar to anticline decreases rapidly and it plunges into the Siwalik Group rocks (Fig. 4).

d. Synclines

Fig. 4 shows two major synclinal structures within the study area namely the Pir Mela Syncline and the Dherakki Banda Syncline. Both these synclines expose the top most Nagri Formation of the stratigraphic sequence of the area, in their cores.

Faults

There are two main types of faults in the study area,

A. Faults having vergence similar to that of the regional tectonic transport vector. This includes;
   - Banda Daud Shah Thrust (BDST)
   - Zanka Ghar Thrust (ZGT)
B. Faults having vergence opposite to the regional tectonic Transport vector. This includes;
   - Manzalai Ghar Thrust (MGT)
   - Dherakki Banda Thrust (DBT)

Banda Daud Shah Thrust

The Banda Daud Shah Thrust is found to be moderately north dipping fault that trends east-west. The eastward extension of this fault is one kilometer west of Dharangi whereas to the west it is extended up to the end of Banda Daud Shah Range. The folded package of Makori Anticline in the hanging wall of this thrust bears a parallel relationship with the fault trend (Fig. 4). This fault emplaces the older Jatta Gypsum and Kuldana formations over the younger Kamlial Formation.

Zanka Ghar Thrust

This thrust is also north dipping and trends northeast-southwest. Its eastward extension is up to the western terminus of north lying Dan Faqir Anticline. The folded package of Makori Anticline in the hanging wall of this fault bears parallel relationship with the fault trend. The hanging wall sequence is constituted by Jatta Gypsum, Kuldana and Kohat formations and these are thrusted over the Kamlial Formation.

Manzalai Ghar and Dherakki Banda Thrusts

Both of these faults are verging in the opposite direction i.e. towards north, in contrast to the regional tectonic transport vector i.e. towards south. Manzalai Ghar Thrust disrupts the northern flank of Manzalai Ghar Anticline and it carries the older Jatta Gypsum, Kuldana and Kohat formations and thrusts these over the Kamlial Formation whereas the Dherakki Banda Thrust disrupts the northern flank of Dherakki Banda Syncline and emplaces the Chinji Formation over the Nagri Formation.

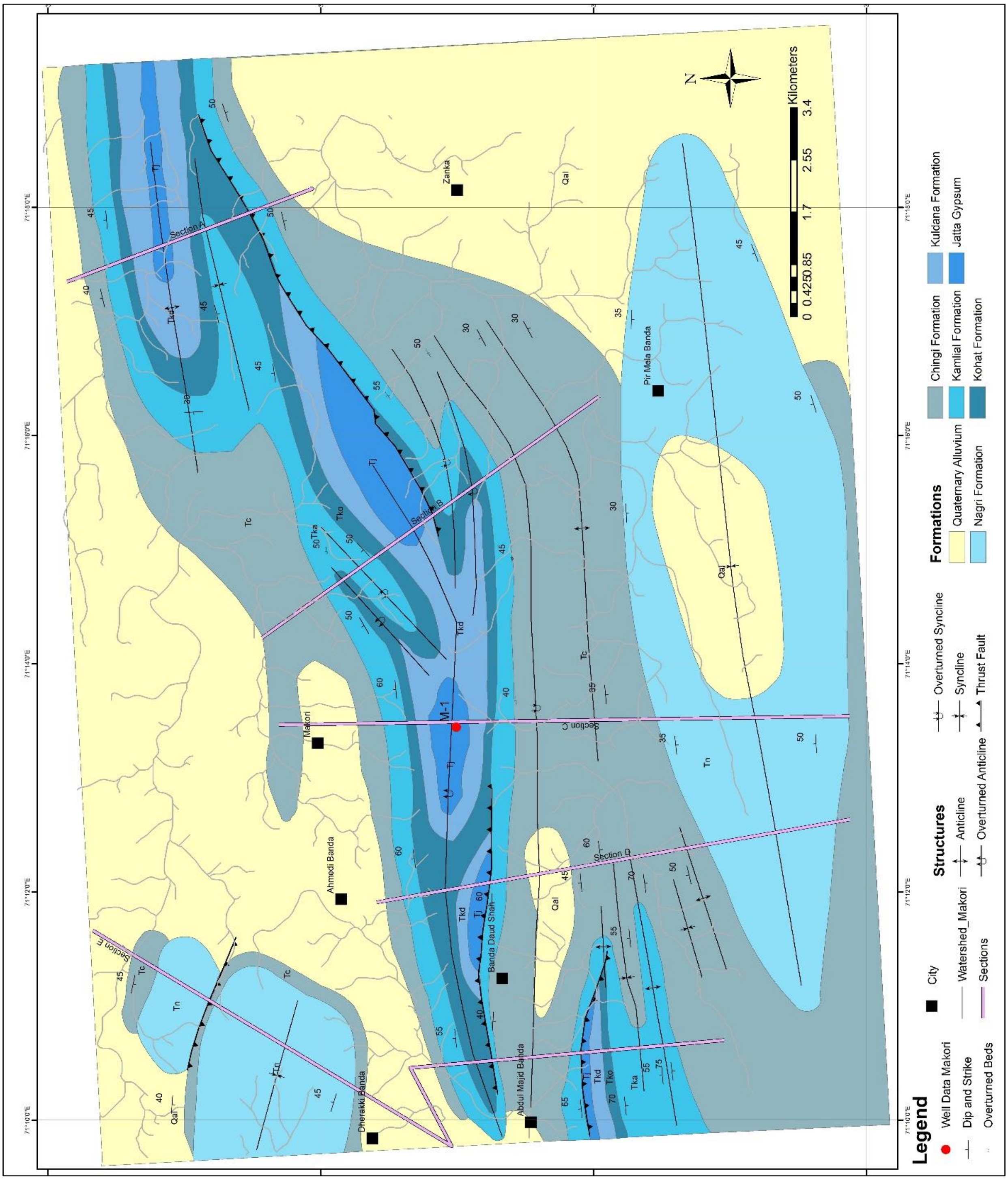

Fig. 4 Geological Map of the Study Area.

Cross sections Description

Methodology

The cross-sections play a key role in understanding the structural geology of the outcropping rocks. Therefore, to understand the structural geology of the outcropping rocks within the study area five geological cross-sections were constructed along line AA', BB', CC', DD', EE' by Midland Valley Move Suite (Fig. 5).

Cross-Section AA'

Cross-section AA' is constructed near the eastern periphery of the study area and is oriented along the northwest-southeast direction. This section passes through the western terminus of the anticline and the Zanka Ghar Fault. From north to south traverse along the section (Fig. 5) depicts that the northern flank of the Dan Faqir Anticline is north dipping. The Bahadur Khel. The southern limb i.e. forelimb is characterized by steeper dips as compared to that of the northern limb and this steepness increases further to the east of the study area. The overall facing of the fold is southward, so coherent with the regional tectonic transport vector. Based on the limbs geometry of this fold a subsurface ramp is interpreted.

Cross-Section BB'

The cross-section BB' is constructed to the west of section AA' (Fig. 5) and is also oriented northwest-southeast, passing through the Zanka Ghar Fault and the eastern terminus of the Makori Anticline (Fig. 5). From north to south the cross-section (Fig. 5) shows that the northern flank of the Makori Anticline which is north dipping. The section also shows a low angle thrust fault namely the Zanka Ghar Fault. The hanging wall of this fault is occupied by south facing Makori Anticline. It is interpreted to be detached at the base of Bahadur Khel Salt, which does not crop out at the surface along the fault trace. South of this fault the structural geometry is dominated by folded terrain that comprises overturned folds i.e. a couple of overturned synclines and an overturned anticline. The decoupling horizon for the folds and fault is interpreted to be Bahadur Khel Salt but is not exposed at the surface in the study area and it is interpreted that the folds are associated with the south verging blind thrusts, at the tips of the forelimbs, in the subsurface.

Section CC'

The section CC' is constructed to the west of BB' (Fig. 5) and is oriented north-south, passing through the Makori Anticline and Pir Mela Syncline. From north to south traverse along the section (Fig. 5) depicts that the northern flank of the Makori Anticline is north dipping, ranging from 50°-60° The Jatta Gypsum cores this anticlinal structure whereas the southern limb is mostly overturned. South of this the structural geometry exhibits a couple of overturned syncline and an anticline, followed by the prominent synclinal structure i.e. the Pir Mela Syncline. The attitude data collected over the northern limb ranges from 30°-35°, whereas that of southern limb ranges from 45°-50°. It is interpreted that the decoupling horizon for the folds is Bahadur Khel Salt but is not exposed at the surface.

Section DD'

Section DD' is constructed to the east of the section CC' and is oriented northwest-southeast, passing through the western folded package of Makori Anticline, Banda Daud Shah Fault and the prominent Pir Mela Syncline. From north to south traverse the cross-section (Fig. 5) depicts that the northern limb of the western folded package of the Makori Anticline, which is occupied by a couple of small scale anticline and syncline. The Jatta Gypsum cores this anticline on the surface Whereas the Bahadur Khel Salt which is present in the subsurface core is the major decoupling horizon. Further to the south the section shows a low angle thrust fault namely Banda Daud Shah Fault and the Makori Anticline is present in its hanging wall. This fault is also interpreted to be detached at the base of Bahadur Khel Salt which is not exposed at the surface along the fault trace. South of this thrust the structural geometry is dominated by a folded terrain that comprise open asymmetric folds with gentle north dipping back limbs and comparatively steeply south dipping fore limbs, before it enters into the Pir Mela Syncline. Based on this geometric nature of the folds a series of south verging blind imbricate fan is interpreted at the base of the Eocene rocks.

Section EE'

Section EE' is constructed along the western periphery of the Fig. 5 and is initially oriented northeast-southwest and then north-south, passing through the Dherakki Banda Thrust, Dherakki Banda Syncline, Makori Anticline, Banda Daud Shah Thrust, Manzalai Ghar Anticline and Manzalai Ghar Thrust (Fig. 5). From north to south the cross-section (Fig. 5) depicts that the Dherakki Banda Thrust, passing through northern flank of Dherakki Banda Syncline and emplaces the below lying Chinji Formation over the above lying Nagri Formation. The vergence of the fault is northward i.e. opposite to the regional tectonic transport vector and is interpreted to be detached at the base of Bahadur Khel Salt but is not exposed at the surface.

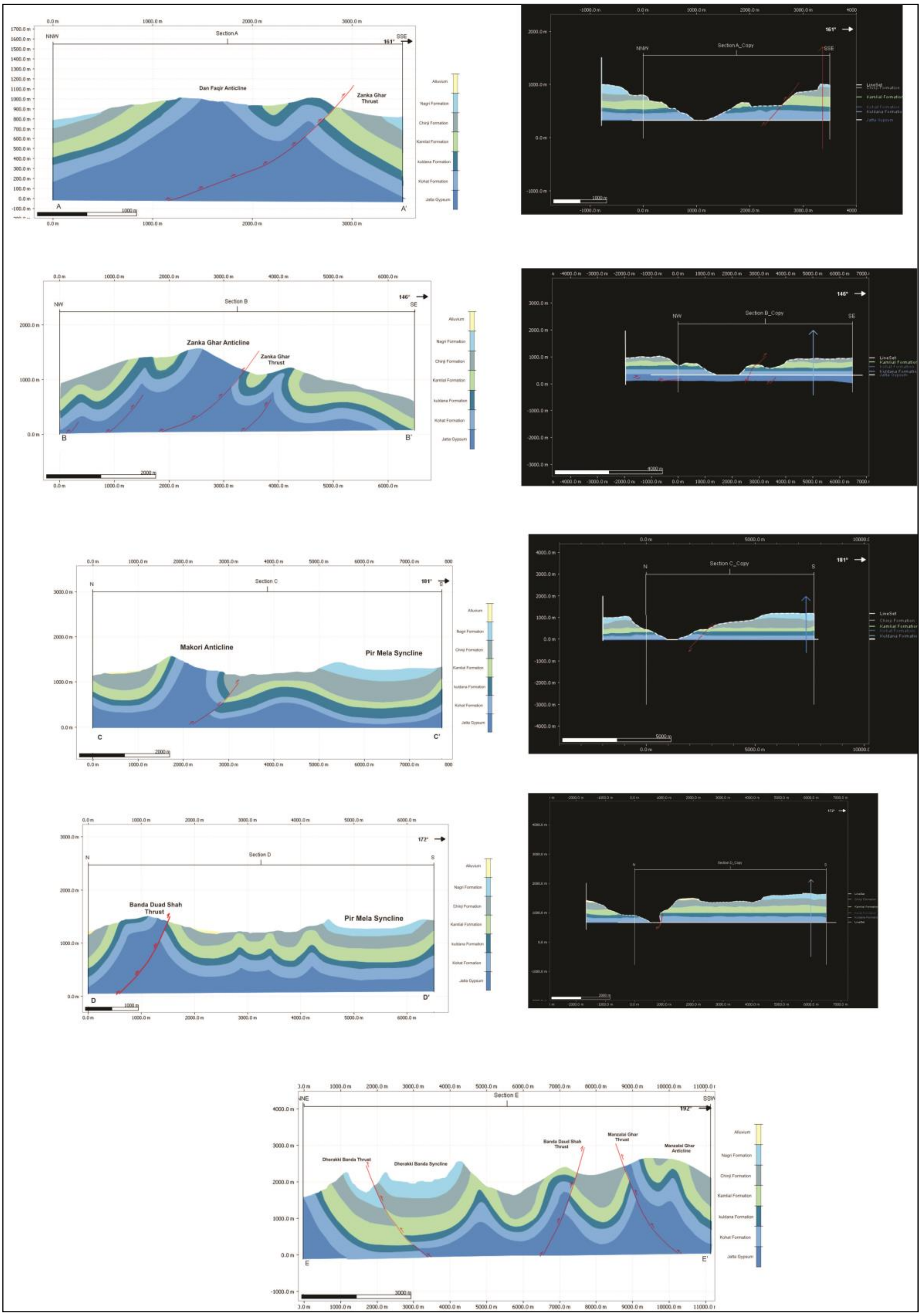

Fig. 5 shows cross sections and their restoration.

Cross section restoration

The restoration of the cross section was done by move suite and by using a two-step process; move on fault and 2D unfolding (Khalid et al., 2020 & 2023; Fig. 5). The restoration shows overall shortening of 20% which shows that Kohat Fold Belt has been subjected to severe compressional forces.

Shortening in Percentage = (Change in length/ Restored length) x 100

Table 1 Restoration of Cross sections

Cross Sections Name	Deformed Length (m)	Restored Length (m)	Change in Length (m)	Shortening Percentage
A	3515.1	4295.2	780.1	18.16
B	6487.4	8448.7	1961.3	23.21
C	7734.3	9720.5	1986.2	20.43
D	6517.7	8163.9	1646.2	20.16
			Average Shortening	20.49

3D Model of the Area

This 3d model represents the continuity of structures across the four cross sections (Fig. 6). Different traverses were prepared mostly perpendicular to the strike and which were internally connected to create a 3d model to represent the geology of the area. It shows the three dimensional geometries of sub surface. The two different types of surfaces have been generated, Kuldana and Kohat formations in the footwall sequence of the Zanka Ghar Thrust Fault. This 3d model represents convex fault geometry. Dip of the fault plane is steep in the central sections and becomes gentle towards limbs which provides easier glide for the strata to glide southward. The convexity of fault plane towards south also represents that the movement along the fault central part enhanced than the movement on sides. The 3D model also represents very nicely closing anticlinal bulge which is shaded as red in the footwall surface.

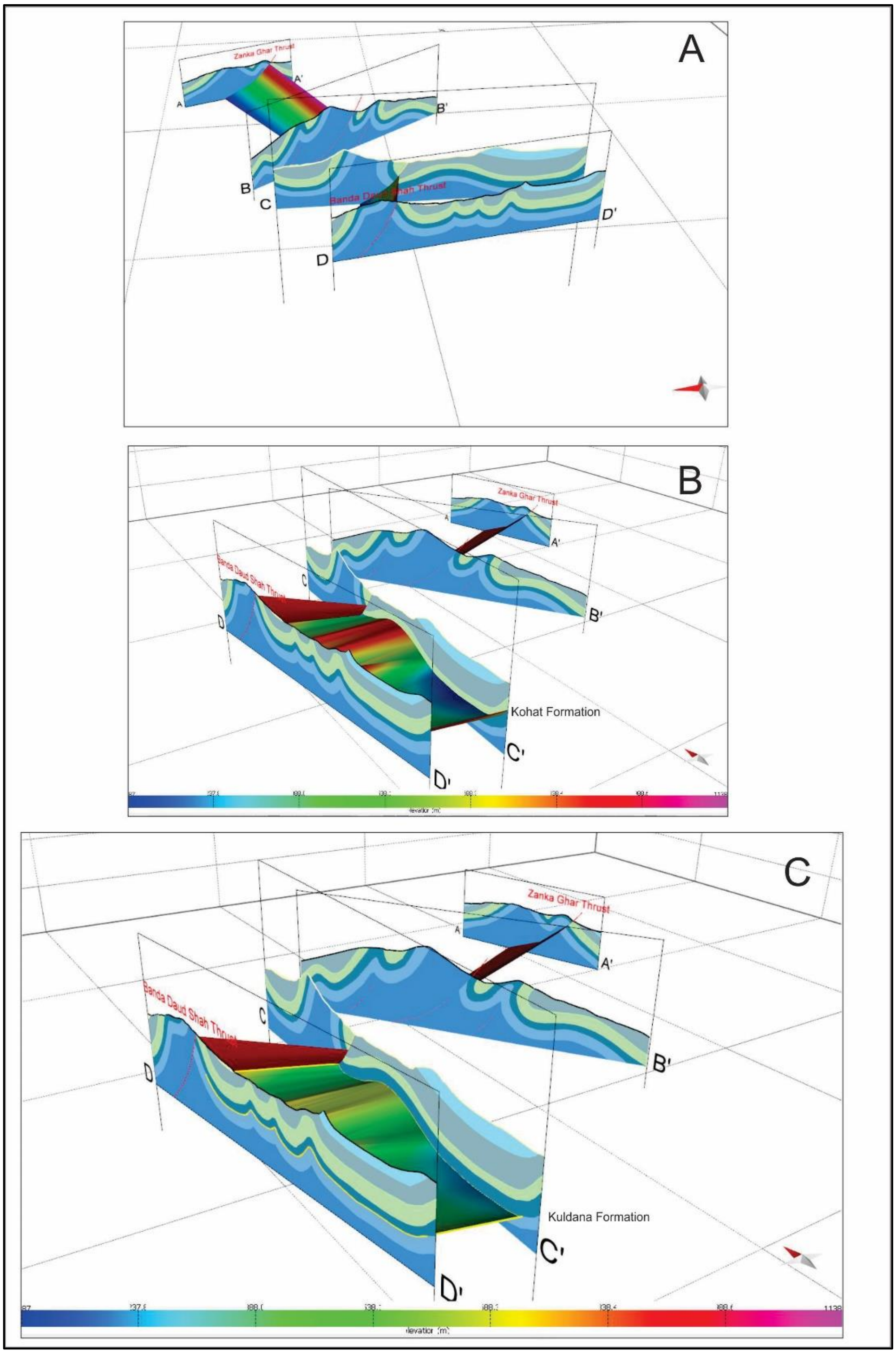

Fig. 6 3D view of four cross section showing structural continuity.

(A) Structural continuity along Zanka Ghar Thrust Fault.

(B) 3D view of Kohat Formation showing Structural continuity

(C) 3D view of Kuldana Formation showing different structural undulation.

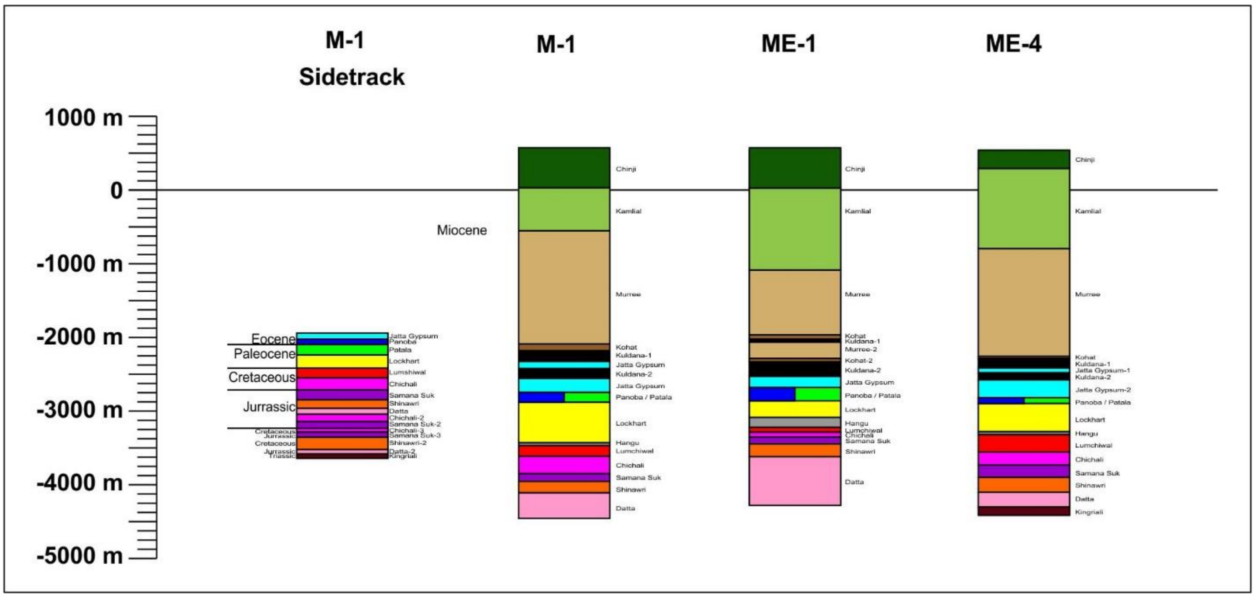

Fig. 7 stratigraphic correlation chart of various wells showing different lithological units in and around the study area.

Discussion and Conclusions

The structural geology interpreted from the cross-sections and well data clearly demonstrates that this part of the Central Kohat Plateau has been deformed in thin-skinned fashion due to tectonic stresses resulting from Indian and Eurasian plates collision (Figs. 5 & 7). The stratigraphic correlation chart shows disharmonic distribution of rocks within and nearby study area.

- The orientation of both small and large scale structures suggests that the area has experienced contractile deformation as a result of mainly north-south oriented stresses.
- The data on the fold limbs suggest a dominant south facing direction and this is also supported by the Banda Daud Shah Fault and Zanka Ghar Fault geometries.
- It seems that a shallow level detachment is present at the base of Eocene evaporites that have served as the main decoupling horizon for the folds and faults.
- The Eocene strata is translating southward on this shallow level and is not deforming as a north translating package of rocks above a passive roof thrust as suggested by the earlier workers (McDougal and Hussain, 1991).
- One of the anticlinal structures of the region i.e. Dan Faqir Anticline exhibits typical limb geometry of a ramp anticline that is detached at the base of Eocene evaporites. This clearly contradicts the earlier idea that the anticlinal folds within the Kohat Plateau are pressure ridges above deep rooted wrench faults. So it can be easily concluded that this part of the Central Kohat Plateau is typical fold and thrust belt with a shallow detachment at base of Eocene evaporites and the structural system is dominantly south verging and has experienced compressional deformation in the north-south direction.

Importance of The Area

The Study area is very important from oil and gas point of view. Four wells have been drilled in and around the area. unfortunately, only limited data is available in public domain. If seismic data and well data is shared, more useful and detailed investigation of the study area can be made. This area is also important for minerals like Gypsum which is being mined in large quantities from different localities of the area.

Acknowledgment

This research work is a part of MSc. research work. The authors are very thankful to the Department of Geology, University of Peshawar for providing field facility. PETEX is highly acknowledged to provide MOVE suite academic licenses to University of Peshawar, Pakistan.

Conflict of interest:

There is no conflict of interest in the research.

Financial Disclosure statement:

The author(s) received no specific funding for this work

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Manuscript received October 10, 2024;
Revision accepted October 21, 2024;
Published October 25, 2024.

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