

MOUNTAIN FRONTS PAKISTAN TECTONIC ORIGIN AND SEDIMENTATION

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Professor & Chairman

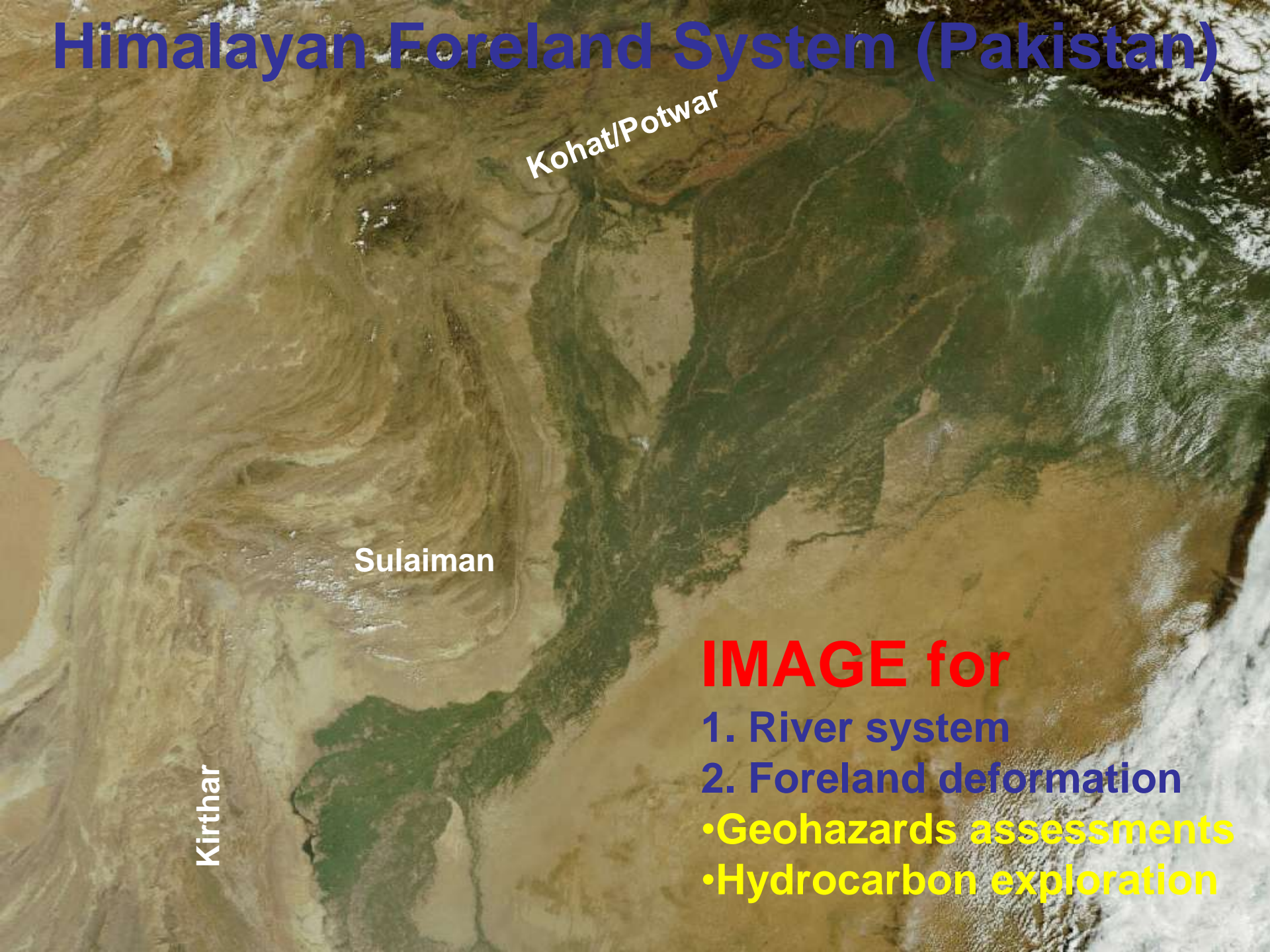
Dept. of Environmental Sciences, CIIT, Abbottabad



**International Planning Workshop “Watershed Management and Land Rehabilitation,
NW Frontier Region, Pakistan”**

(NCE in Geology, University of Peshawar, December 6-8, 2010)

Himalayan Foreland System (Pakistan)



Kohat/Potwar

Sulaiman

Kirthar

IMAGE for

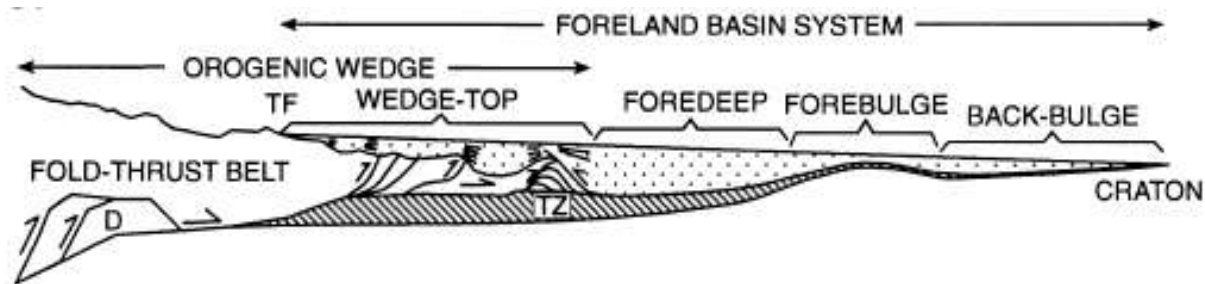
1. River system

2. Foreland deformation

• Geohazards assessments

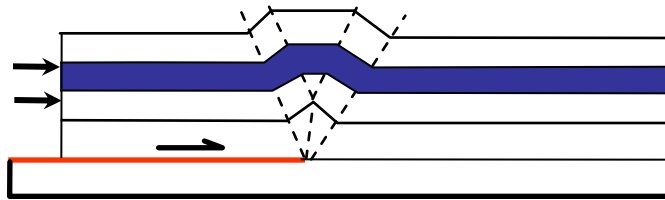
• Hydrocarbon exploration

Mechanics: Foreland Deformation

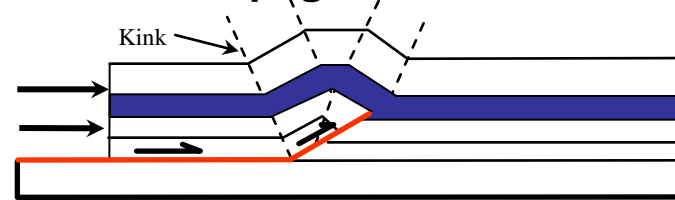


Kinematic Models Of Foreland Deformation

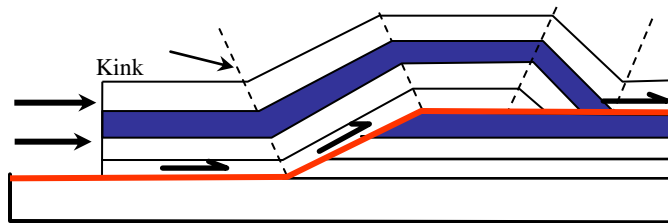
Detachment Fold Model



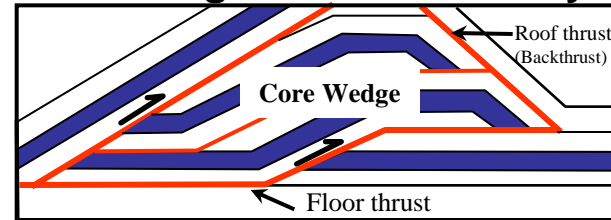
Fault Propagation Fold Model



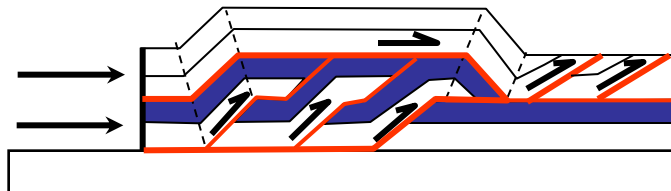
Fault-bend Fold Model



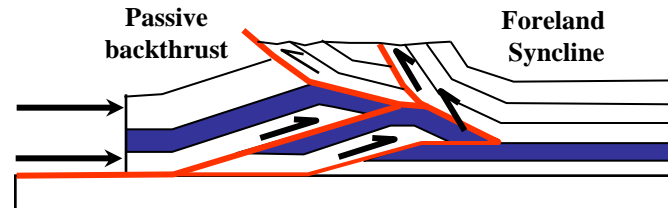
Triangle Zone Geometry



Emergent Allochthonous Roof Duplex

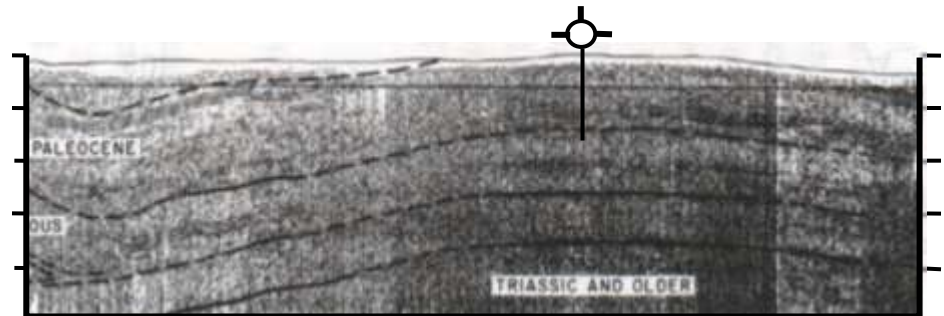


Passive-Roof Sequence



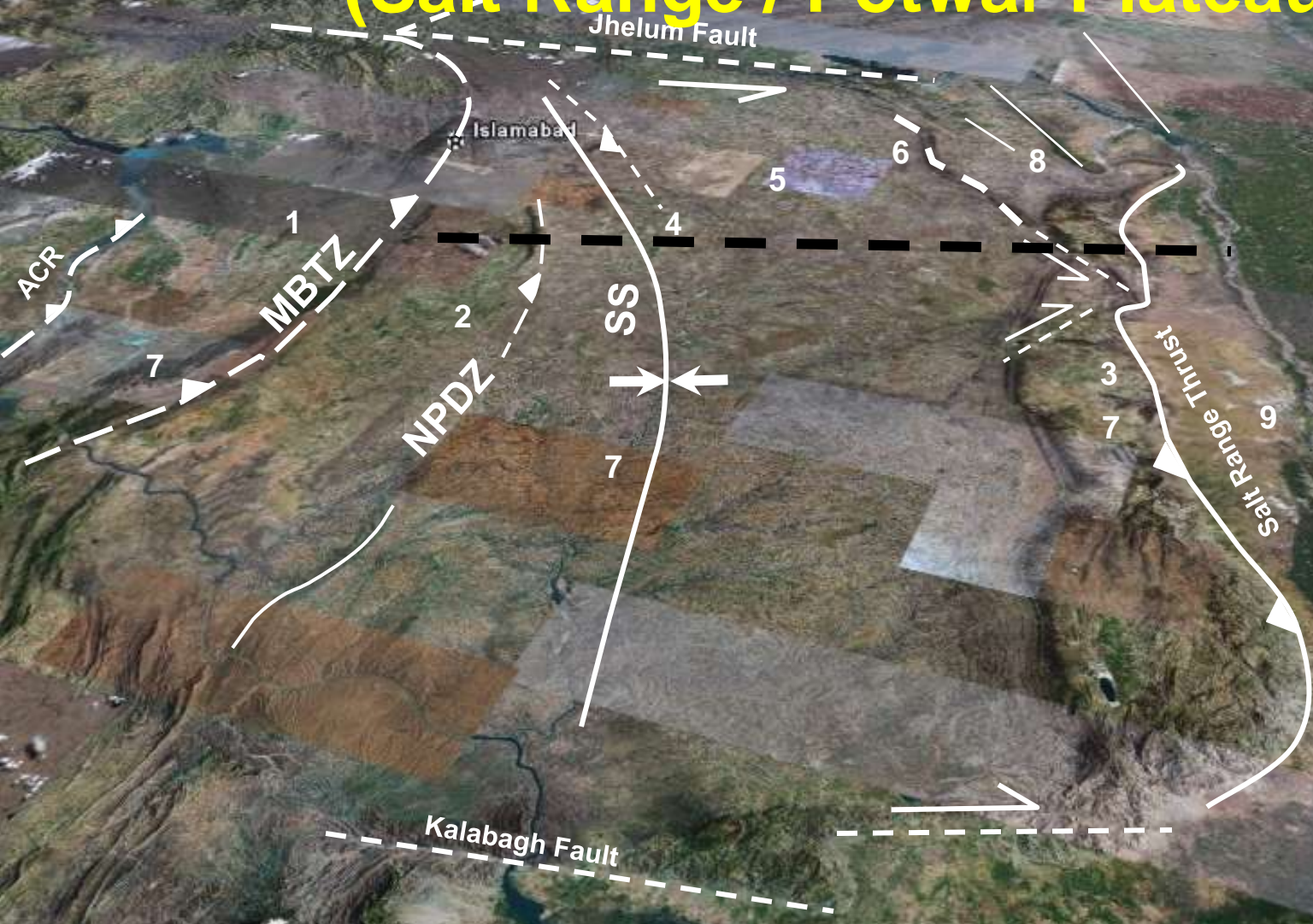
Data

- **Surface geology**
- **Landsat data**
- **Borehole (logs, dips, & image) data**
- **Seismic reflection profiles**
- **Gravity data**
- **Age constraints**
- **Balanced sections**



Nanga Parbat
(8126 m)

Foreland System (Salt Range / Potwar Plateau)

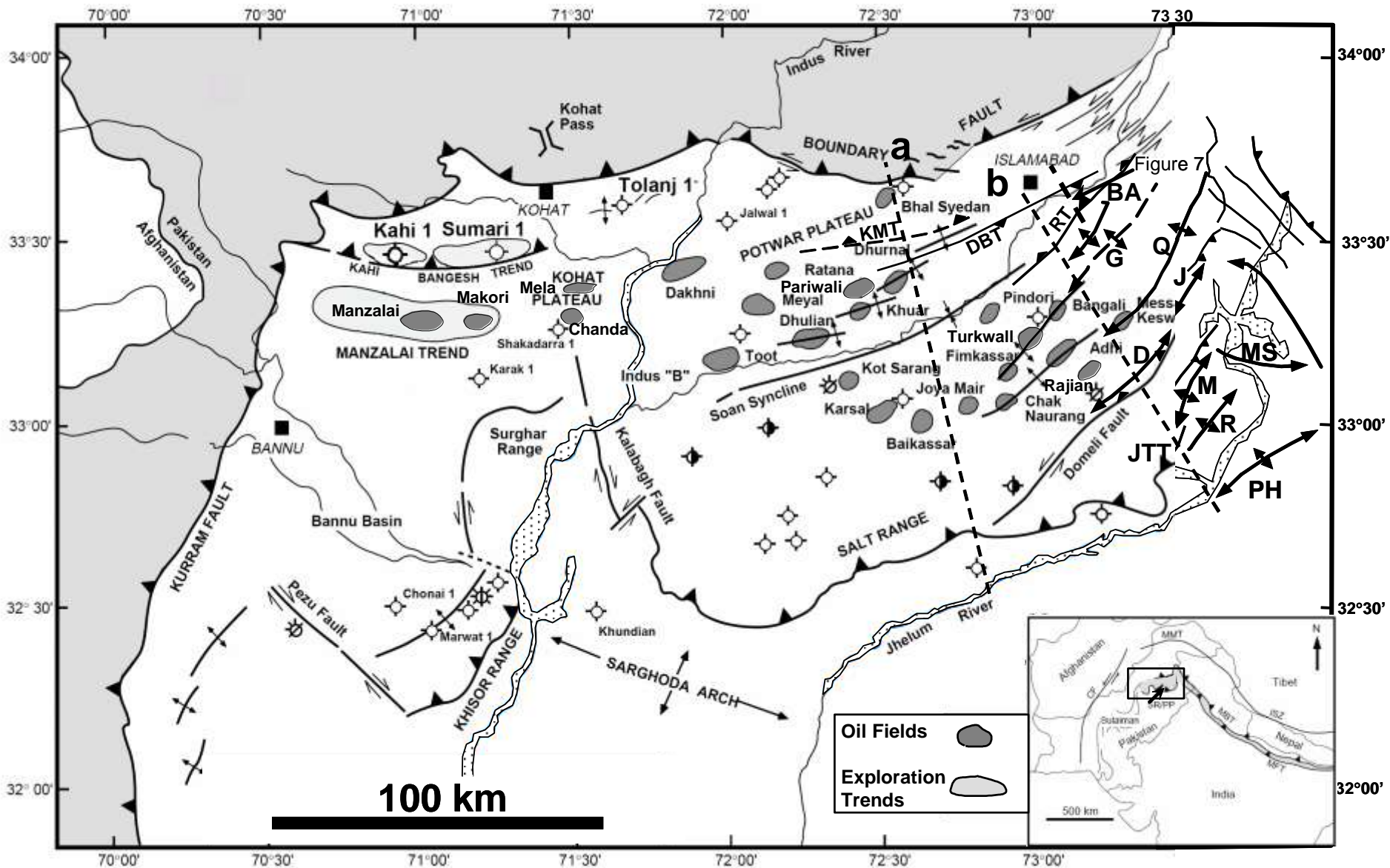


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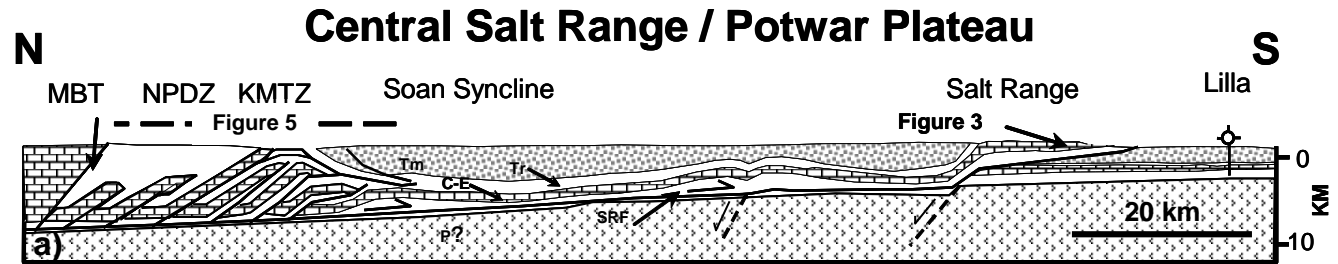
Google

Foreland System & Oil Fields in Kohat/Potwar Plateau

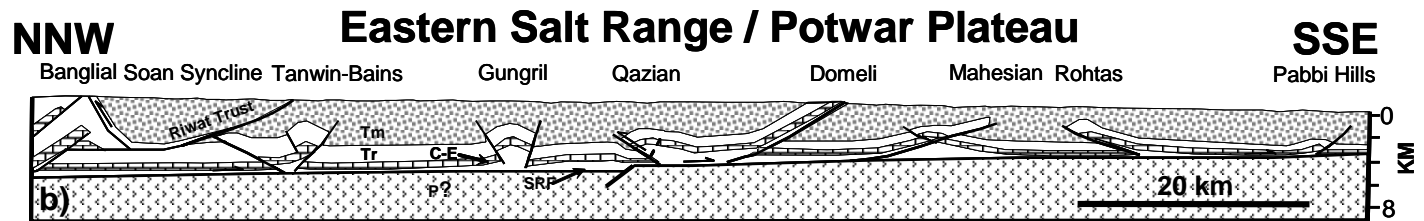


Foreland Deformation (SR/PP)

AGE	FORMATION	SY	
PLIO- PLEISTOCENE	POTWAR SILT		
	0.7 Ma		
MIOCENE	SOAN	Ts	
			5.1 Ma
			DHOK
			8.6 Ma
			10.2
	Rawalpindi Group	Tr	
			13.1 Ma
			KAMLIAL
			18 Ma
			MURREE
EOCENE	CHORGALI		
	SAKESAR		
	NAMMAL		
PALEOCENE	PATALA		
	LOCKHART		
	HANGU		
PERMIAN	WARGAL	C-E	
	AMB		
	SRDHAI		
	WARCHA		
	DANDOT		
	TOBRA		
	CAMBRIAN	BAGHANWALA	
		JUTANA	
KUSSAK			
KHEWRA			
INFRA-CAMB	SALT RANGE FORMATION	SRF	
PRE-CAMB	BASEMENT OF INDIAN SHIELD	P?	

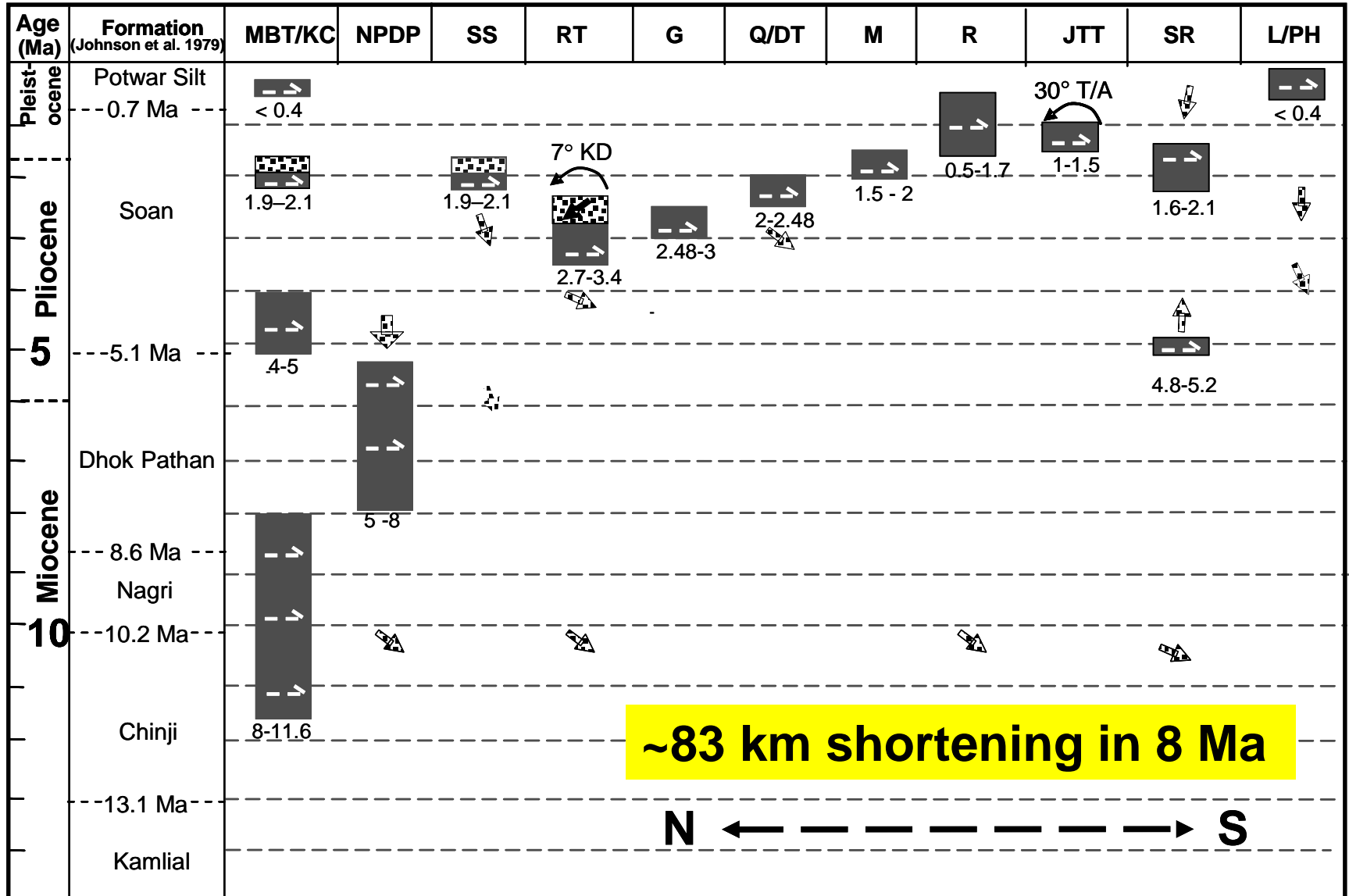


Lillie et al. 1987

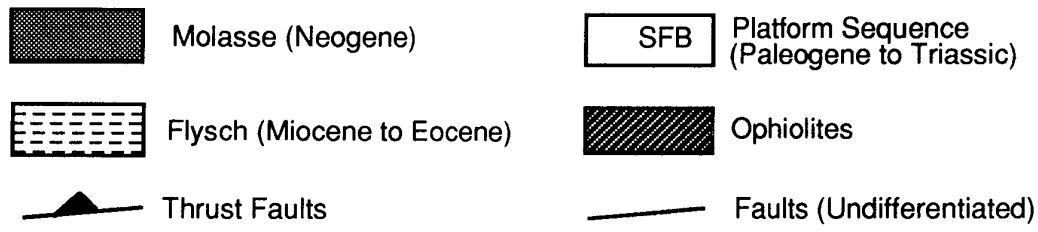
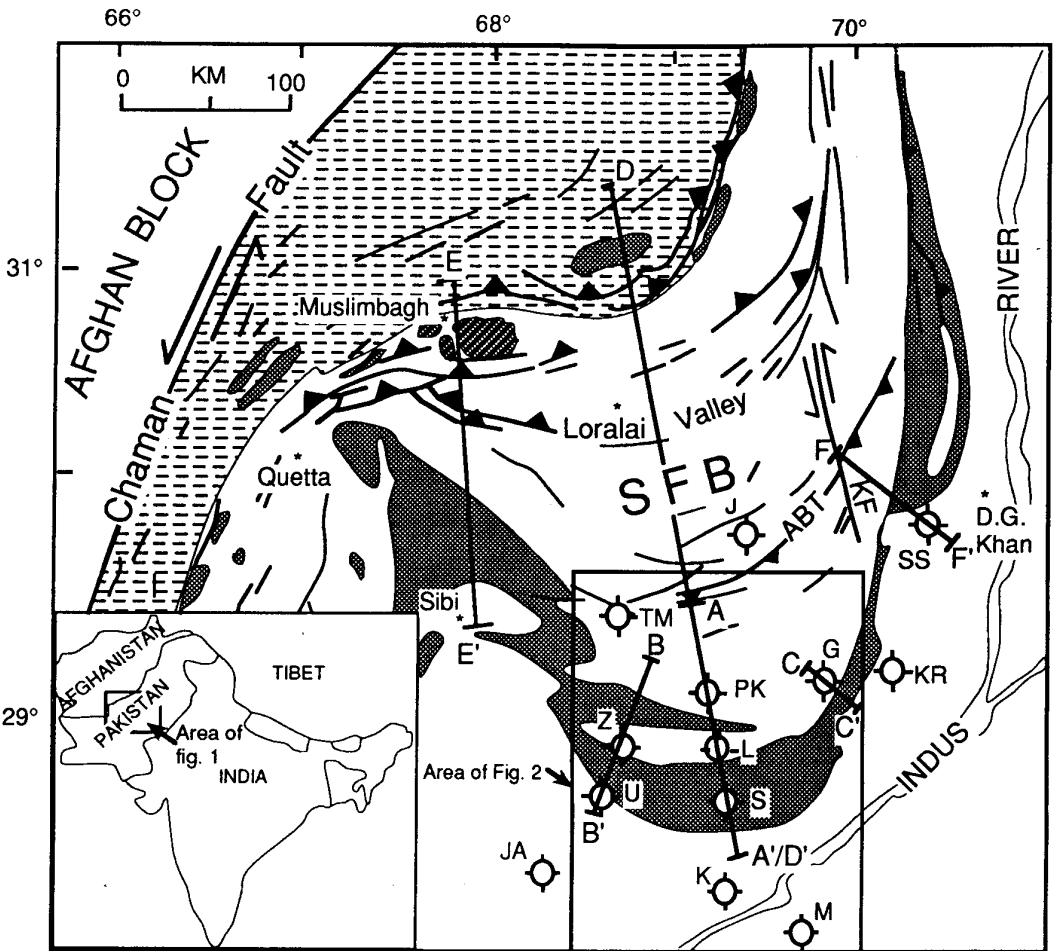
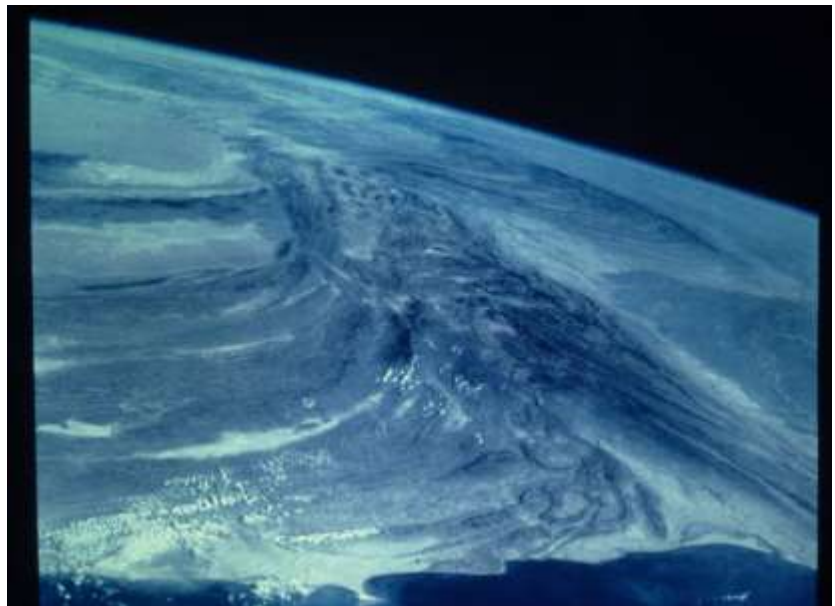


Pennock et al. 1989

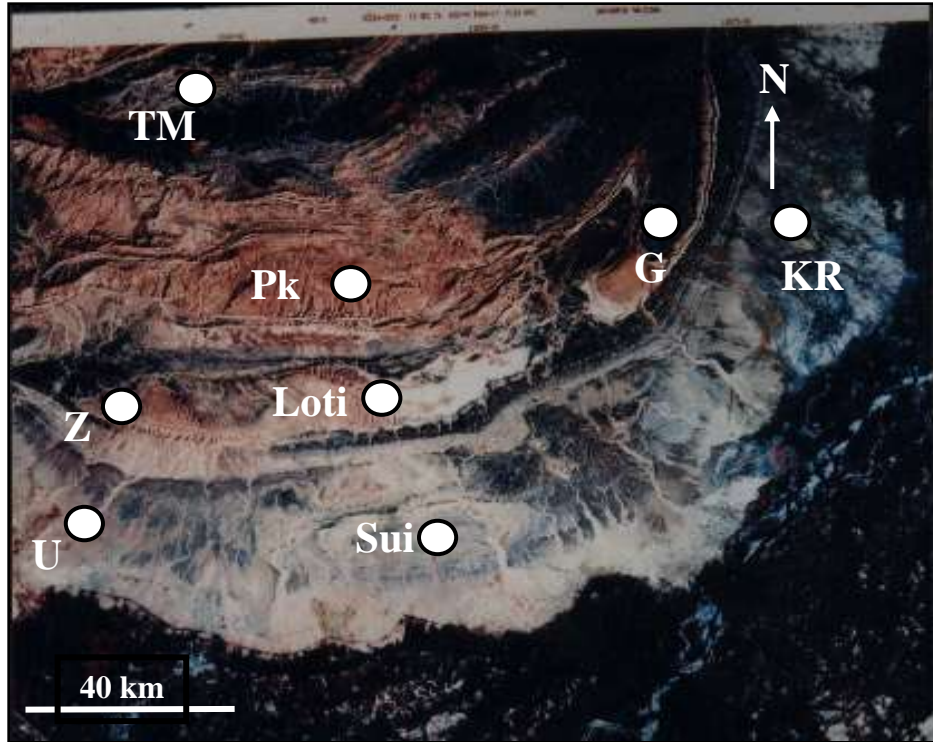
Chronology of Deformation



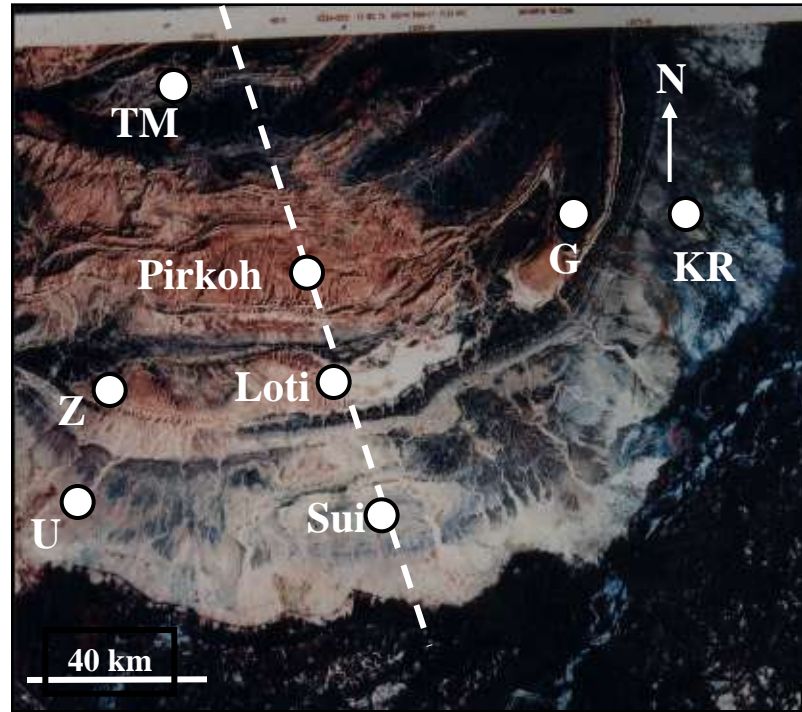
Sulaiman Lobe



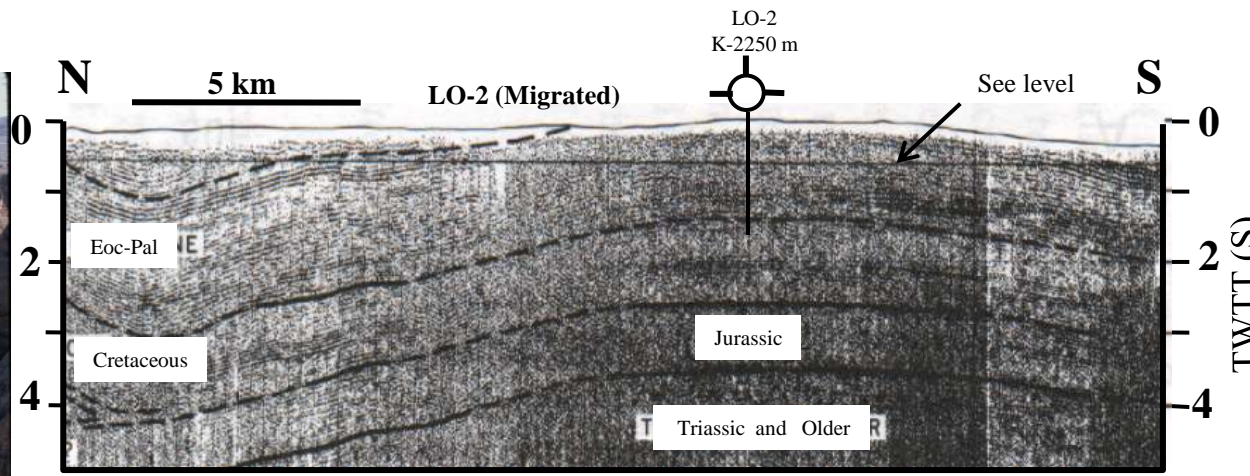
Mountain Front Sulaiman



Sulaiman Foreland

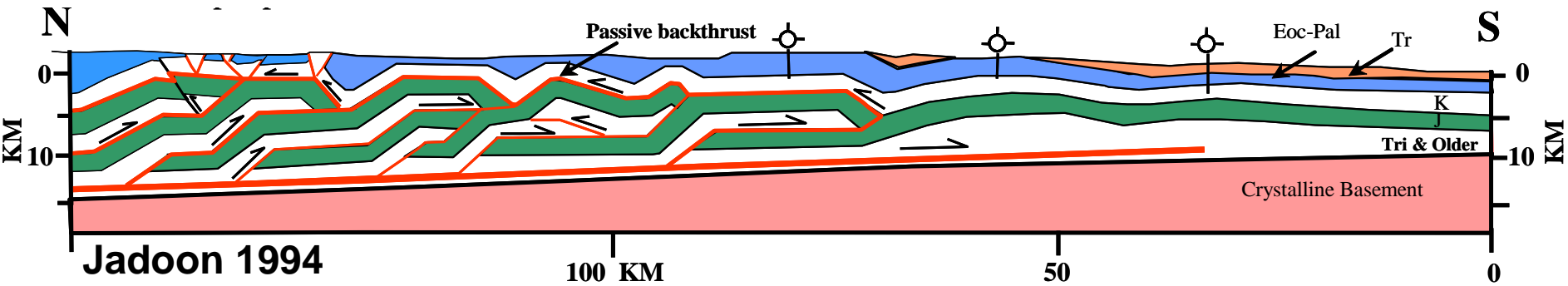


Loti



From Jadoon et al. (1992)

Sulaiman Foreland



Stratigraphic Column & Expression of Rock Types

KM	AGE	FORMATIONS	LITHOLOGY and SEIS. VEL. (app)		SYM-BOLS
5	NEOGENE	SIWALIKS		2500 m/s	Tm
		KIRTHAR		2800 m/s	T(e+p)
	GHAZU				
	DUNGAN RANIKOT				
	CRETACEOUS	PAB		3800 m/s	K
		MUGHALKOT			
		PARH			
		GORU			
	JURASSIC	CHILTAN		4500 m/s	J
		LORALAI			
TRIASSIC	ALOZAI		5000 m/s	Tr	
	PALEOZOIC		5000 m/s	Pal	
10	PRECAMBRIAN	BASEMENT		6000 m/s	



10 km

Loralai Valley

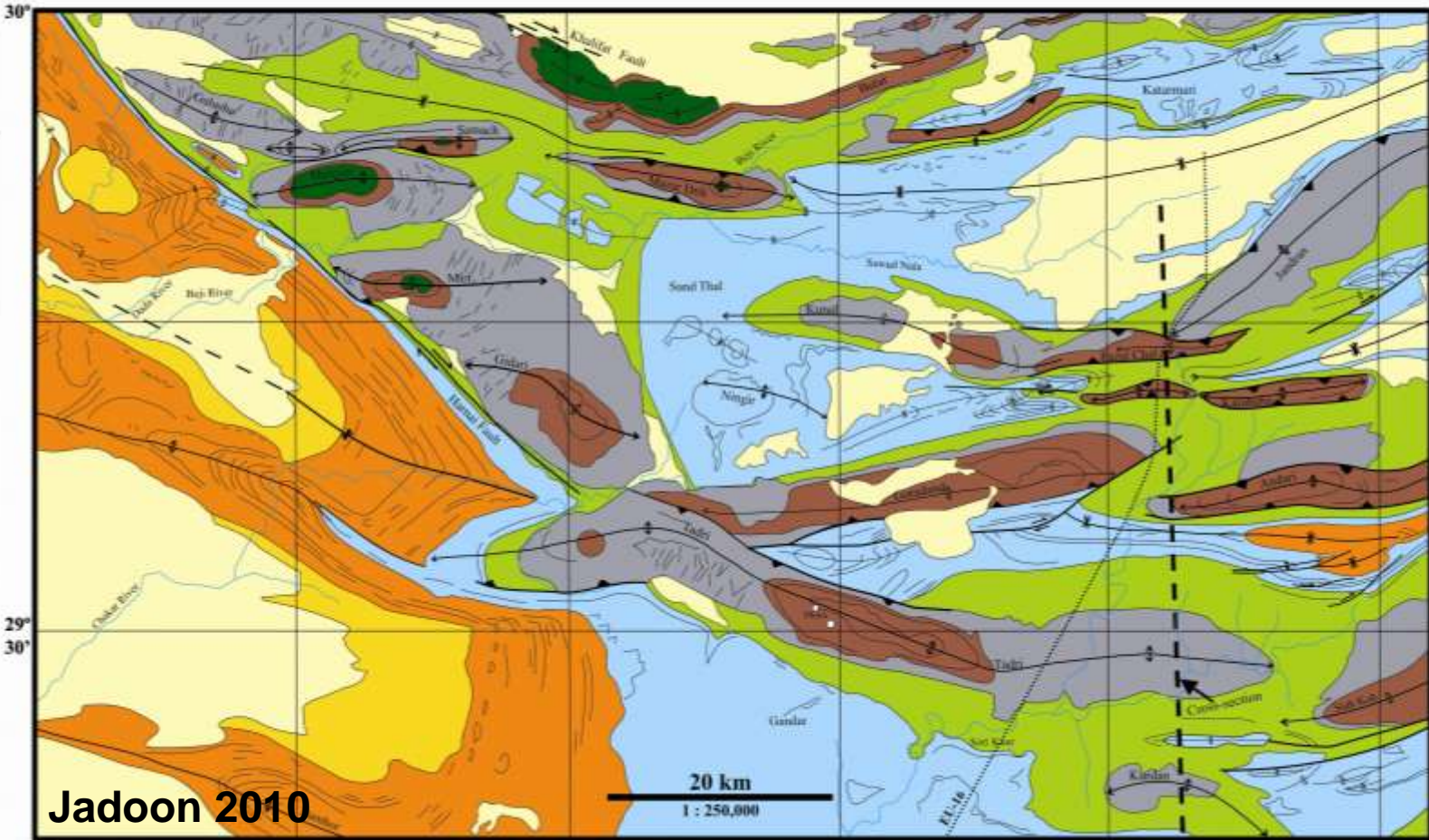


Duki Valley



TECTONIC MAP OF CENTRAL AND WESTERN SULAIMAN FOLD BELT, PAKISTAN

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	Quaternary (Alluvium)
	Quaternary (Dune Complexes)
	Pliocene-Miocene (Himalayan Substratum)
	Eocene (Kirthar) (Chaman, Pab, Gana, Sindh Tect., Magdadi, Pab, Gana, Sindh Tect.)
	Eocene (Illam)
	Paleocene (Gardar, Bander Tect.)
	Cretaceous (Pab, Magdadi, Pab, Gana, Sindh Tect.)
	Jurassic (Sulaiman, Loralai Tect.)
	Folds
	Faults
	Bedding
	Fractures
	Rivers
	Well



Conclusions

- **Kinematic models with presence & absence of faults are applicable to the mountain front Pakistan**
- **Geometry of folds-and-faults influences the foreland geomorphology (distribution of rock types) and river system. It may be accounted for effective watershed management & land rehabilitation**

Thank you

