

# Imperial College Turpan 2002 Expedition Preliminary Report



*“In the footsteps of the Monkey King”*

Report written by Alex Davis and Matthew Brown

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# Imperial College Turpan 2002 Expedition

## Introduction

The expedition aim was a “science led adventure” investigating tectonic geomorphology in the Turpan Basin, Xinjiang Uygur Autonomous Region, NW China. The objectives focussed on mapping geomorphology and geologic features pinpointed using remotely sensed imagery and digital elevation models. This allows an interpretation of the interaction between drainage and erosional processes, and tectonic development in this intermontane foreland basin.

The expedition was carried out from August 18<sup>th</sup> to October 8<sup>th</sup>, 2002. The student team consisted of two postgraduates and one undergraduate from the Earth Sciences and Engineering Dept., Imperial College, London (see table 1). Dr Liu, from the dept., has previous knowledge of the area and advised us on scientific aspects of the expedition.

Parts of the Flaming Mountain field area are on the tourist route e.g. the Bezklik Buddha caves on the western side of the Mutougou River, but the majority of our fieldwork covered the more remote parts of the mountain range. The adventure part of the expedition involved exploring the more remote parts of the mountain range and interacting with the local people. Our contact in the Turpan office of the Seismological Bureau, indicated that the expedition was the first foreign group to spend a significant amount of time in the mountain range.

**Table 1:** Summary of Expedition Members and Host Country Collaborators

Expedition members and collaborators	Name
Expedition Leader:	Alex Davis
Expedition Treasurer:	Matthew Brown
Expedition Member:	Joseph Piggott
Expedition Adviser:	Dr J.G.Liu
Chinese Collaboration: Institute of Disaster Prevention of Xinjiang (formally Seismological Bureau), No.42 South Beijing Road, Urumqi, Xinjiang, China.	Ms Wei Ruping (Foreign Liaison Officer) Prof Shen Jun, (Deputy Director)

This preliminary report outlines the fieldwork timetable and details the logistics and scientific work.

## Expedition Itinerary (What we did in our summer holidays)

The expedition spent six weeks studying the geomorphic development of the Bajada fans south of the Bogda Shan Mountains and their interaction with east-west fold structures in the Turpan basin. The fieldwork was carried out using our initial pre-fieldwork plans, which were modified based on initial reconnaissance and advice from the local Turpan Seismological Bureau office. The pre-expedition fieldwork plan focussed on the following aims and objectives.

### Pre-fieldwork Aims

- To understand the spatial and temporal geomorphologic interaction between the Bogda Shan mountains and the Turpan.
- To reconstruct recent Quarternary evolution of the Flaming Mountains



## *Pre-fieldwork Objectives*

- Map geology and geomorphology along the Flaming Mountains.
- To measure river and terrace profiles.
- To identify and measure geomorphic features.

The itinerary was modified based on advice from an initial meeting with the Seismological Bureau, budget constraints on vehicle hire, and initial reconnaissance which highlighted areas for fieldwork. The fieldwork area was reduced to concentrate on two areas i.e. western end of the flaming mountains and the red mountain folds (see attached image, Appendix 2, showing fieldwork areas). This allowed more efficient and productive use of time to collect the relevant data.

The expedition decided to re-arrange the timetable based on availability of the off-road vehicle and problems with limited access to the central Tien Shan Mountains. The timetable was modified and separated into the following three main sections which focussed from the large scale down to the small scale fieldwork:

Tien Shan Traverse	Regional Overview
Flaming Mountain Reconnaissance	Planning for fieldwork
Flaming Mountain Mapping	Geomorphology mapping

The Tien Shan Traverse was re-timetabled to the first part of the expedition so that we could better plan the more focussed fieldwork based on large scale observations. The route through the Tien Shan is now closed to all foreign nationals so we changed the route of the Tien Shan traverse. We traversed the north side of the Tien Shan and then travelled into the range via a more easterly route. We were still able to observe geomorphic and geologic structures outlined in our original plan.

The Turpan reconnaissance allowed an overview “first look” at the Flaming Mountains. Access routes across and into the mountain range were identified. Overview localities together with the remotely sensed imagery pinpointed key areas for the mapping phase of the expedition. Table 2 (Appendix 1) summaries the expedition timetable of events and indicates the changes made to the original pre-expedition plan.

## **Expedition Logistics and Scientific Measurements (How we did it)**

The expedition changed the original plan logistics based on local conditions. The following summarises travel, accommodation and fieldwork methods and highlights changes made to the pre-expedition plan.

### *Travel Logistics*

International travel to China involved return flights on Turkish Airlines to Beijing via Istanbul. Internal travel to Urumqi, Xinjiang was made using the T69 sleeper train. Local travel in the Urumqi / Turpan area alternated between 4 x 4 off-road vehicle and taxis depending on budget constraints. The budget covered two weeks of 4x4 vehicle hire. A local Turpan taxi was then hired for the remaining fieldwork.

### *Permissions*

Local permissions were obtained by our host country collaborators including local military clearance. This was essential as the fieldwork could not have been done without these permissions.

### *Accommodation*

The accommodation through-out the expedition changed from the initial plan. We were able to afford cheap accommodation for the whole fieldwork which solved several problems including power for digital equipment. Accommodation in Urumqi was based on the academic complex near to the Seismological Bureau. The six day regional overview, covering a large area north and south of the eastern Tien Shan, involved staying at local hotels. Based on advice from the local Turpan Seismological office and the weather conditions, the budget was re-assessed and we were able to afford basic accommodation in Turpan.

### *Scientific Measurements*

Access to the Flaming Mountains was generally good but the expedition still needed to focus on collecting essential data based on the limited fieldwork time. This involved locating features using the remotely sensed imagery and digital elevation model. The systematic data collection focused on:

- Verification of satellite imagery geometric accuracy was made using GPS.
- Altimeter and laser ranged profiles were surveyed for geomorphology of terraces and water gap / wind gaps.
- Structural geology kinematics and strata were measured to allow construction of a structural model.

### **Results**

The main results were the identification of new geomorphic features in the Flaming Mountains. The expedition was the first foreign team to explore this new tectonic geomorphology “natural laboratory”. The expedition has identified and measured the following landscape features new to this area:

- Several wind gaps
- Uplifted palaeo-river channels
- Terraces

Two major wind gaps have been identified which will improve our understanding of the westward evolution of the mountain range. The group measured over **fifty kilometres** of topographic, terrace and stream profiles. Work is currently focussing on processing all field data and collating it with field photos and remotely sensed imagery. Appendix 2 shows the location of the fieldwork areas.

### **Budget Summary Report**

The expedition finances are in a healthy state and are within budget. We currently have a surplus of £214 which will be used for the production of final copy expedition reports including copying and colour printing. The budget is summarised in table 3 (Appendix 3). The sources for expedition funding came from personal contributions and the following:

- Imperial College Expedition Society (£1500 award + £500)
- RGS, £1000 support contributed by RTZ



## **Summary**

The expedition objectives were successfully achieved and exceeded. The excellent preservation of geomorphology and geologic structures allows a reconstruction of recent Quaternary tectonic geomorphic development and evolution. This new area has been identified as a potentially important area for tectonic geomorphology research in this part of China.

## **Expedition Report**

The following draft chapter headings outline the expedition report which will be available next May.

### Abstract / Overview

#### Introduction

- Location
- Local geography
- Aims and Objectives
- Expedition Methodology
- Pre, Syn and Post expedition planning

#### Data

- Remote Sensed Imagery
- Digital Elevation Models
- Fieldwork measurements

#### Results

- Geology Mapping
- Geomorphology

#### Interpretation

#### Conclusions / Summary

#### Further Work

#### Bibliography / References

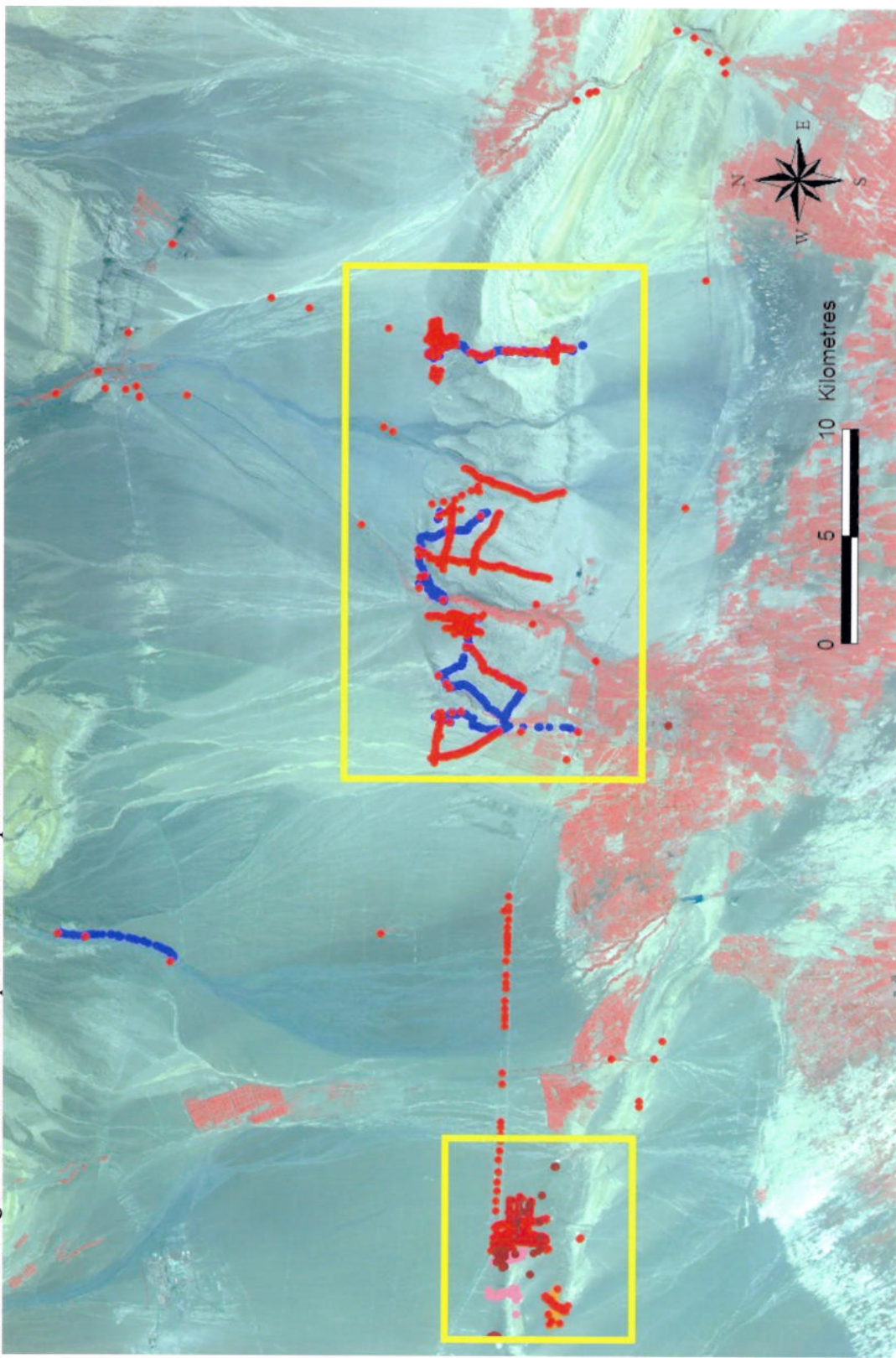
**Appendix 1. Table 2. Revised itinerary / timetable**

<b>Date</b>	<b>Description</b>
18	Flight to Beijing via Istanbul 11.45am
19	Landed at 12.15, train to Urumqi at 7.55pm (T69)
20	Train
21	Arrived Urumqi train station at 20.00pm, stayed at hotel near Seismological Bureau off Beijing Road
22	Logistic planning, meeting at Seismological Bureau
23	Logistic planning and supply buying
24	Tien Shan Traverse
25	Tien Shan Traverse
26	Tien Shan Traverse
27	Tien Shan Traverse
28	Tien Shan Traverse
29	Tien Shan Traverse (Turpan reconnaissance), drive back to Urumqi
30	Rest day
31 September	Tien Shan Traverse (Glacier No.1)
1	Drive to Turpan
2	Turpan Reconnaissance, road traverse from grape valley to range front.
3	Turpan Reconnaissance
4	Turpan Reconnaissance
5	Turpan Reconnaissance
6	Rest day
7	Water gap (no.5) traverse (Foutugou)
8	Water gap 4 profiles
9	Water gap 4 profiles
10	Water gap no.2 (grape valley) traverse
11	Wind gap 1 traverse
12	Rest day
13	Reconnaissance west of grape valley
14	Profile traverse of wind gap 1& 2
15	Structural traverse of water gap 6 (Shenginko)
16	½ day bank stop, terrace profile southern end of water gap 5 (seven wells)
17	Range front traverse
18	Rest day. Alex goes to Urumqi to sort out bills
19	Structural traverse of water gap 7
20	Small wind gap profile traverses west of water gap 2
21	Red Mountain Folds (RMF) general traverse
22	Profile traverse of RMF east streams
23	N-S traverse of RMF east streams
24	Rest day
25	West end tip traverse of FM
26	Profile traverse of wind gaps 1 & 2
27	RMF stream traverse
28	Water gap 6
29	Structural traverse of RMF
30	GPS survey traverse of RMF
1 October	Aiding lake, travel back to Urumqi

2	Urumqi
3	T70 train to Beijing (11.45am)
4	Train back to Beijing
5	Arrived in Beijing at 11.55 a.m
6	Beijing
7	Beijing sightseeing, flight to London at 23:55pm
8	Arrived at Heathrow at 10.30am



**Appendix 2.** Satellite image mosaic of the Flaming Mountains, Turpan Basin with overlain geospatial data. Red tones in the image indicate vegetation. Blue and red dots / lines indicate GPS localities and topographic profiles and topographic profiles positions. Yellow boxes indicate the two main fieldwork areas identified during the reconnaissance phase of the expedition.





Appendix 3 : Table 3, Turpan 2002 Summary Expenses

Income		Field Expenditure						
Source	Sterling	Tien Shan	Flaming Mountains	Between phases	Other Costs	Flaming Mountains	Between phases	Other Costs
IC Exploration Board	2000	1065	4680	1964	Air tickets	4680	1964	1546.2
Royal Geographical Society	1000	755.5	2944.5	303.3	train tickets	2944.5	303.3	435.48
IC Remote Sensing Unit	300	3735.6	4609		Visas	4609		80
Alex Davis	710	215	150	100	Film	150	100	180
Matthew Brown	500		3486		admin fee	3486		80.65
Joseph Piggott	500		3000		seismological bureau	3000		133.72
			1356.2	360	"other stuff"	1356.2	360	
			20225.7	2727.3		20225.7	2727.3	
			488.52	219.94		1631.1	219.94	
<b>Total Income</b>	<b>5010</b>							
<b>Total Expenses</b>	<b>4795.6</b>							
Surplus for report production (IC RSU contrib)	214.39							

Exchange Rate  
Sterling / RMB  
12.4