# Growth of the north Pamir since ~12 Ma and its paleoclimate implications

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**Lin Li[1*], Guillaume Dupont-Nivet[1,2], Pierrick Roperch[1], Yani Najman[3], Mustafa Kaya[2], Niels Meijer[2], Jovid Aminov[4]**

*[1] University of Rennes 1, France; [2] Potsdam University, Germany; [3] Lancaster University, UK; [4] Academy of Sciences, Tajikistan; [*] li.lin8611@gmail.com*

**ABSTRACT:** This study reports a new sedimentary section from the eastern Tajik Basin, that was dated to deposit between ~20–8 Ma by magnetostratigraphy. Detrital zircon U-Pb age spectra indicate sediment source shift from the central Pamir to the north Pamir at ~12 Ma; sediment accumulation rate also increased significantly from 240 m/Myr to 780 m/Myr at ~12 Ma; and starting from ~12 Ma, there was also a negative shift of the carbonate stable oxygen isotopic values. These multiple lines of evidence indicate that the north Pamir experienced strong tectonic deformation and started to grow upward since ~12 Ma. We infer that the topographic growth of the north Pamir and closure of the moisture transport channel between the north Pamir and southwest Tian Shan since ~12 Ma caused enhanced aridification in a broad region of northwest China.

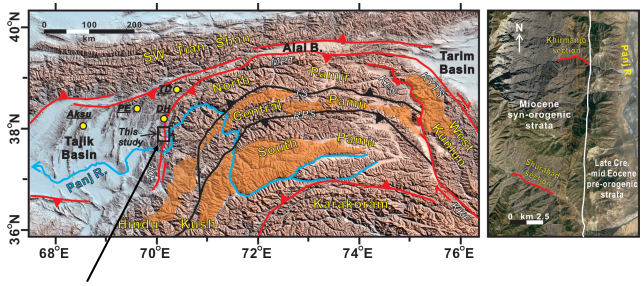
## 1. Introduction

The Central Asia experienced several phases of aridification after the final retreat of the Para-Tethys sea at ~37 Ma. These aridification events have been variously interpreted as the results of the retreat of the Para-Tethys sea, global cooling or surface uplift of the Central Asia mountains (e.g., Pamir Plateau and Tian Shan). It's, however, difficult to determine the dominant controlling factor for a specific aridification event, especially the significance of the Central Asia mountains.

The south and central Pamir Plateau have been suggested to be deformed mainly during the Late Cretaceous and Oligocene, respectively. However, the deformation history of the north Pamir was subject to arguments between Cretaceous and Neogene times.

The Tajik foreland basin was formed in response to the northward indentation of the Pamir Plateau. The sedimentary rocks of the basin record the tectonic evolution of the plateau. This study dated a new stratigraphic section from the Tajik Basin and reported new provenance and stable isotope data to predict source terrane tectonic evolution.

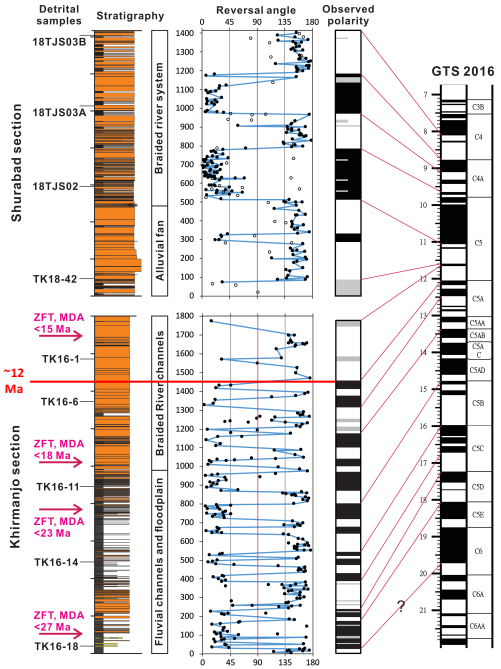
## 2. Geological Background




**Research target:** A combined sedimentary section on the eastern edge of the Tajik Basin, that includes two sub-sections with slight overlap: the lower Khirmanjo section and the upper Shurabad section.

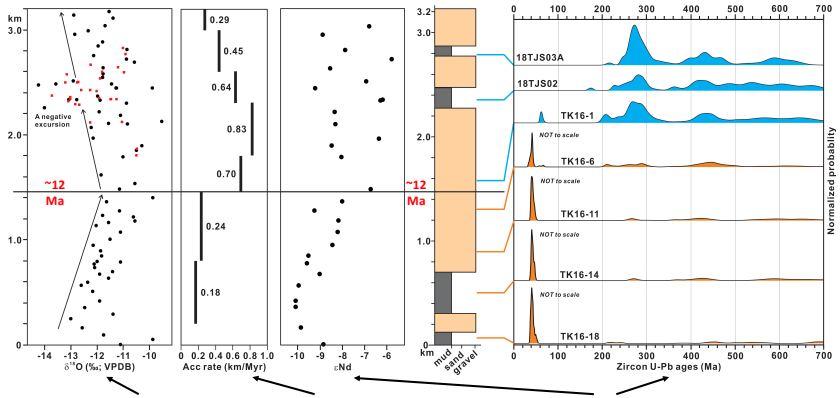
## 3. Litho- and magneto-stratigraphy

- 533 oriented samples with 378 accepted data for determination of magnetic polarities;
- Additional age constraints from ZFT ages of a nearby section (DH; *Chapman et al., 2019*).




- Dominated by fluvial and alluvial deposits;
- Most likely deposited between ~20-8 Ma;
- ~14.5 Ma onset of dominantly conglomerate deposits.

## 4. Concurrent tectonic changes at ~12 Ma




Negative $\delta^{18}O$ shift since ~12 Ma most likely caused by surface uplift of the north Pamir.

Increase of accumulation rate at ~12 Ma indicates strong deformation in the north Pamir.

Provenance change at ~12 Ma from the central Pamir to the north Pamir.

## 5. Conclusions

- Our provenance, sediment accumulation rate and carbonate stable oxygen isotope data provide strong evidence to support that the north Pamir experienced deformation and surface uplift since ~12 Ma, which was concurrent with the initiation of the tectonic inversion of the Tajik Basin and rapid exhumation of the southwest Tian Shan (*Abdulhameed et al., 2020*).
- We argue that the ca. ~12 Ma aridification event observed from the northeastern Tibetan Plateau to the southwest Tarim Basin was not caused by growth of the Tibetan Plateau to block the southernly monsoon moisture (e.g., *Dettman et al., 2003*), but as a result of the topographic growth of the north Pamir and closure of the Westerly moisture transport channel between the north Pamir and southwest Tian Shan since ~12 Ma.