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Interactive comment

Interactive comment on “Three-dimensional structural model of the Qaidam basin: Implications for crustal shortening and growth of the northeast Tibet” *by* Jianming Guo et al.

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Dear reviewer:

I am very grateful to your comments for the manuscript. According with your advice, we amended the relevant part in manuscript. Some of your questions were answered below.

Comment:

This paper deals with the geological evolution of a basin in the Tibetan Plateau. The theme is very interesting overall because it deals with the geological evolution of an interesting and very complex area. The methodology is innovative and the used tools

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are surely useful. Nevertheless, the paper lacks of data. These are poor or not presented in an exhaustive way. For example, the geometry and kinematics of the faults have not been well documented, as well as the stratigraphy of the basin. In fact, the relationships between structures and sedimentation are primary analyses to be done dealing with evolution of a basin. This is completely omitted in the paper. Also the seismic interpretation needs of more strong geological constrains. This is why, in my opinion, this paper has to be improved a lot before to be published.

Answer: In the revision, we have re-organized the manuscript and added some description. More about the Altyn Tagh fault:

The Altyn Tagh fault extends for at least 1,500 km from the west Kunlun thrust zone in the southwest to the edge of the Qilian mountains in the northeast. It is divided into three main sections: southwestern, central and northeastern. There is one major splay fault, the north Altyn fault. The main active fault trace of the fault lies within a zone of secondary structures that is about 100 km wide in the central section; The horizontally offset gully, which have been displaced from several meters to several hundred meters, and vertical fault plane, which has an 82° dip and 76° strike, indicates it is a left-lateral strike-slip fault (Fig. 3b, 3d), meanwhile the uplifted fault scarp and 11° oblique striations on the fault plane means that the fault has a vertical component (Fig. 3c, 3e). The thickness of the fault core is over several hundred meters on the outcrop (Fig. 3d). Faults and folds extending northward are cut and terminated by the Altyn Tagh fault.

we added a paragraph to describe the stratigraphy:

Cenozoic strata in the Qaidam basin, over 15 km in total thickness, contains a continuous sequence of lacustrine sediments, and the depositional center of the basin shifted progressively towards the east during Cenozoic times. The shift was accompanied by uplift in the west and subsidence in the east of the basin. Cenozoic stratigraphic division and age assignments across Qaidam basin are based on outcrop geology and its correlation with subsurface well data. The units are: Paleocene to early Eocene of the Lulehe formation (65–52.5 Ma); middle Eocene of the lower Ganchaigou formation (52.5–42.8 Ma); late Eocene of the lower Ganchaigou formation (42.8–40.5 Ma); late Eocene to Oligocene of the upper Ganchaigou formation (40.5–24.6 Ma); early to middle Miocene of the lower Youshashan formation (24.6–12 Ma); late Miocene of the upper Youshashan formation (12–5.1 Ma); Pliocene of the Shizigou formation (5.1–2.8 Ma); and late Pliocene to Quaternary of the Qigequan formation (2.8 Ma–present) (Zhou et al., 2006). Paleocene and Eocene strata has a few small outcrops in northern Qaidam but are not widespread in the rest of the basin. Oligocene strata are more widespread and include lacustrine rocks within the lower Ganchaigou formation in north-western Qaidam. Lacustrine deposition was also widespread in Qaidam during the Miocene, whereas lesser amounts of lacustrine strata are present in lower Pliocene sections. Upper Pliocene and Quaternary sections are generally coarser grained fluvial and alluvial deposits, which are quite thick and reflect high sedimentation rates. Where thickest, Oligocene–Miocene strata exceed 3 km, whereas Pliocene and Quaternary sections in places exceed 5.5 and 2.8 km, respectively (Hanson et al., 2001).

About the seismic interpretation:

A total of 17 seismic lines were gathered, and the total length is over 3400 km, from a single length of 80 km to 450 km. Two-way time of seismic reflection is 6 seconds (Fig. 4), and seismic lines are parallel and perpendicular respectively to the structural direction. Seismic project datum is 2772 m.

A total of 9 wells were used to time-depth conversion, and these wells are located in the vicinity of seismic lines. The depth of wells ranges from 3000 to 6000 m. Well logging data are mainly sonic logs, density logs, and Geological strata data.

The synthetic seismograms were used for the seismic and geologic horizon calibration. Combined with drilling data, the geological horizon system of the basin was established, and the seismic reflection characteristics of each layer was basically defined.

T6 is the bottom of Mesozoic (M) and the top reflection of bedrock. It is an unconformity surface and the low frequency is continuous, when the waveform changes strongly in the west of the basin. Whereas it is clear and reliable in the east of the basin. TR is the bottom reflection of E1+2. It is major angular unconformity in the basin, and is a phase axis under 2-3 continuous strong phases. Due to distinct characteristics, TR is a standard reflection in the basin.

T5 is the bottom reflection of E31. It is characterized by the high amplitude, continuous features.

T4 is the bottom reflection of E32. It is a standard reflection in the basin. It is characterized by 2 phase, strong amplitude and continuous reflection under a set of blank reflection in the western basin. In the eastern basin, it lies at the top of a group strong reflection.

T3 is the bottom reflection of N1. It shows medium-high amplitude and continuous reflection. In the west of the basin, the wave energy becomes weak.

T2 is the bottom reflection of N21. It is a 2 phase, strong amplitude and continuous reflection. The variation of amplitude becomes large and continuity becomes poor in the eastern margin of the basin.

T2ĖŁ is the bottom reflection of N22. It is a regional unconformity, and reflection is continuous except margin and eroded area.

T1 is the bottom reflection of N23. In the depression, it has good continuity, whereas it becomes unrest at the margin.

T0 is the bottom reflection of Q. It shows 1-2 phase, medium-high amplitude, and continuous features in the depression, whereas the reflection is not stable at the margin, and at some area it is missing due to the erosion.

After completing seismic and geologic horizon calibration, the results were taken into the seismic profiles to establish the interpretation network. Through repeated compar-

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ison, repeated modification of the drilling and seismic data, the seismic and geological layer system of the whole basin was built up.

I hope that my response can clarify your concern.

Sincerely,

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