Sequence Stratigraphy of the Lower Cretaceous in Aer Sag, Erlian Basin, North China

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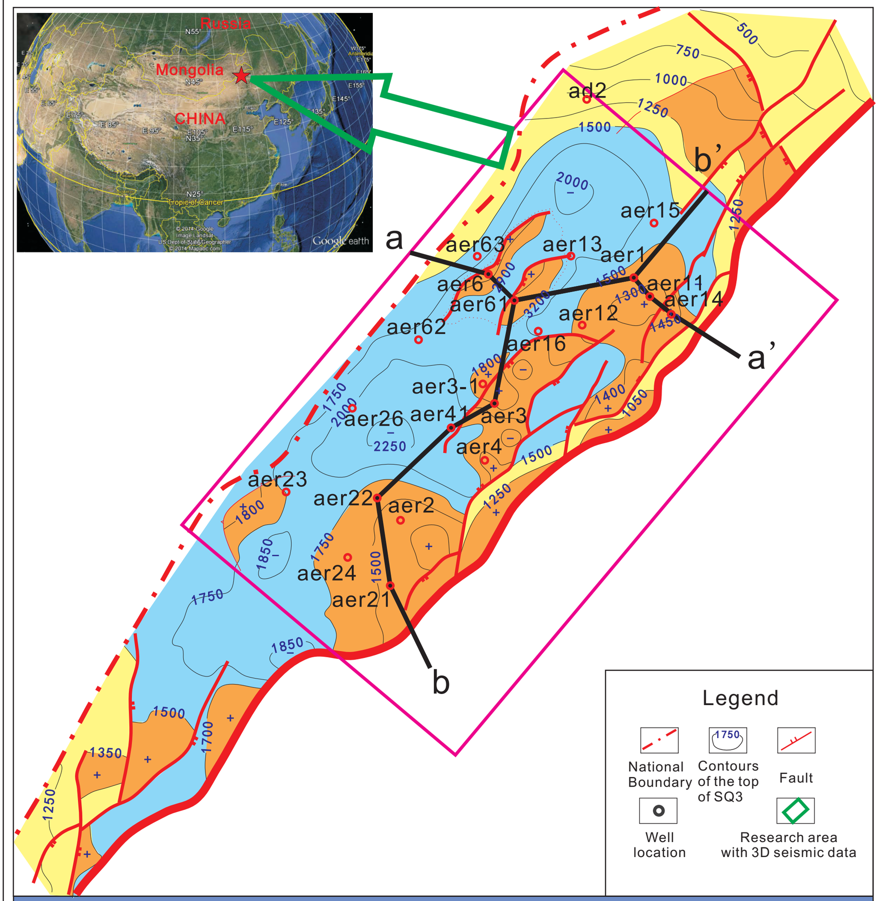


Fig 1. Location of Aer sag and reseach area

Introduction

Aer Sag is a Cenozoic lacustrine half graben on the basement of Hercynian fold belt in Erlian Basin, Northeast China (fig. 1). It is about 20-30km wide, 80km long, with an area of about 2000km^2. As sequence stratigraphy is becoming a more and more important tool in lacustrine basin petroleum exploration especially for lithologic reservoir, it is crucial to build the sequence stratigraphy framework of the principle petroleum exploring target, namely the Lower Cretaceous formation. In this research, the lower Cretaceous formation has been divided into six third-order sequences of which the lower four are analyzed in detail based on seismic, well log and core data.

Subsidence Rate

Basin modeling result(fig 2) shows that each sequence has its own characteristic on subsidence. For SQ1, the boundary fault is not active, so the subsidence rate is very low. For SQ2,SQ3 and SQ4, the subsidence rates are much higher. When it comes to SQ5 and SQ6, the subsidence rates decrease dramatically. As a balanced-fill basin(Lin et al., 2001), the accommodation is mainly created by basement subsidence. Different subsidence rates yield different accommodation creation rates and then effect the sequence stratigraphic framework in each sequence.

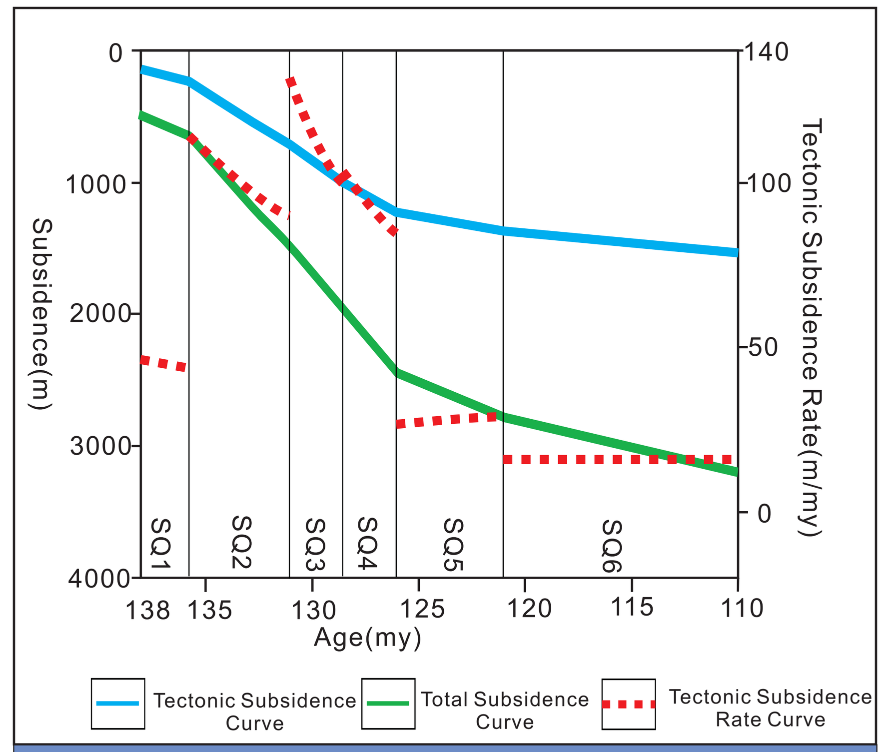


Fig 2: Subsidence Curve and Tectonic Subsidence Rate

Isopach of Sequence and Sand Body

- In SQ1(fig 4A), the sediment area is limited and the subsidence center is controlled by the faults in the middle of research area.
- In SQ2(fig 4B), the boundary fault controls the thickness of formation and confine the subsidence center on the east side of hanging wall.
- In SQ3(fig 4C), there are two subsidence center in the east and west side.
- In SQ4(fig 4D), the subsidence center moves to the middle of research area.
- From LST to TST(fig 5A→B), an evident retrogradation can be observed.
- From TST to HST(fig 5B→C), an obvious progradation is showed.

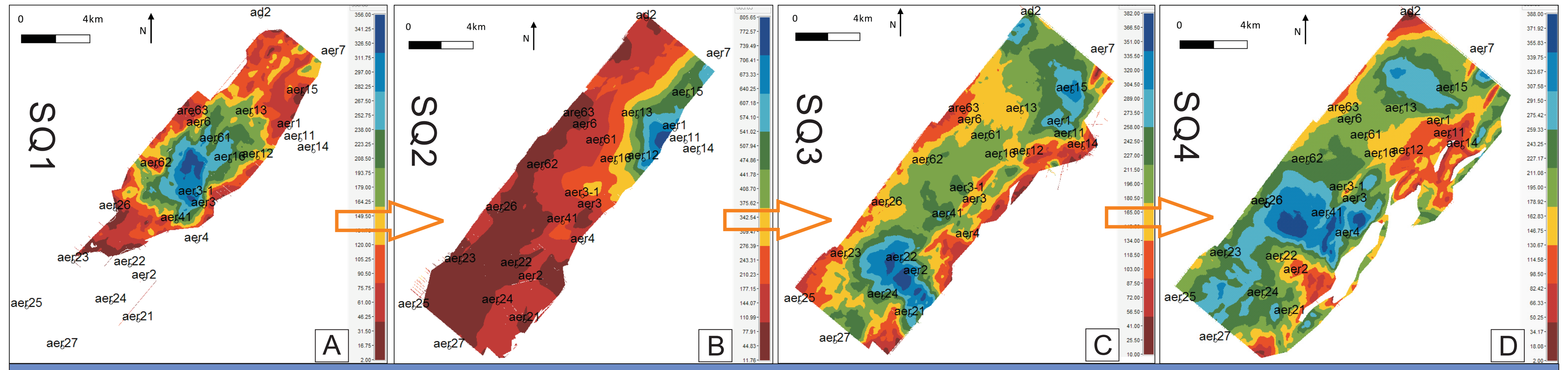


Fig 4. The isopach of each sequence. The unit is milliseconds. Note the movement of subsidence center

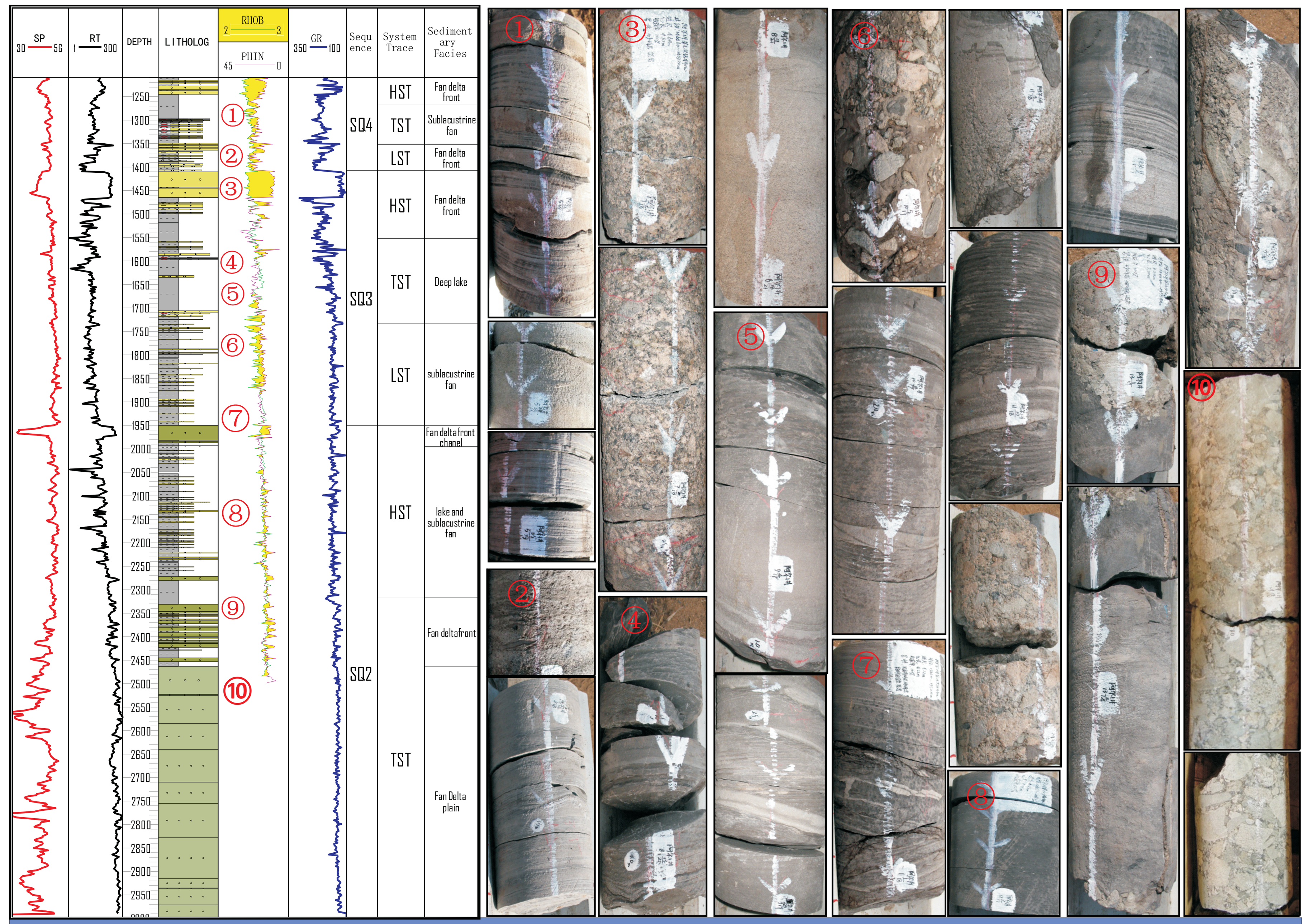
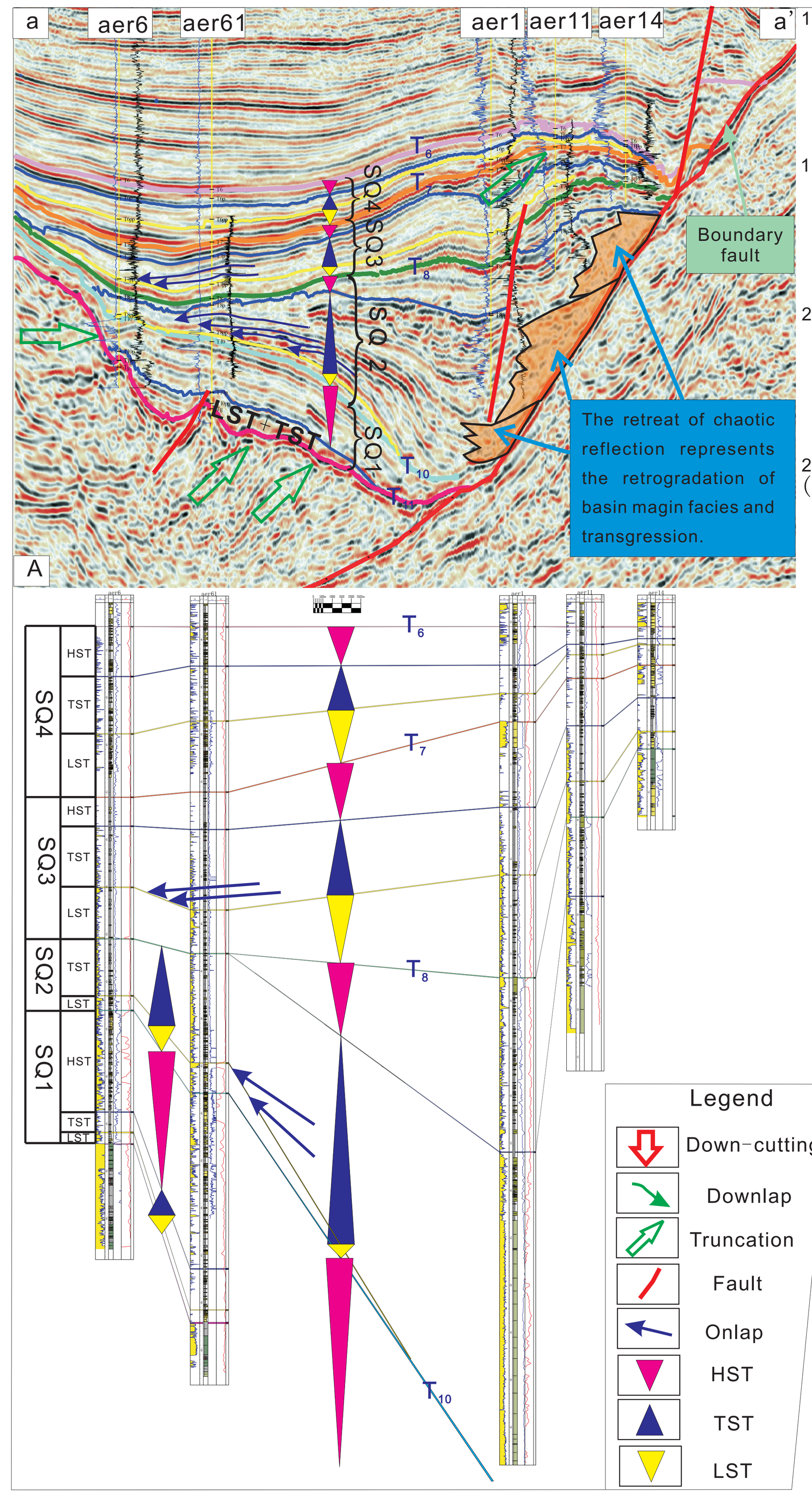


Fig 3. Sequence stratigraphy and sedimentary facies of type well

Sequence Analysis on Single Well

As the core data in SQ1 and LST in SQ2 are absent, the sequence stratigraphy analysis of type well starts from TST in SQ2. Spontaneous potential, resistivity, the combination of density(RHOB) and porosity (PHIN), gamma well log data associated with core data have been used to indicate the changing trend of grain size and sedimentary facies. On the whole, LST shows a coarsening-upward progradation trend, and TST shows a fining-upward retrogradation trend, while HST represents a coarsening-upward progradation trend.



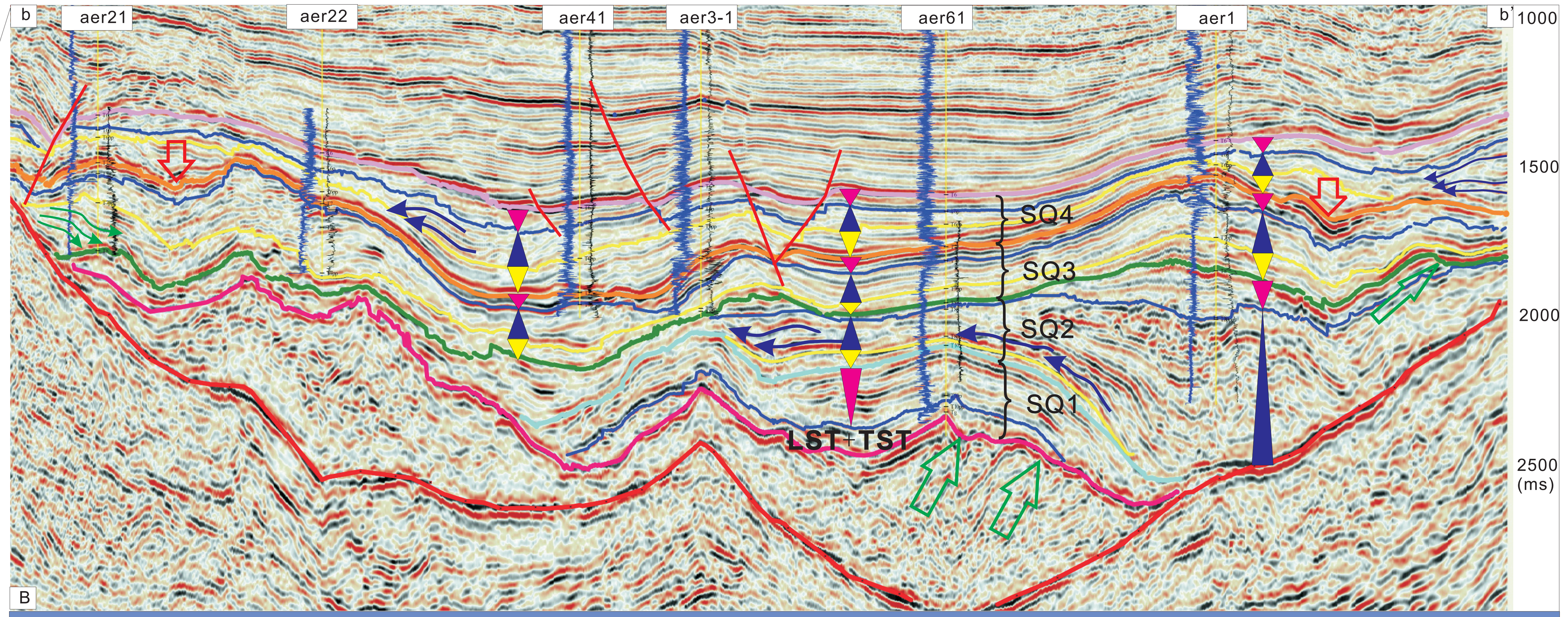


Fig 6. Transverse seismic profile(A) and longitudinal seismic profile(B). The location of profile is shown on fig 1.

Sequence Stratigraphy on Seismic Profile

- In SQ1, the boundary fault is inactive and the subsidence rate is low. The accommodation creation rate is usually smaller than the sediment supply rate, so the progradation of HST is in the majority.
- In SQ2, SQ3 and SQ4, the activity of boundary fault becomes strong and the high subsidence rate makes the accommodation creation rate much higher than sediment supply rate. TST which is characterized by numerous onlaps on seismic profile is the predominant system tract.

Conclusion

- There are six sequences recognized in the lower Cretaceous in Aer sag. According to the recent drilling result, the most favorable reservoir lies in the HST in SQ2 and LST in SQ3.
- Subsidence creates accommodation space in lacustrine rift basin. Subsidence rate decides the proportion of system tract.
- The subsidence centers vary in different sequences as the subsidence rate changes.
- LST is characterized by downlap and down-cutting. TST is characterized by numerous onlaps on the slope. HST is usually eroded and marked by isolated prograding sand.

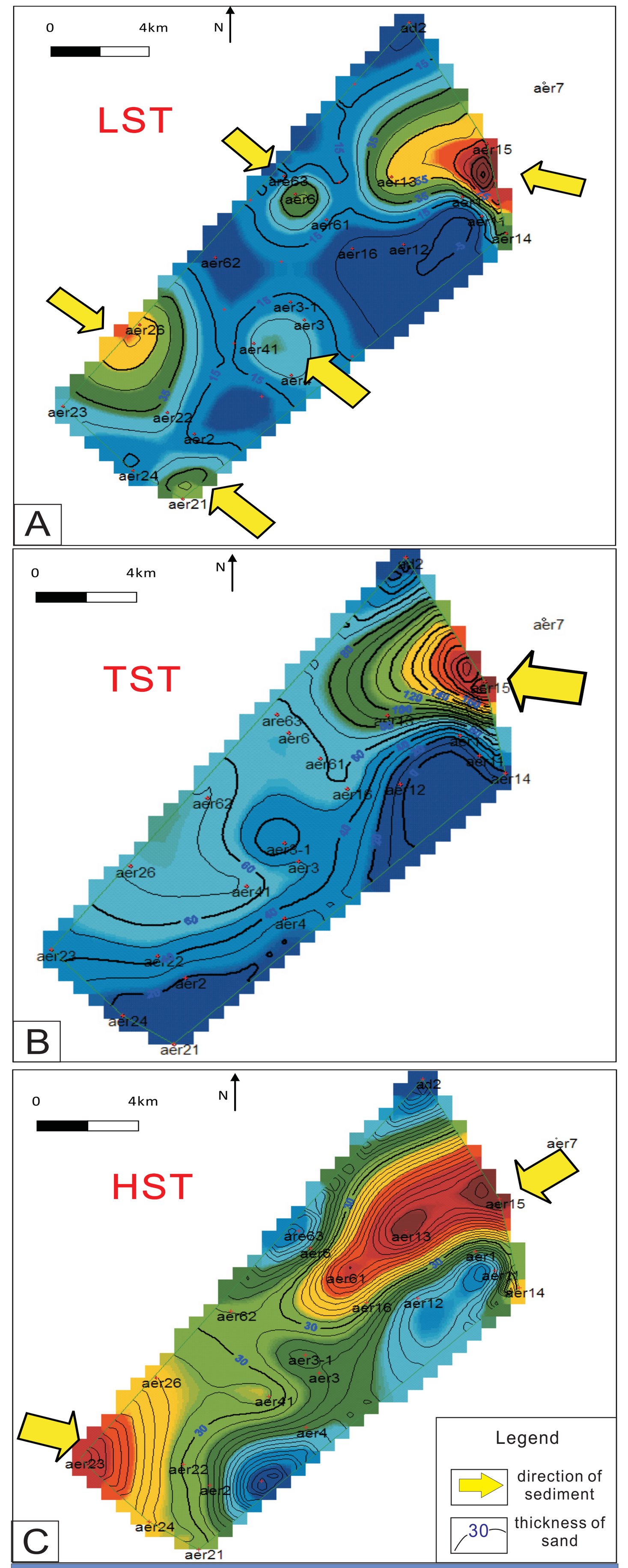


Fig 5. The isopach map of sand in different system tracts in SQ4.

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References

Lin C S, Eriksson K, Li S T, et al. Sequence architecture, depositional systems, and controls on development of lacustrine basin fills in part of the Erlian basin, northeast China. AAPG Bulletin, 2001, 85(11):2017-2043.