

Seismic Sedimentology of Cenozoic in Qinan Sag of Huanghua Depression, Eastern China*

Xiaomin Zhu¹ and Yanmei Dong¹

Search and Discovery Article #30065 (2008)

Posted October 7, 2008

*Adapted from oral presentation AAPG Convention, San Antonio, TX, April 20-23, 2008
Editorial note: Pages 33-58 depict in sequence “Depositional evolution for the basin.”

¹China University of Petroleum, Beijing. (xmzhu@cup.edu.cn)

Abstract

Seismic sedimentology has great potential in improving exploration and production in mature basins in eastern China. Advantages include high-resolution (reservoir-level) imaging of facies images from 3D seismic data and interpretation of lithofacies and reservoir properties for reservoir distribution and quality, which are especially useful for study of subtle stratigraphic traps in complex non-marine basins in China.

We applied seismic sedimentology to study Qinan Sag in Huanghua Depression, eastern China. A series of stratal slices were made among four maximum flooding surfaces in Sha-1 section with 90-degree phase 3D seismic data on a Recon software platform. These stratal slices provide sequential imagery of depositional systems of Sha-1 sequence, depicting a depositional history of braided-fan delta with braided channels and inter-channel facies. More specifically, SI subsequence was the main episode of braided-fan delta development, with widespread channel images on stratal slices; single sandstones are as thick as 30 m and sandstone content as high as 40% in wells. To SIII episode, however, the sediment supply was reduced noticeably, channel images shrank on stratal slices, indicating a significant retreat of braided-fan delta system in the area.

Seismic Sedimentology of Cenozoic in Qinan Sag of Huanghua Depression, Eastern China

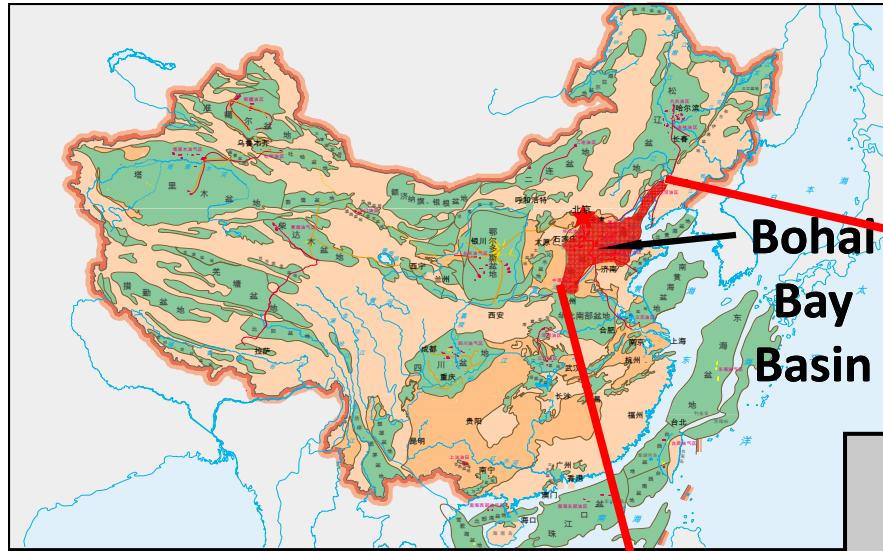
Zhu, Xiaomin and Dong, Yanmei

China University of Petroleum, Beijing

22th April, 2008

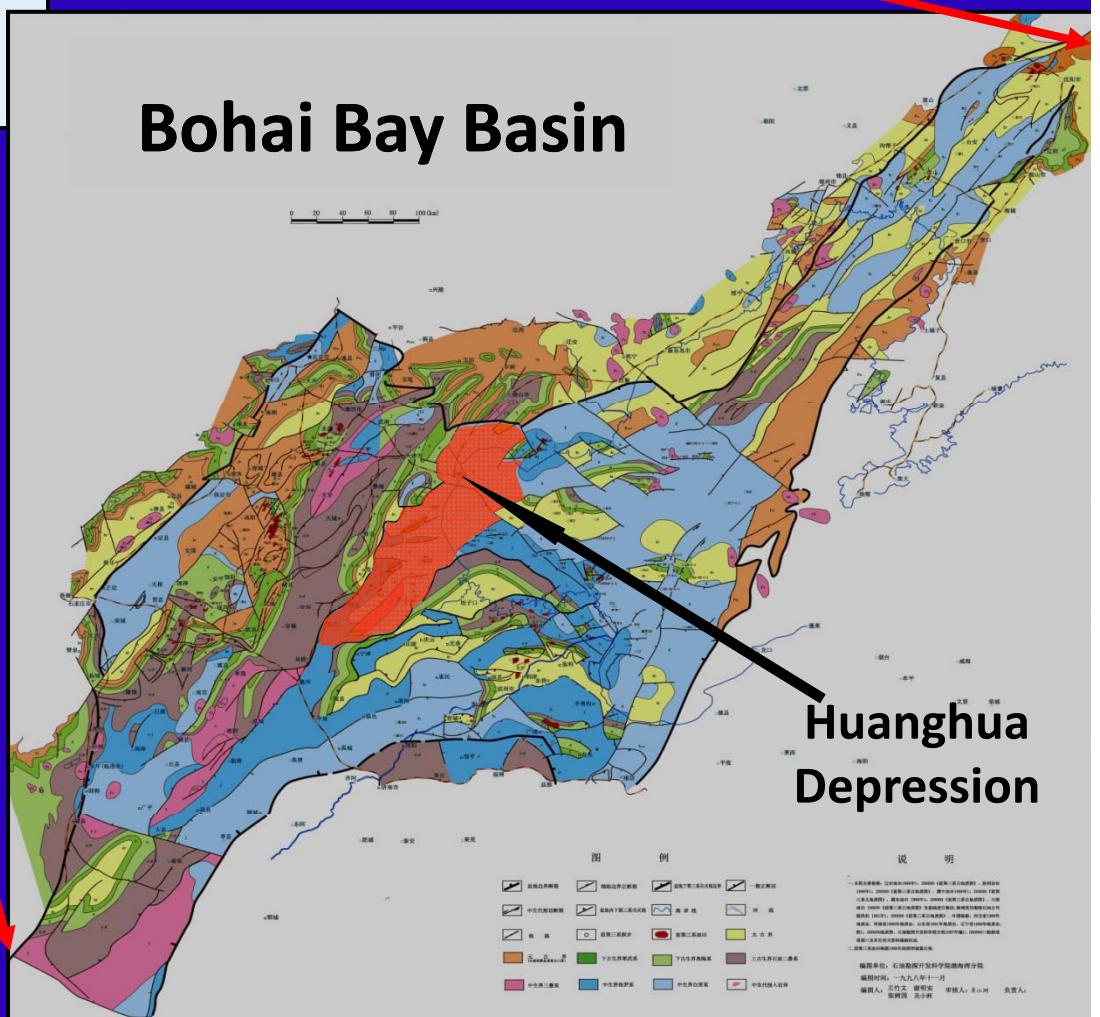
Outline

- 1. Geologic setting**
- 2. Sequence stratigraphic framework**
3. Study of seismic sedimentology
4. Conclusion



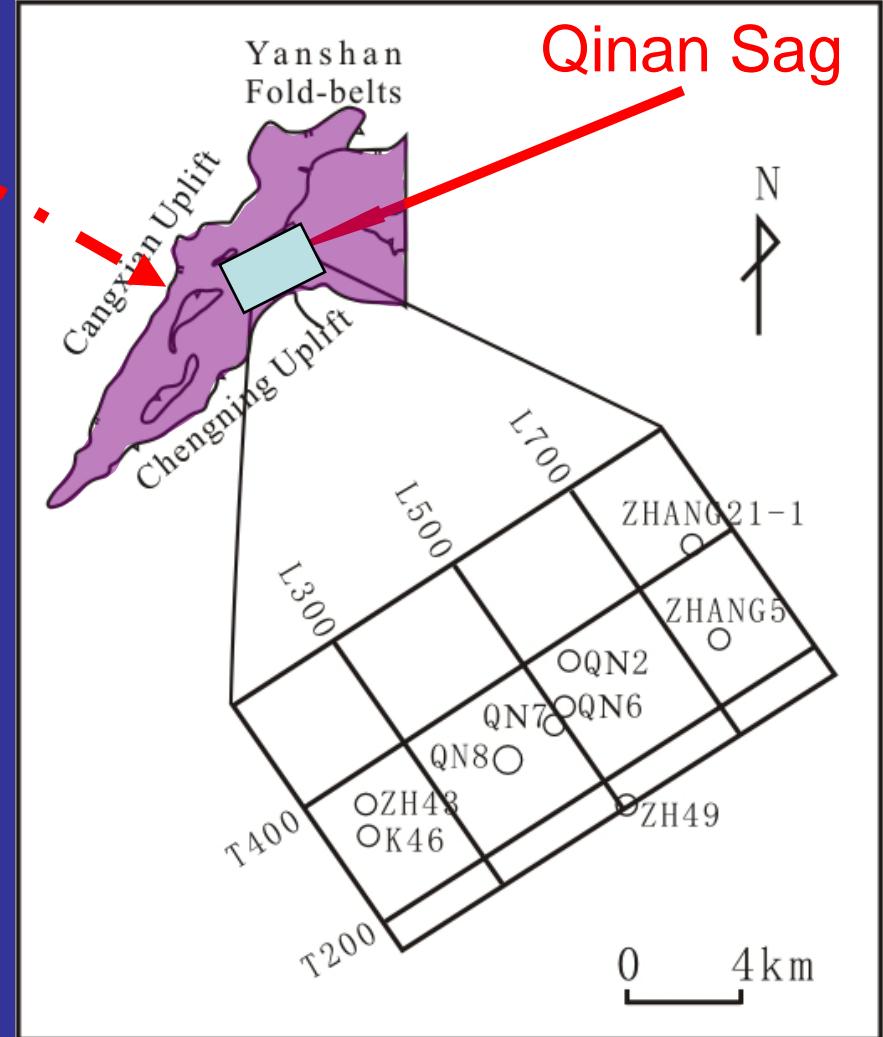
Huanghua Depression

17,000 Km²



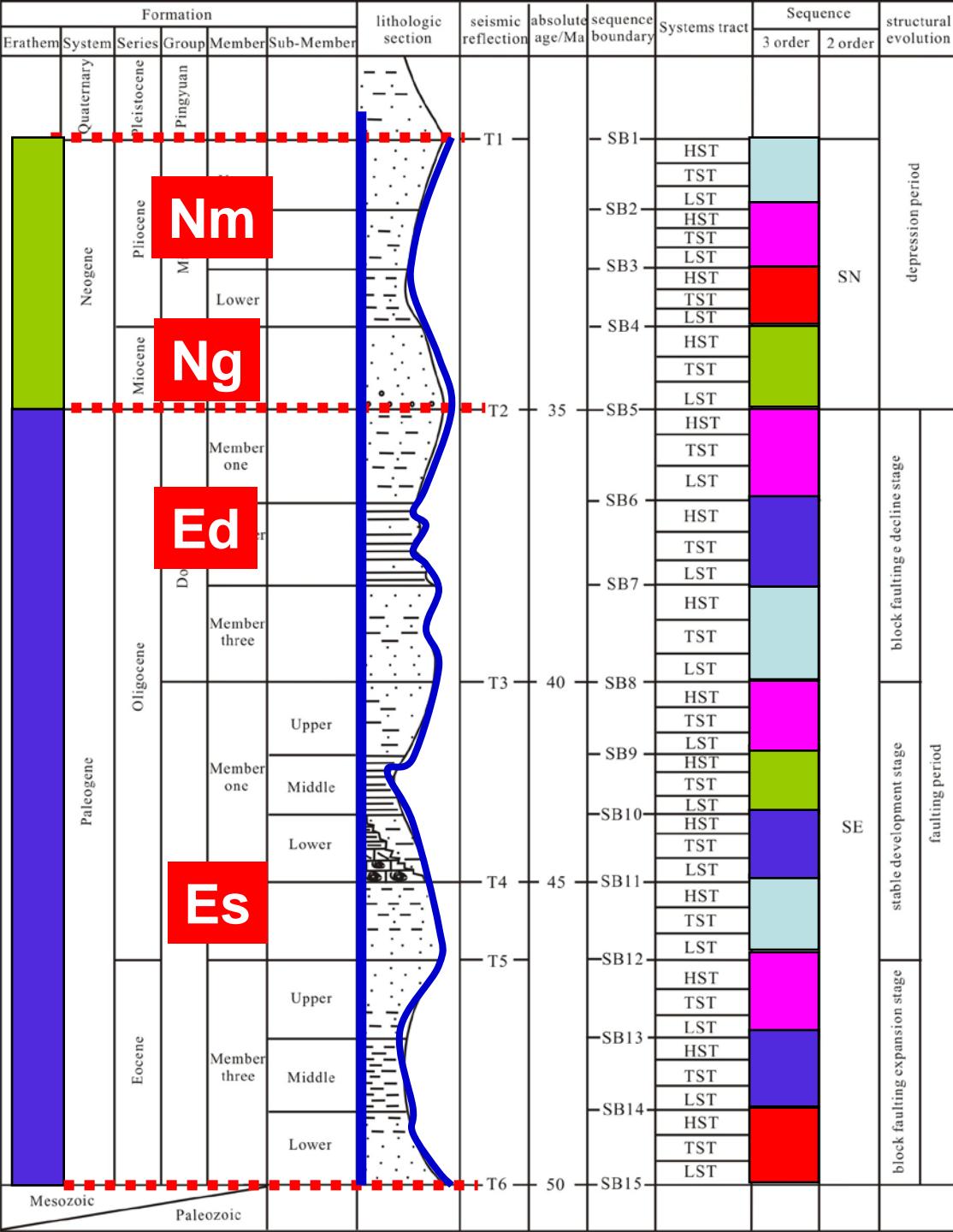
Huanghua Depression

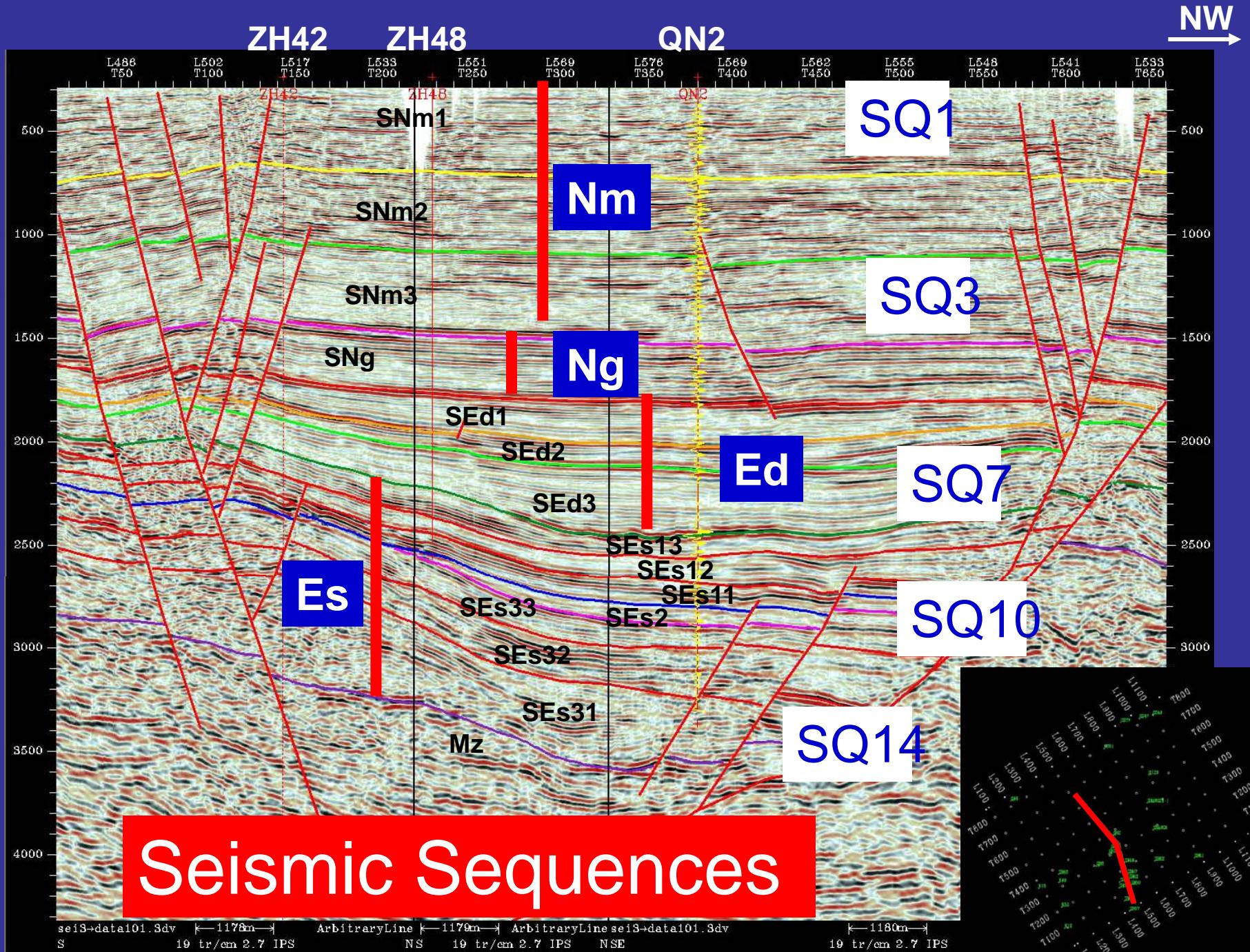
The location of Qinan
Sag, Huanghua
Depression



300Km²

The
Cenozoic in
Huanghua
depression
can be
divided into
14 third-
order
sequences.





Outline

- 1. Geologic setting**
- 2. Sequence stratigraphic framework**
- 3. Study of seismic sedimentology**
- 4. Conclusion**

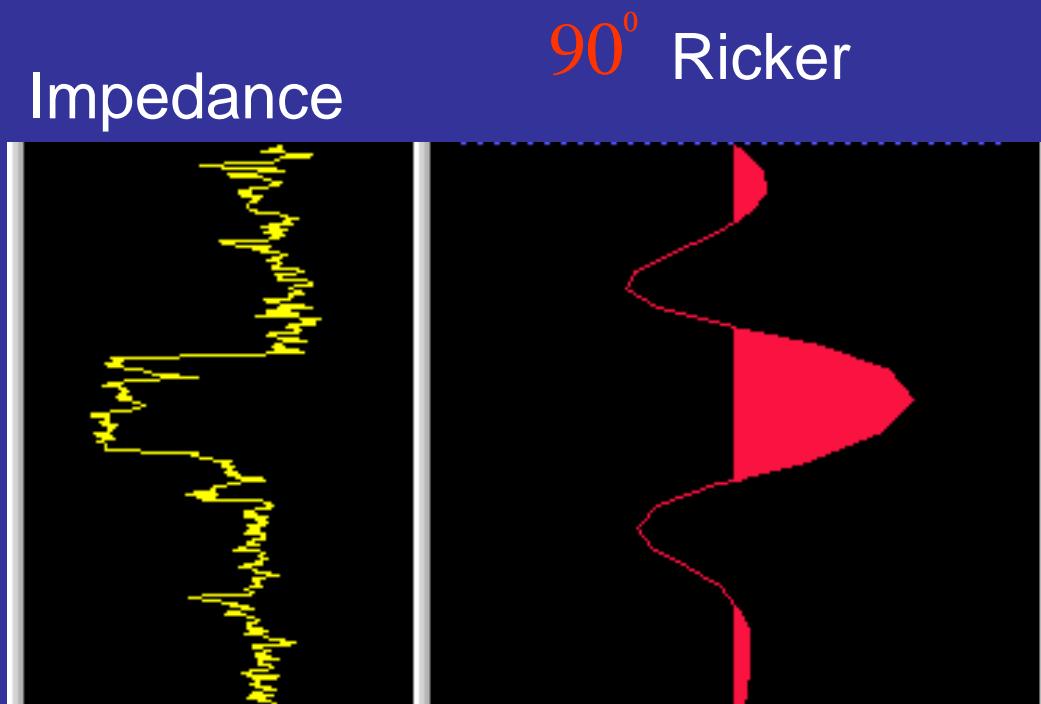
➤ **Study of seismic sedimentology**

Ninety-degree phase shift

Stratal slicing

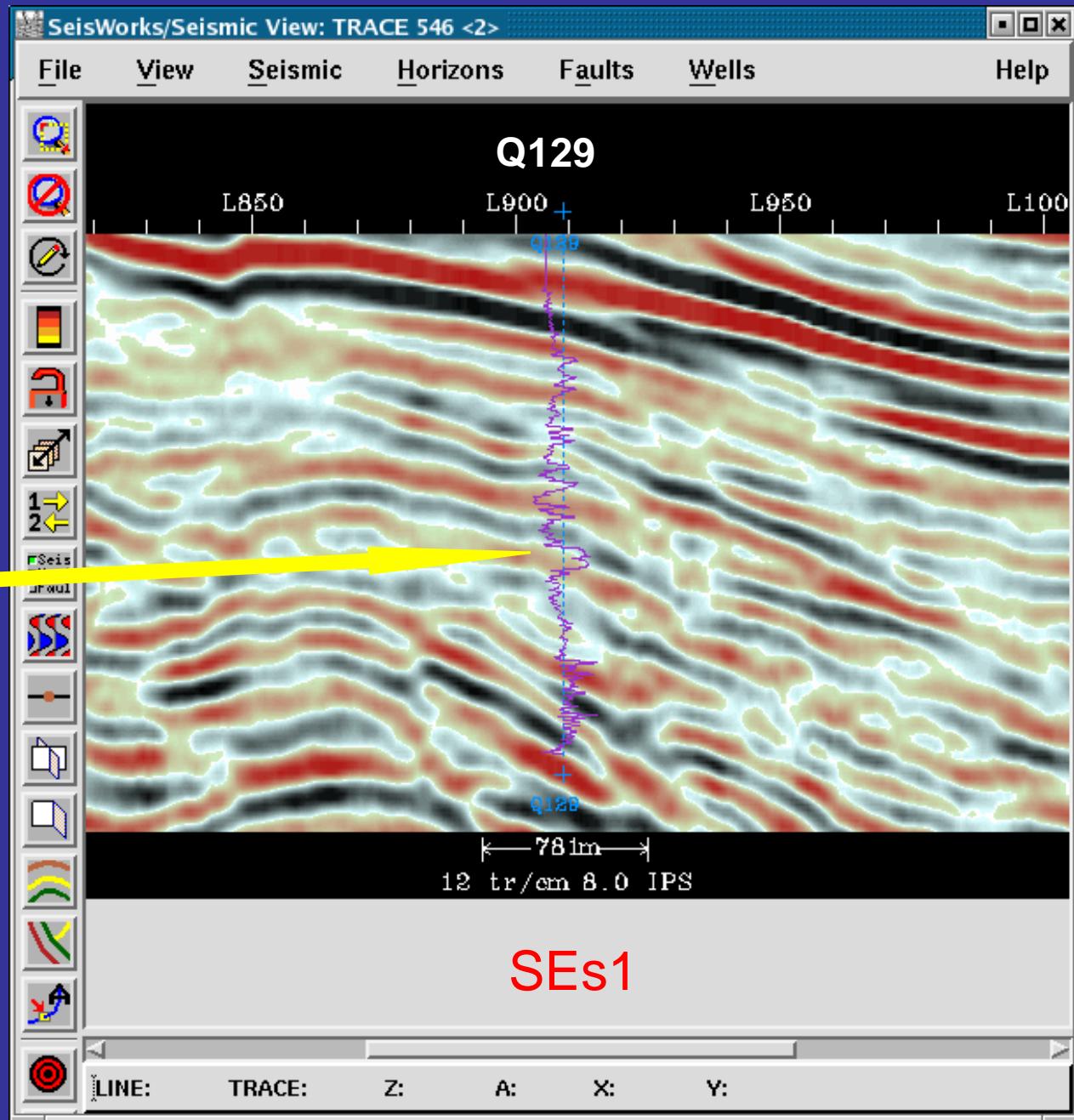
Interpretation

Ricker Wavelet as Function of Phase

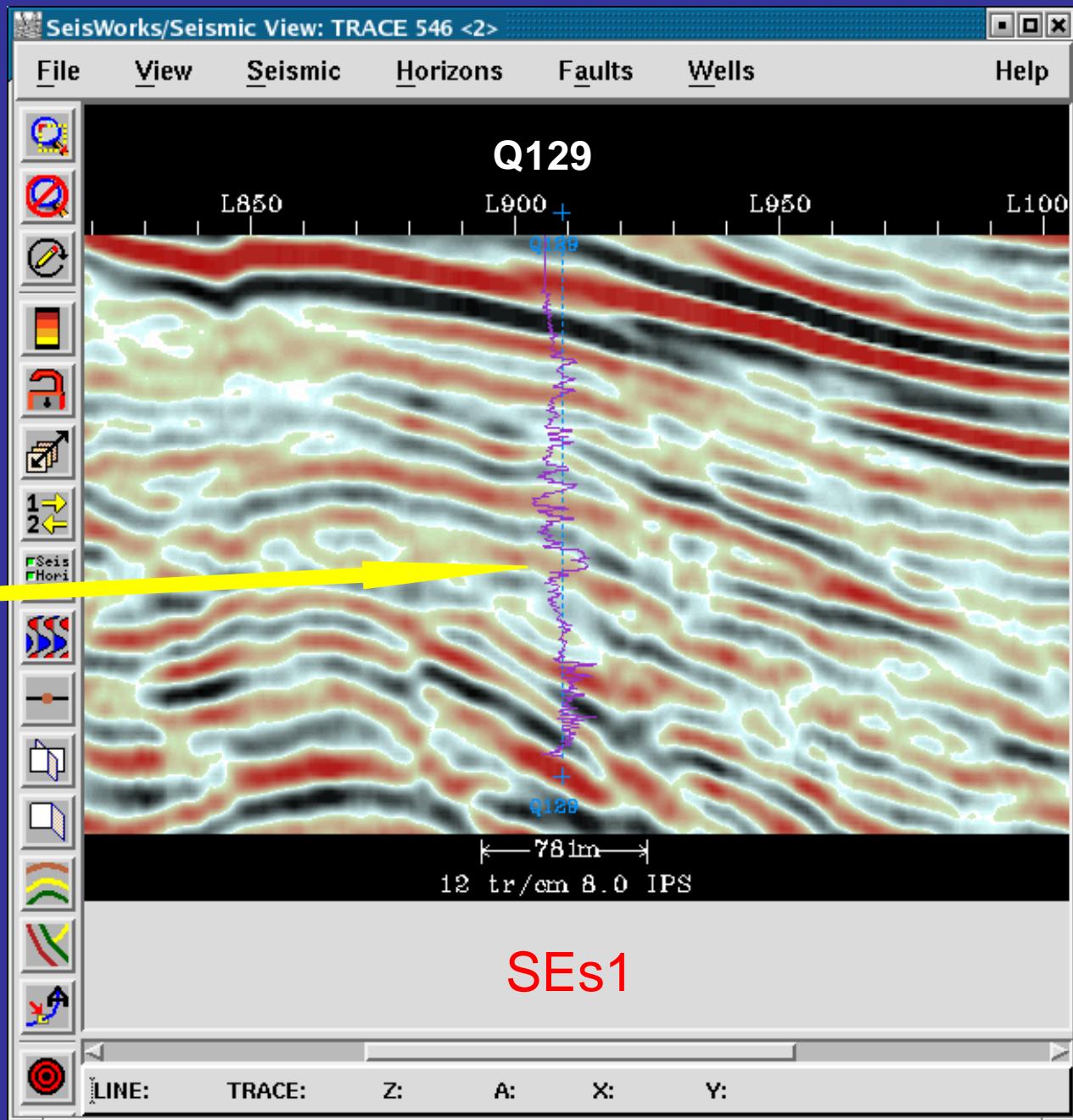


After
Hongliu Zeng
2001

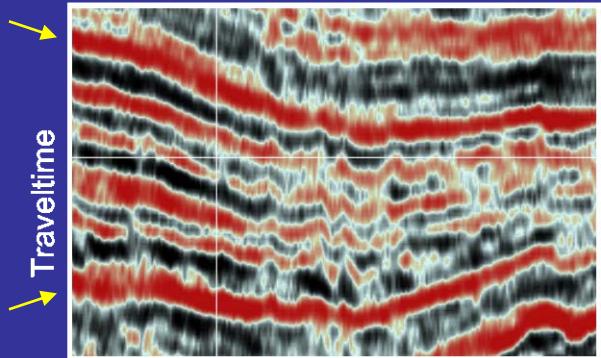
TR546 (0°)



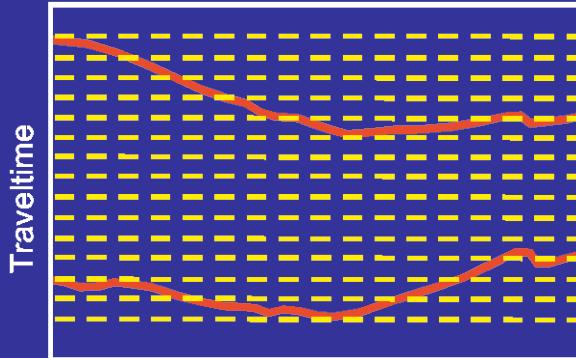
TR546 (90°)



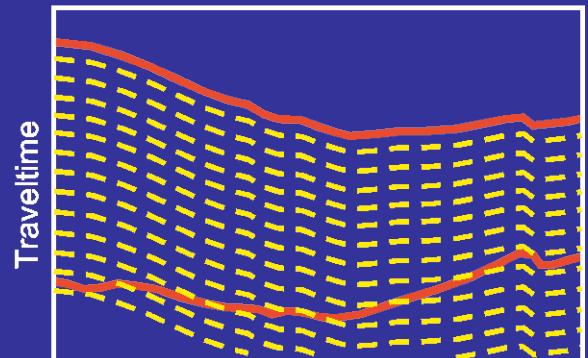
Data Cube



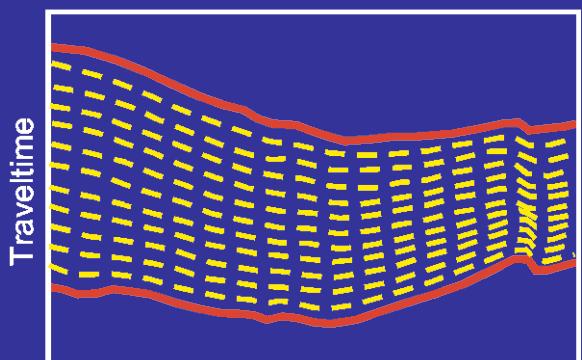
Time Slice



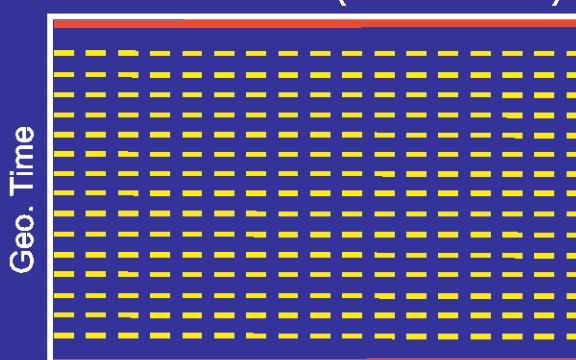
Horizon Slice



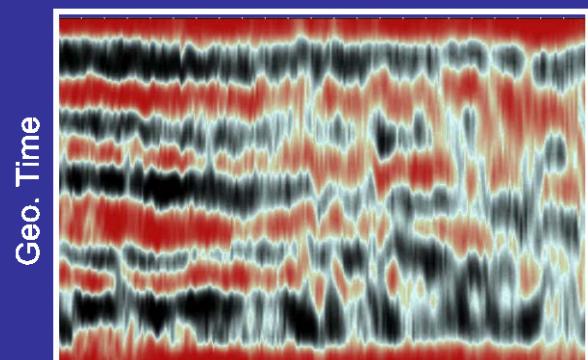
Stratal Slice



Stratal Slice (Flattened)

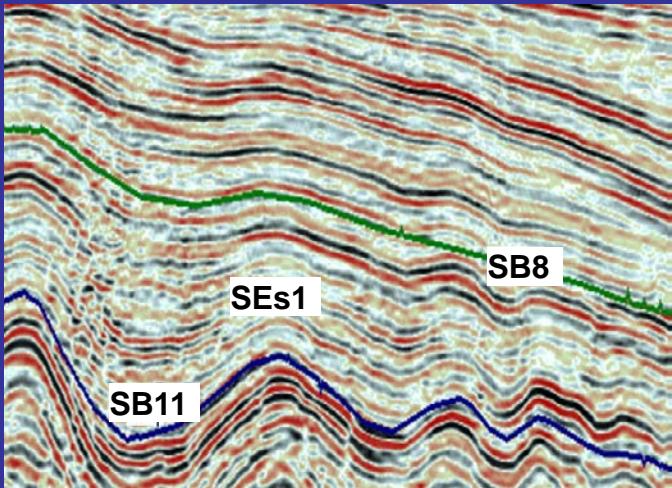


Stratal Slice Cube

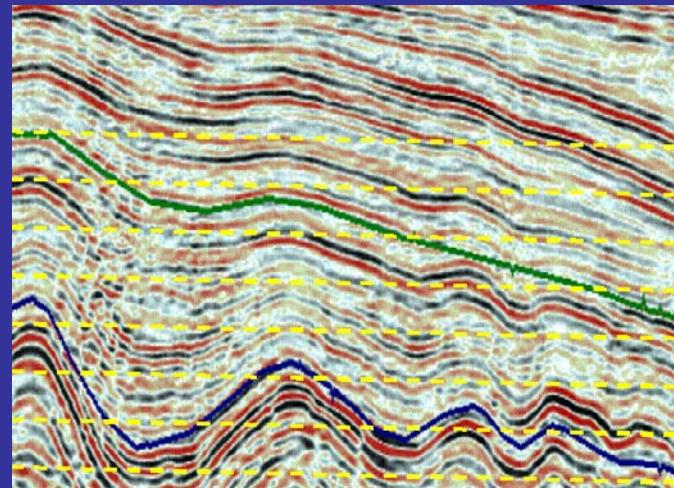


(After Zeng , 2001)

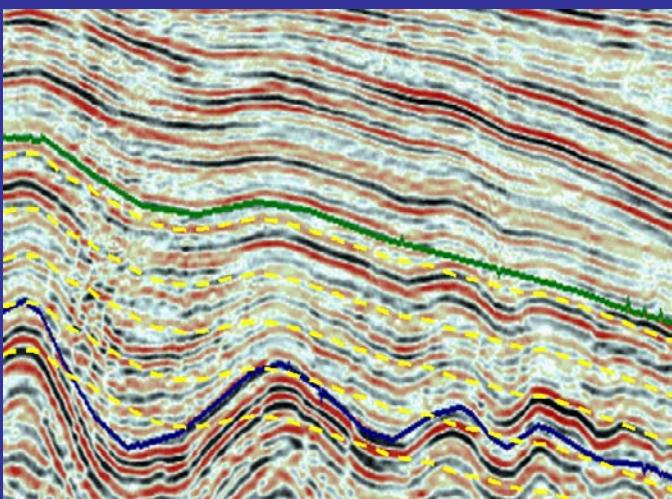
In the study area, strata is characterized by moderate folding and significant lateral thickness variation. Under this condition, stratal slicing technique is the best slicing method.



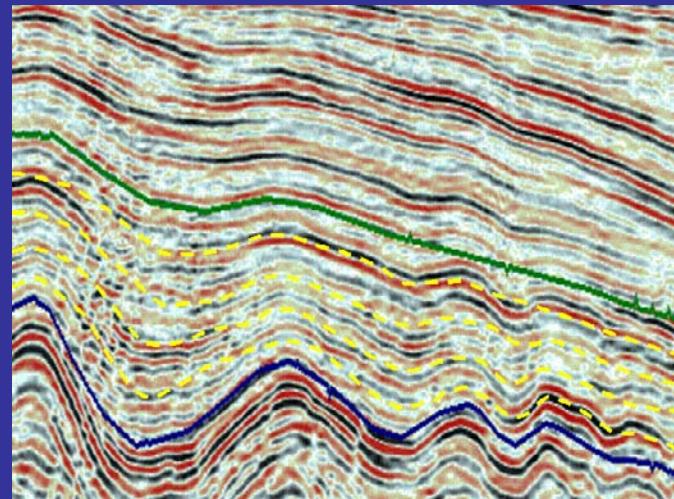
Seismic section



Time slicing

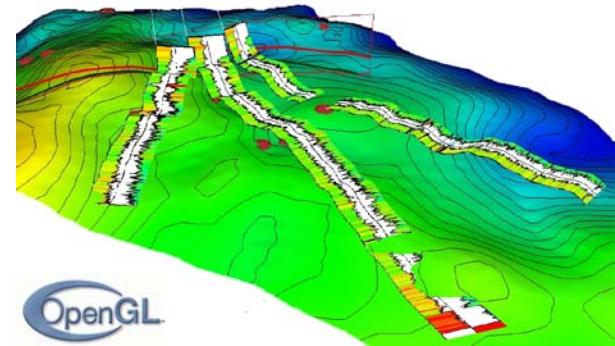
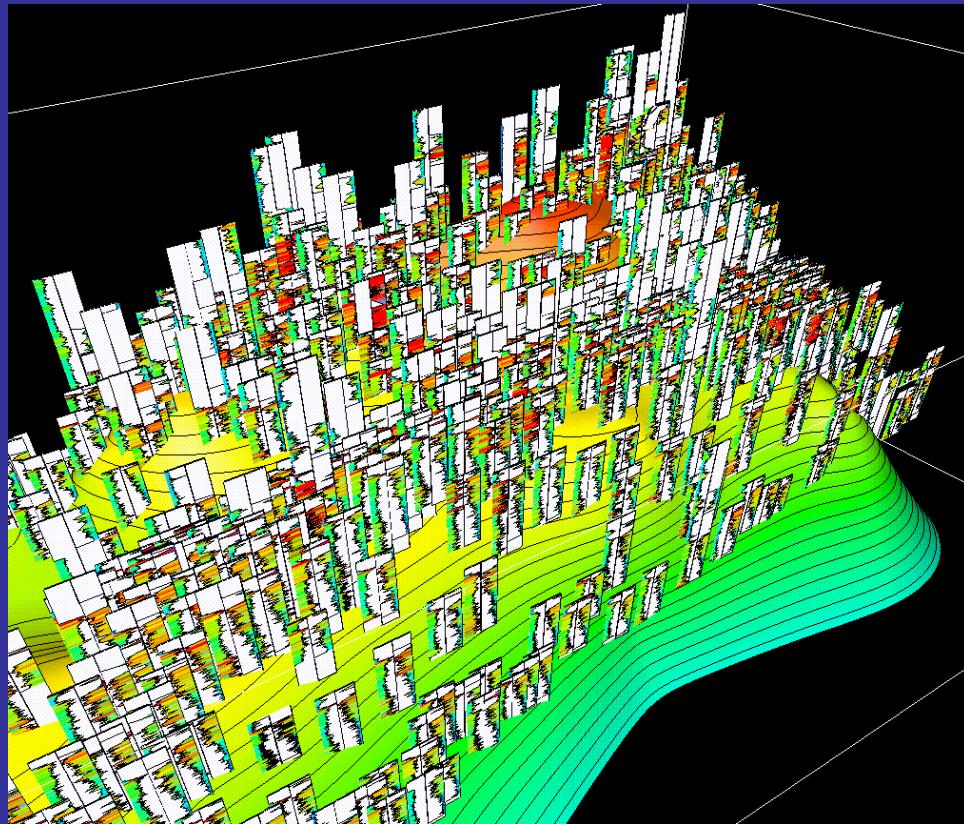


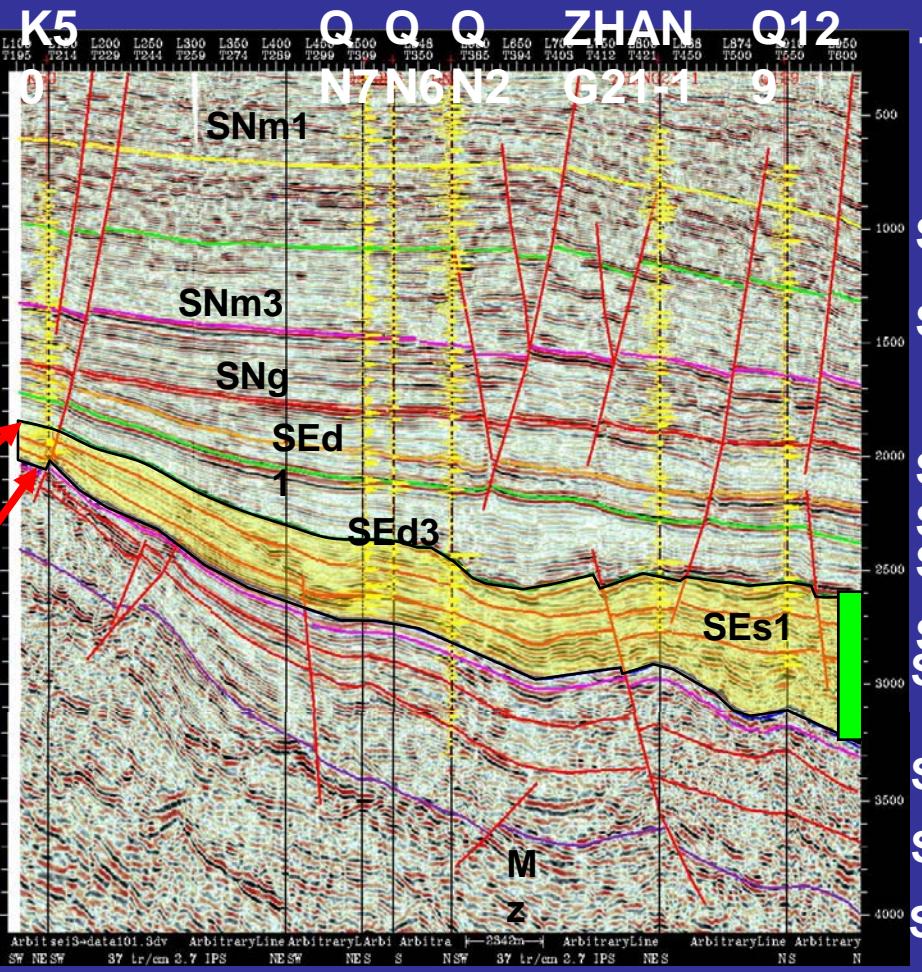
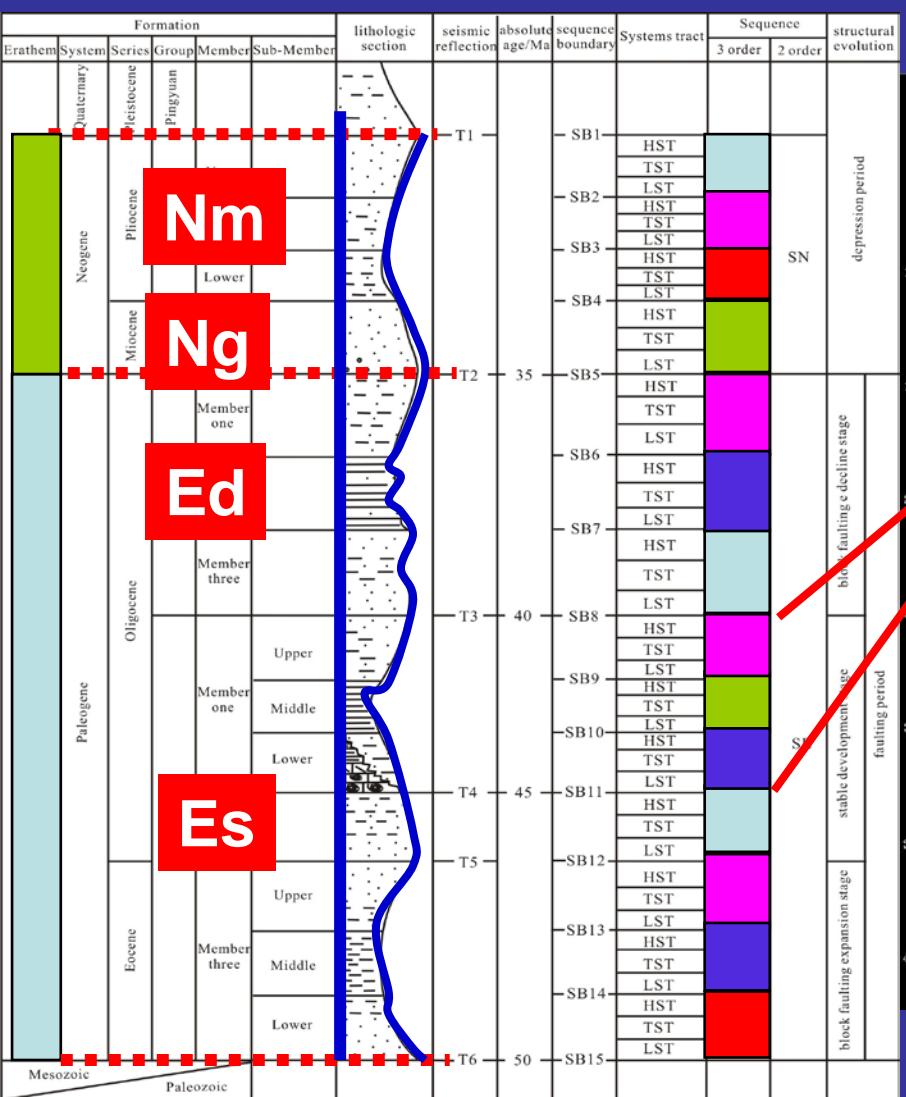
Horizon slicing



Stratal slicing

Software: Recon StratalSlice™

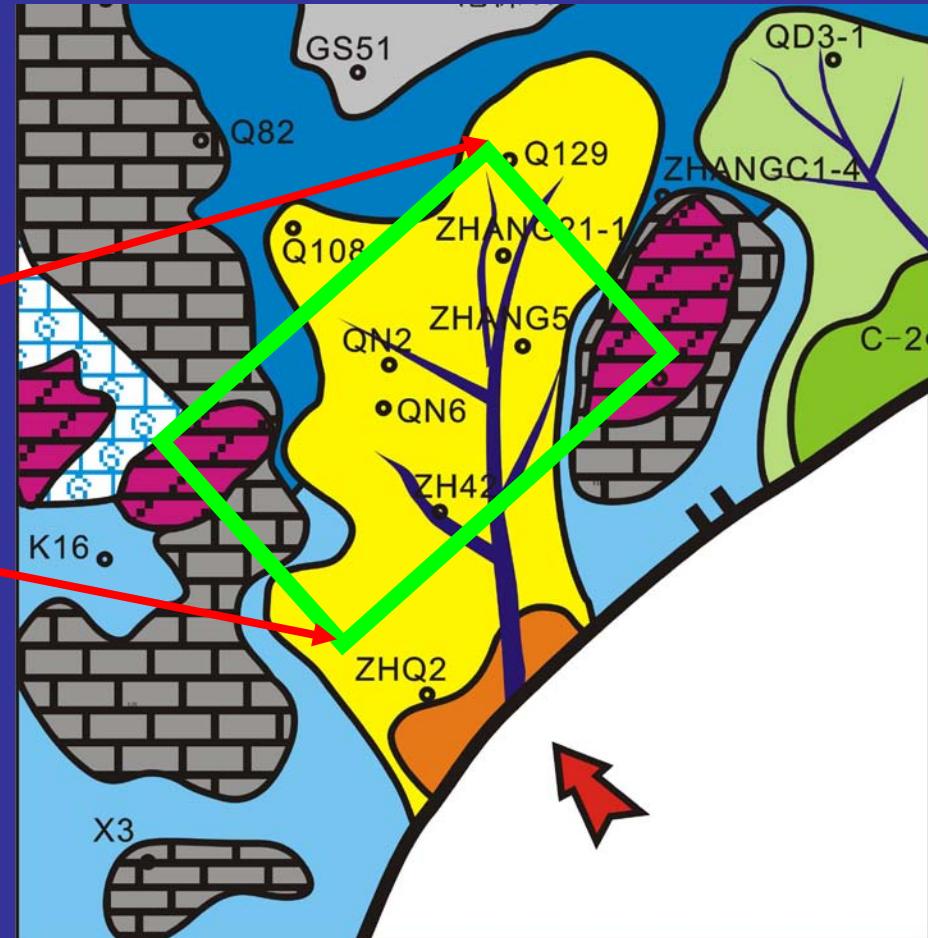
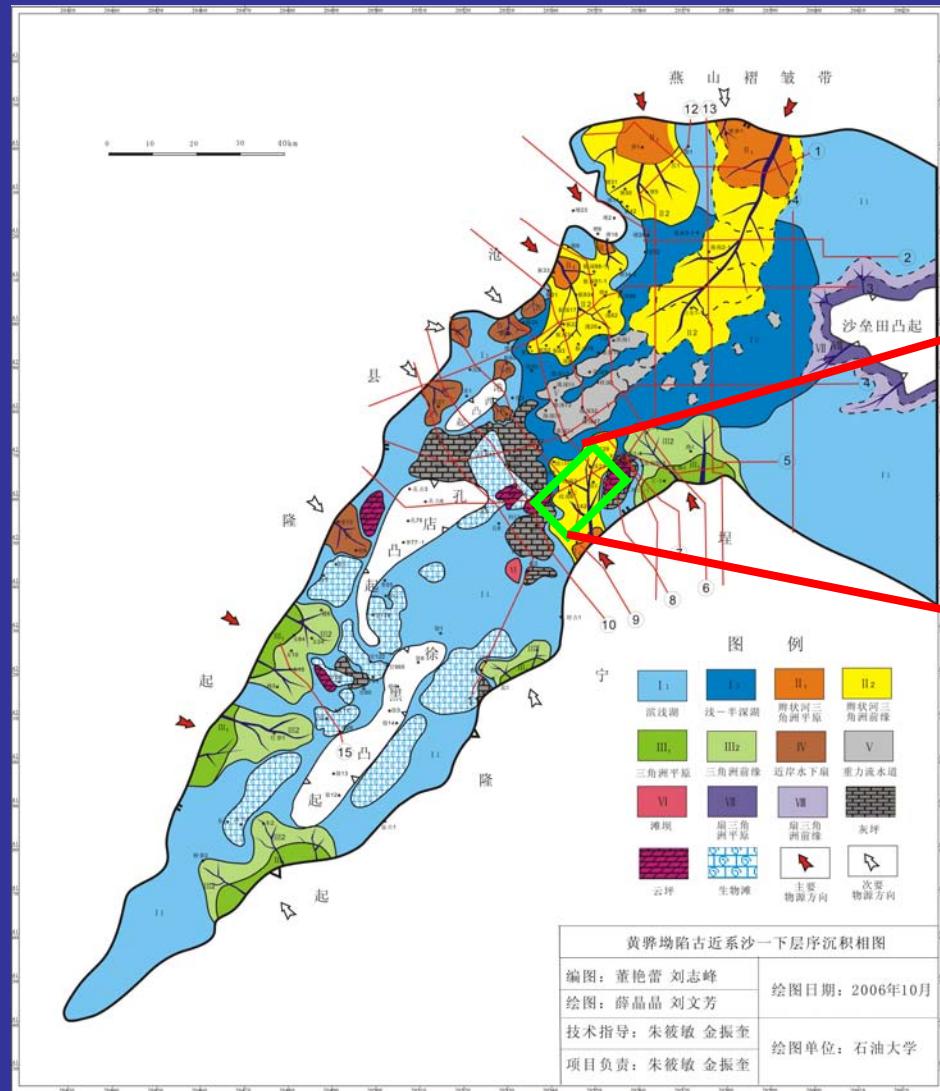




NE

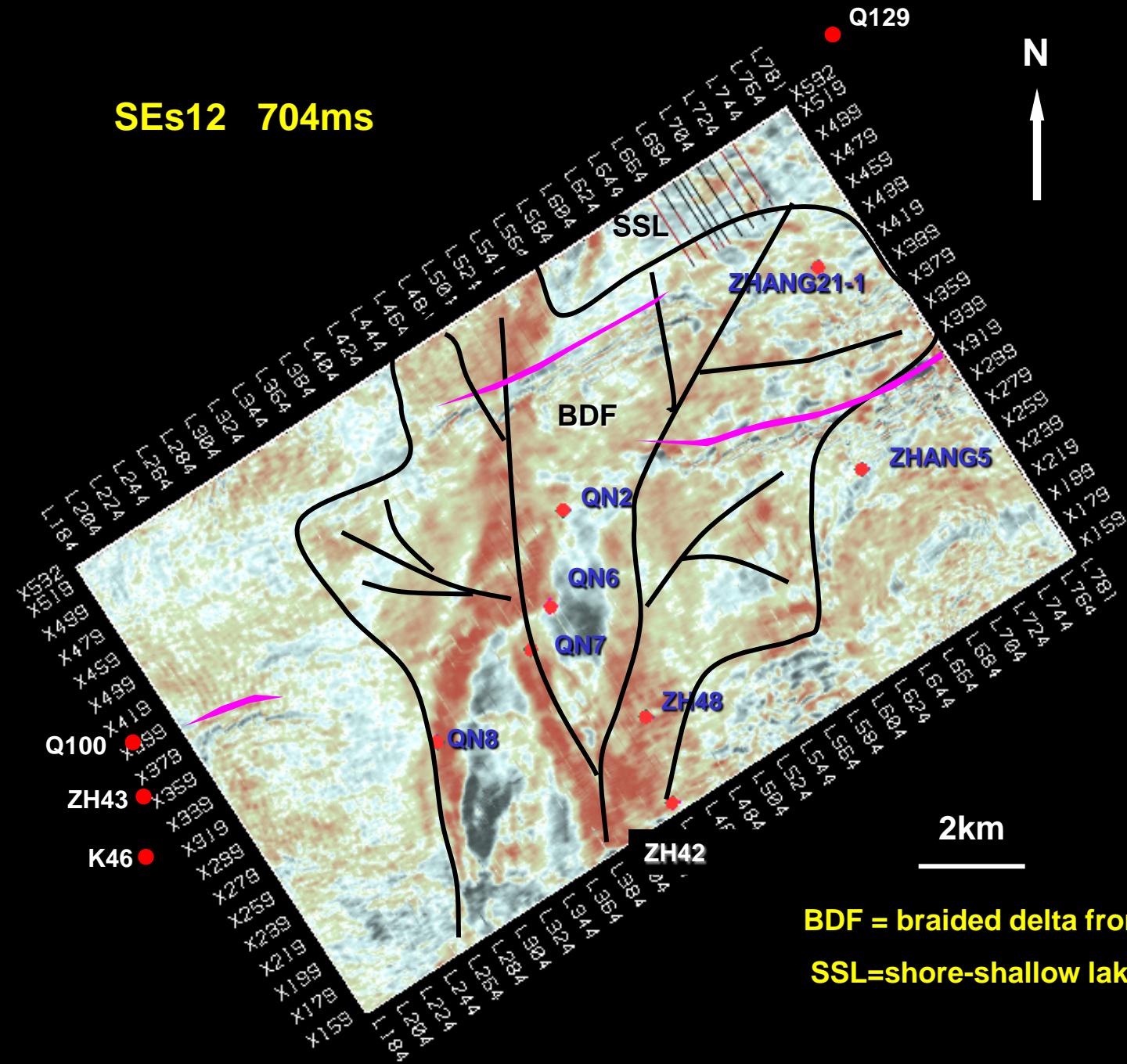
→

Es1 - Braided delta front (3rd)

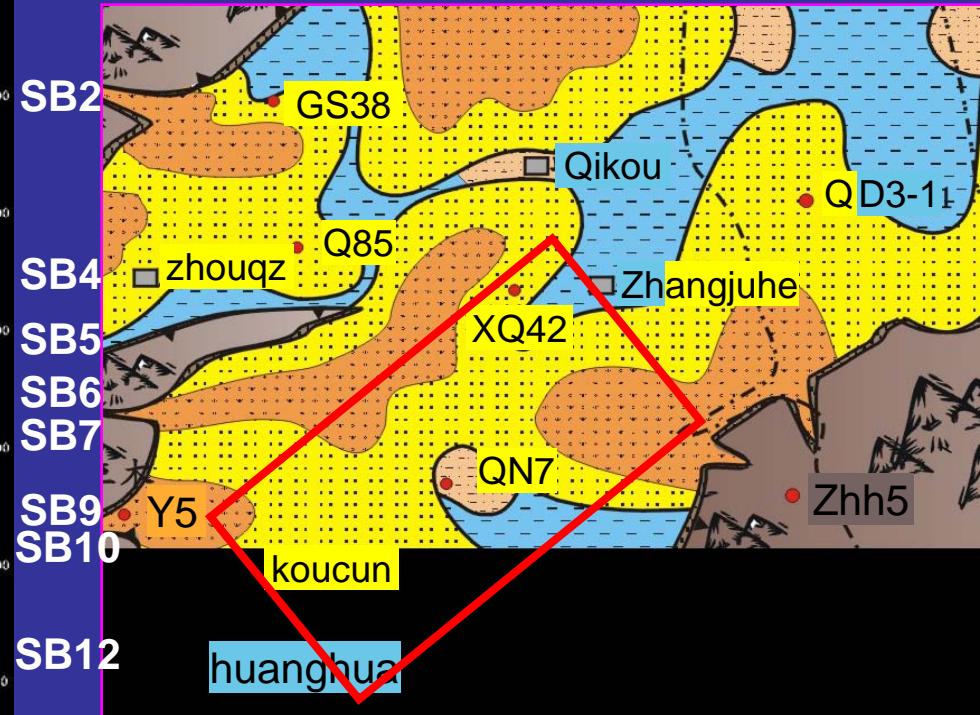
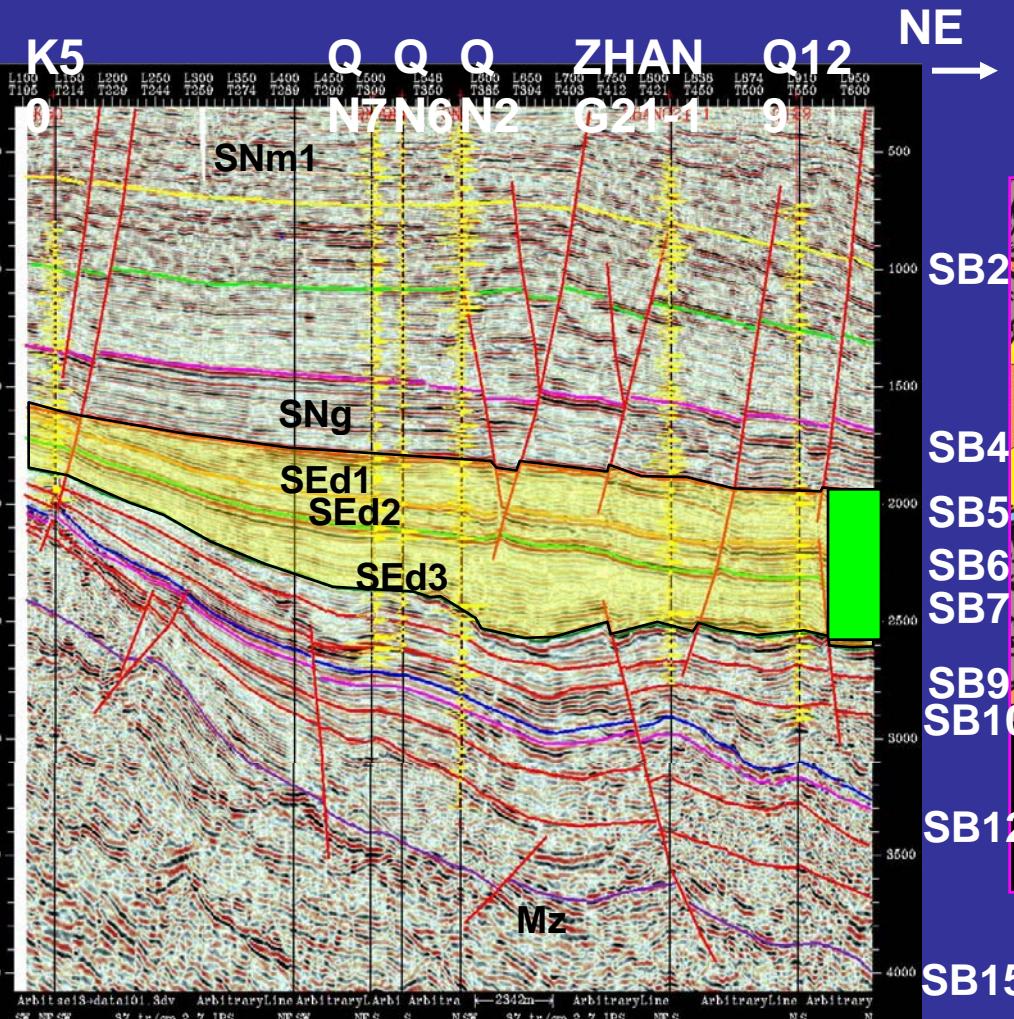


Sedimentary facies map of SEs1, Huanghua Depression

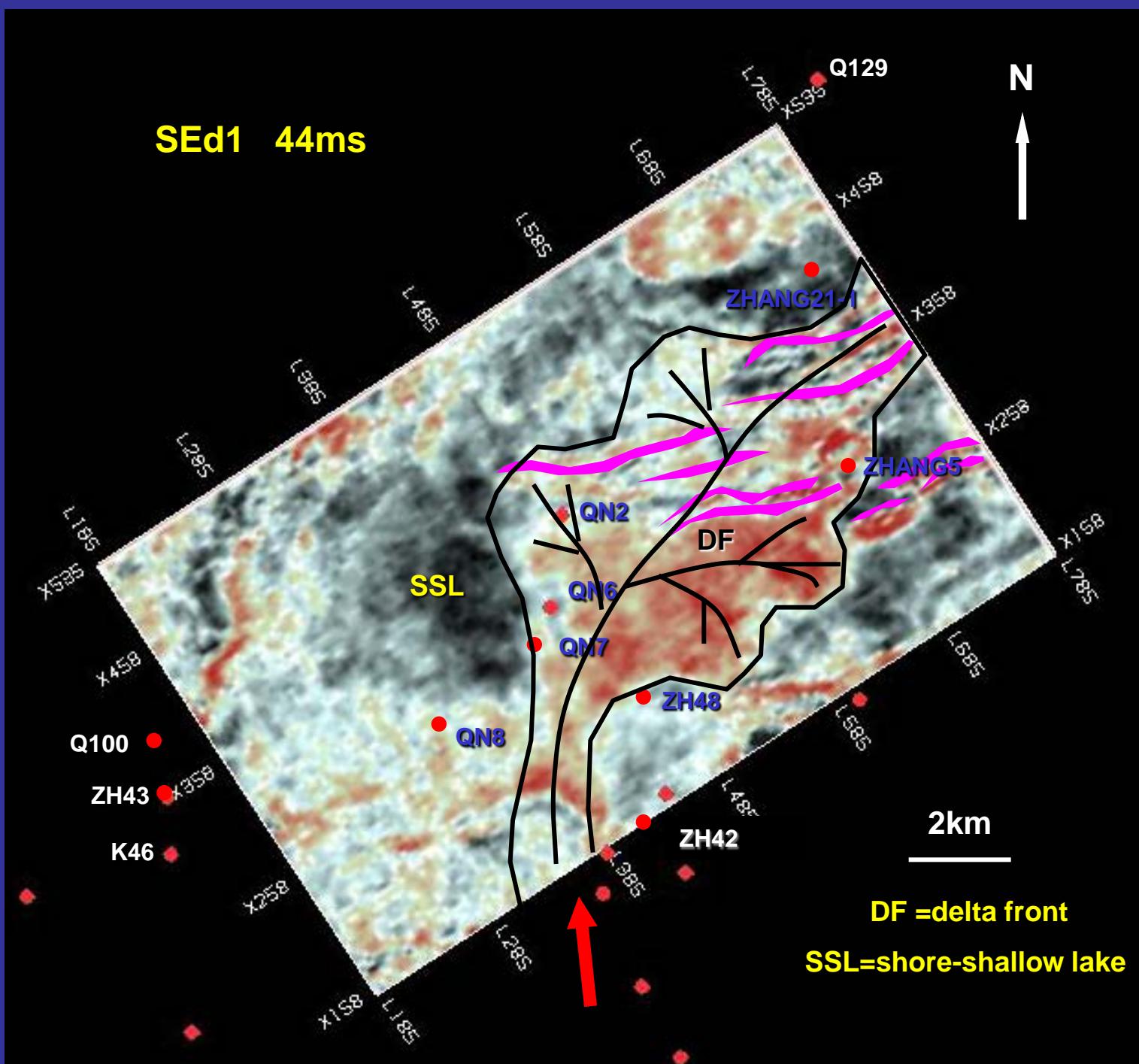
SEs12 704ms



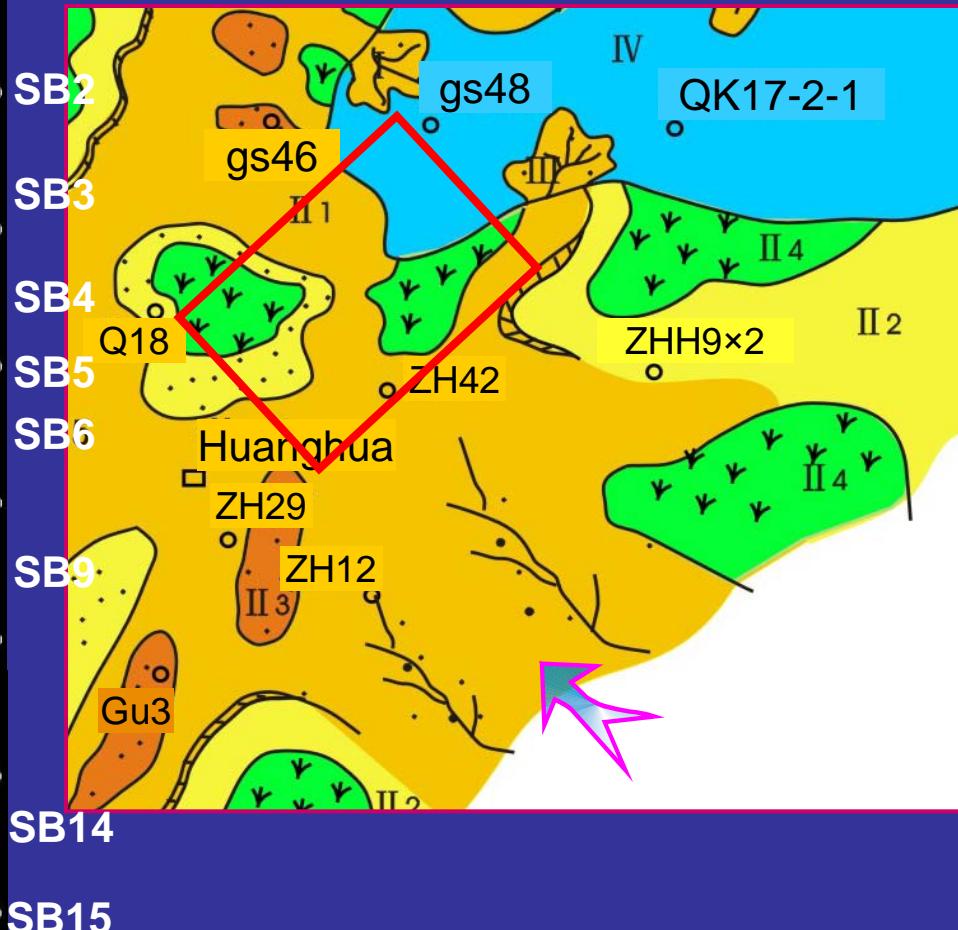
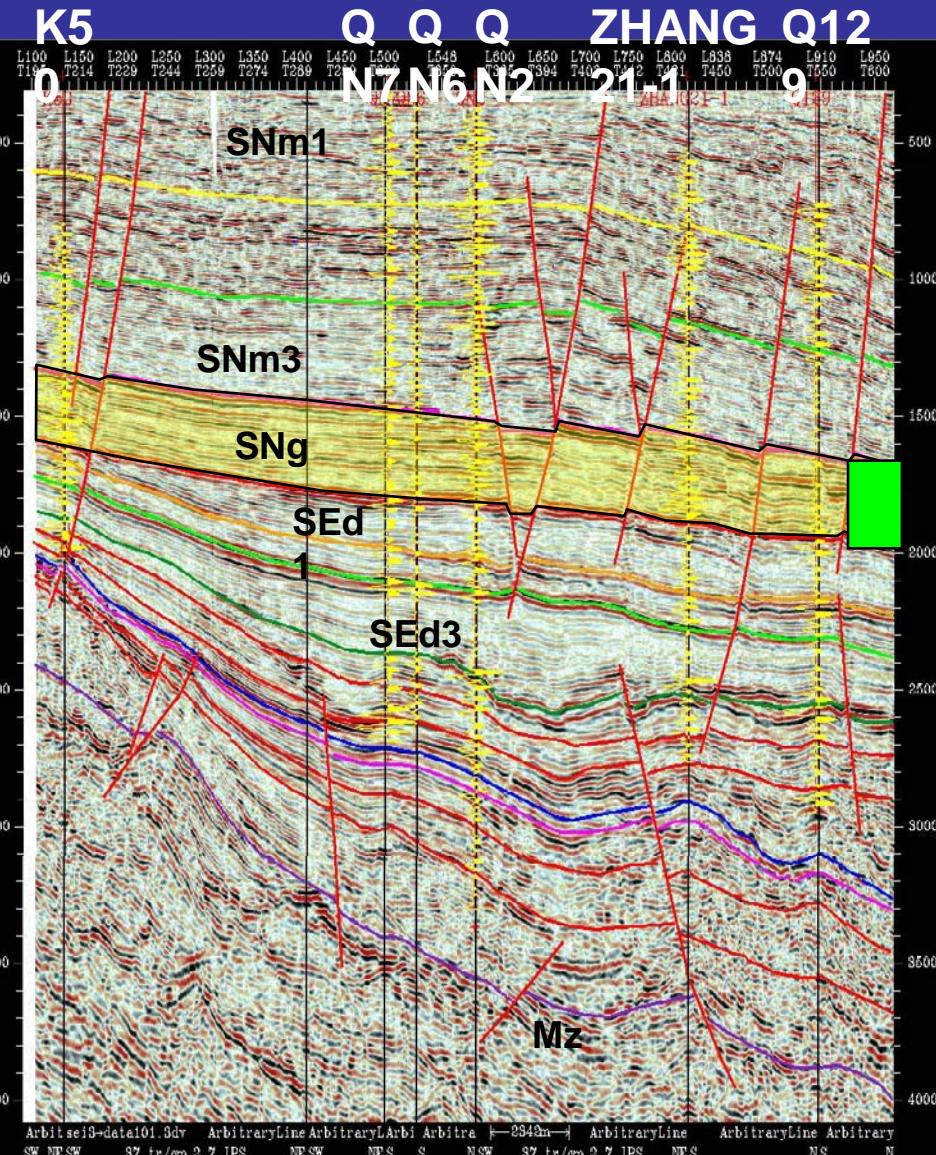
Ed - Delta front (3rd)

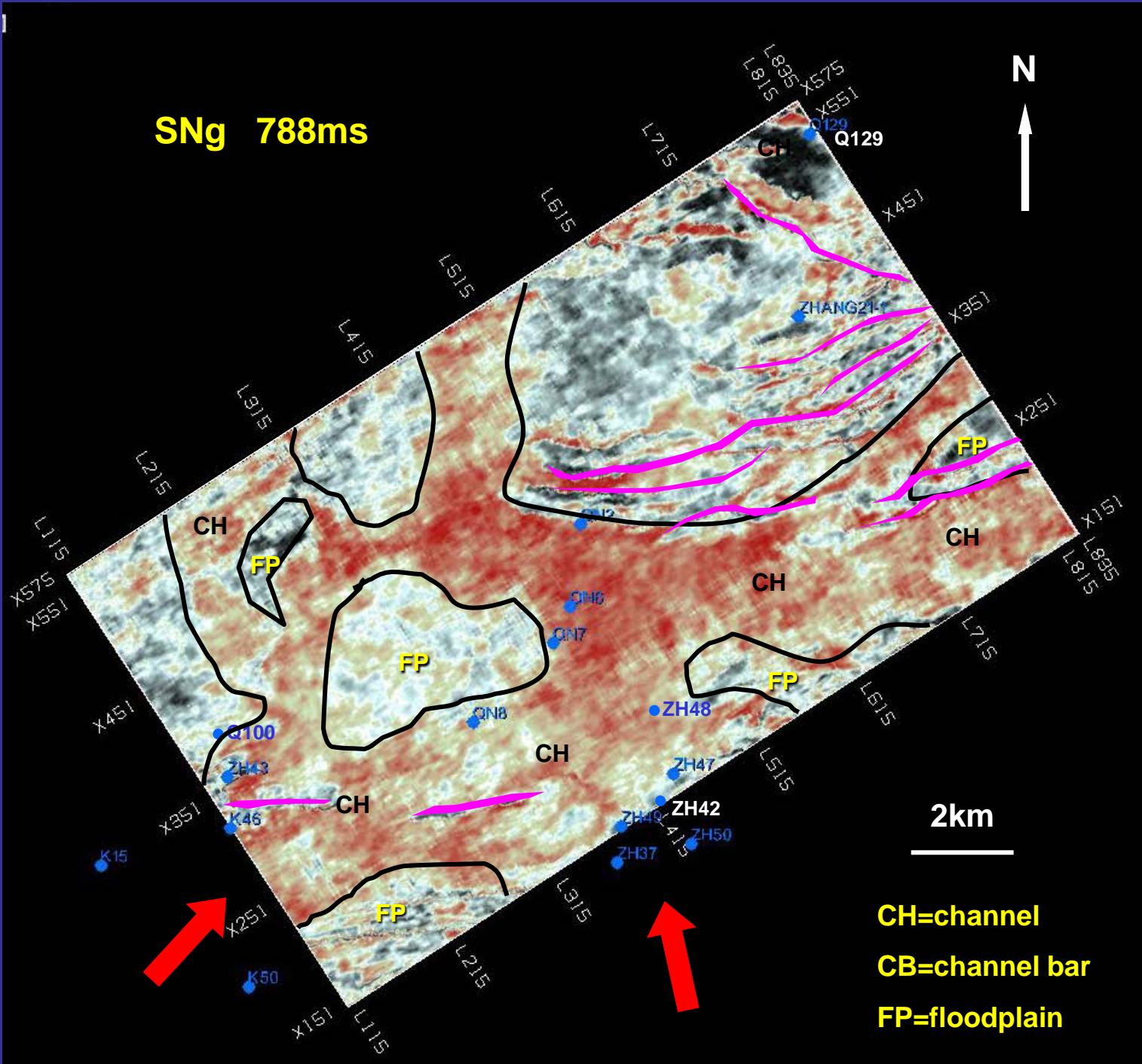


Sedimentary facies map of SEd, Huanghua Depression

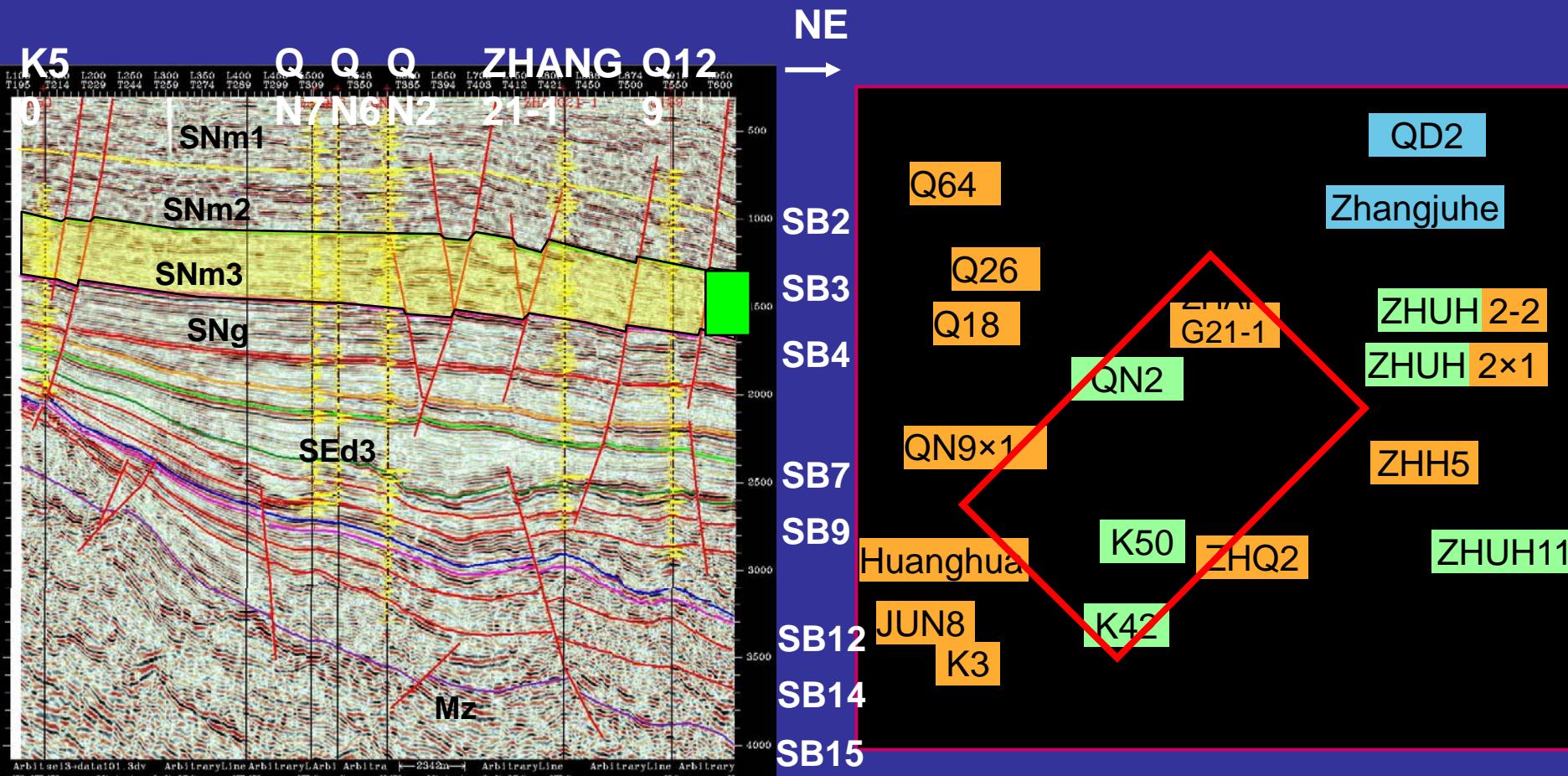


Ng - Braided river (3rd)





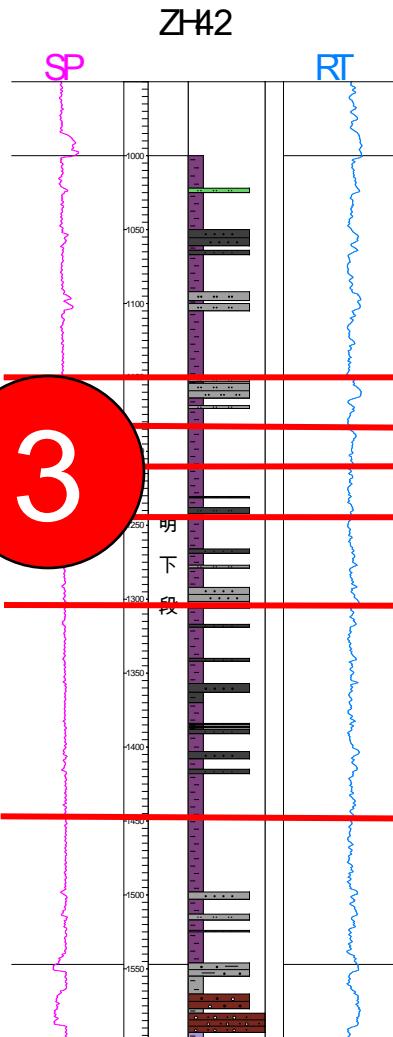
Nm₃ - Meandering river (3rd)



NW



A

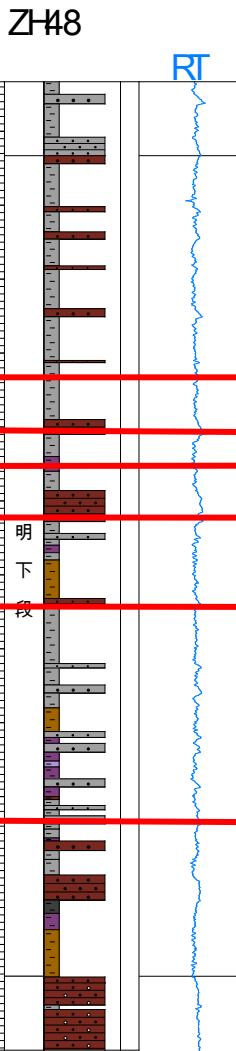
**SNm2****SNm3**

3

64ms

128ms

444ms

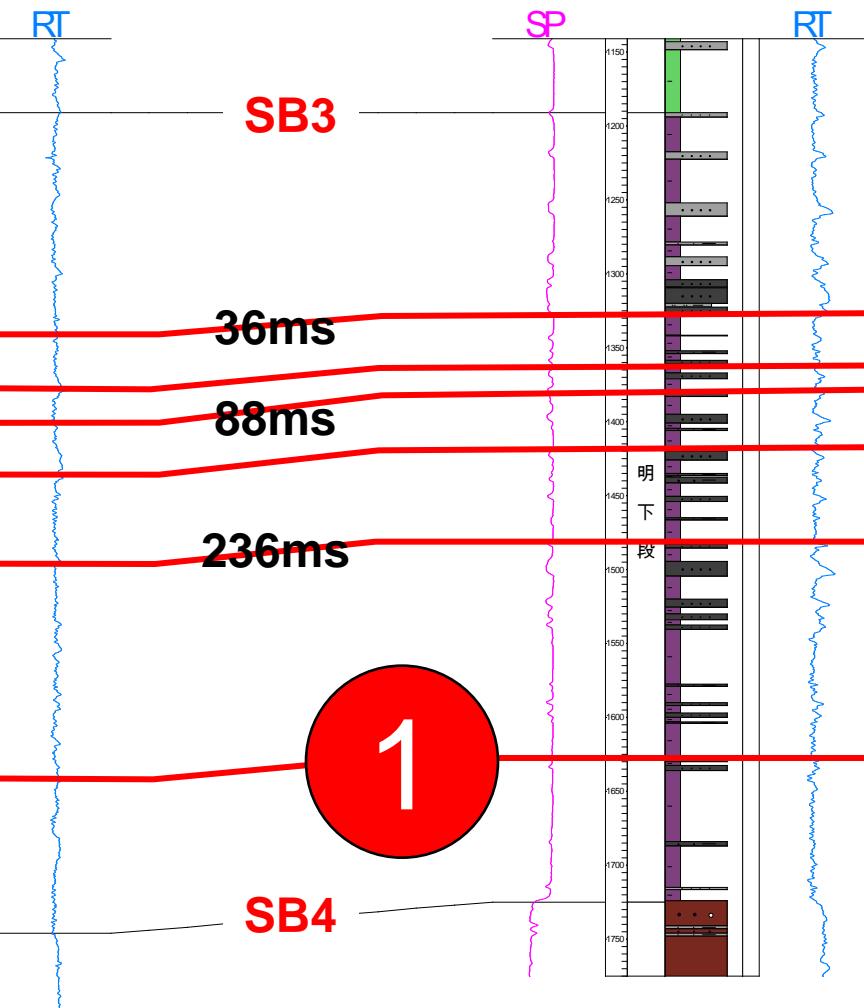
SNg**SB3**

36ms

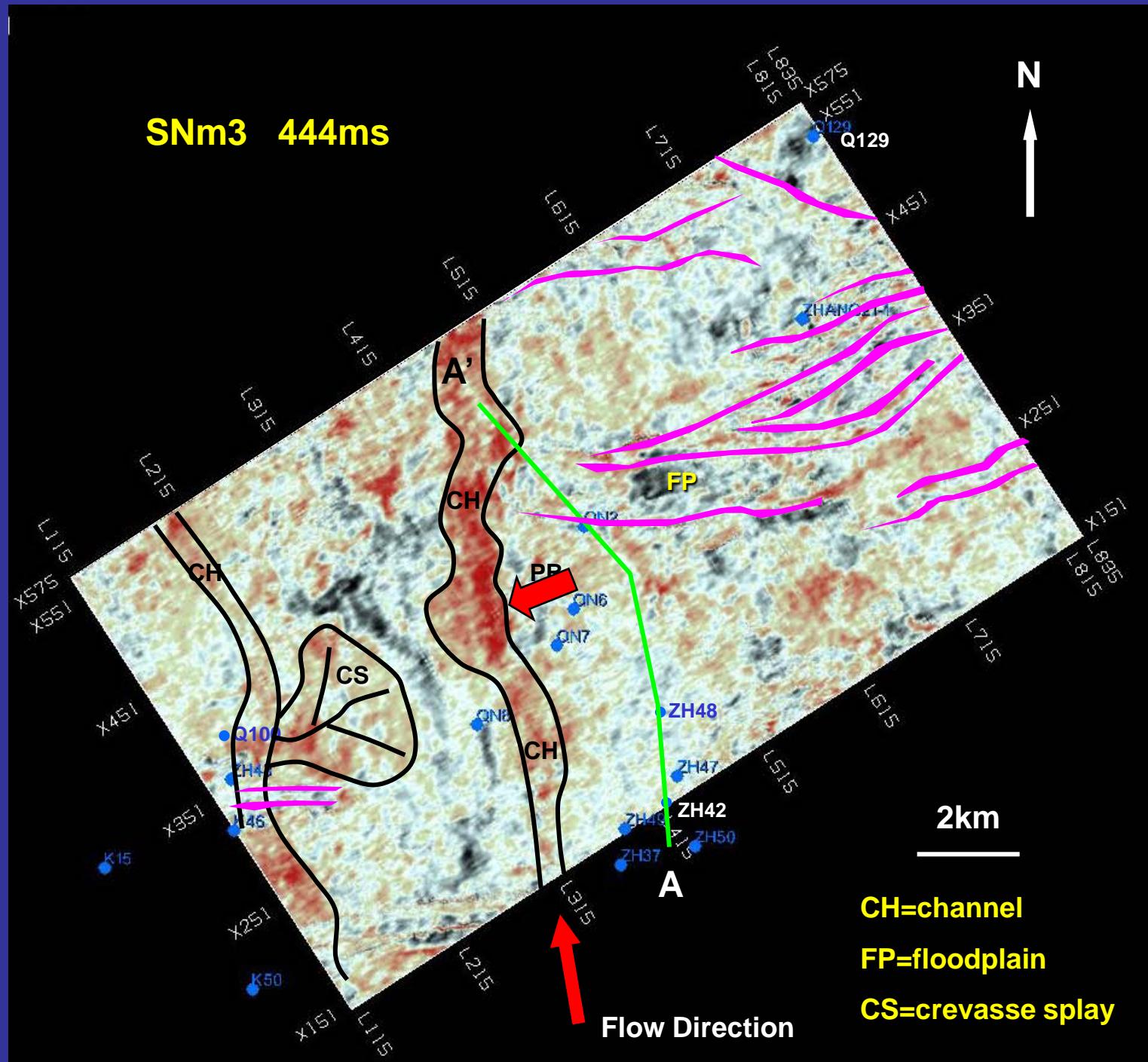
88ms

236ms

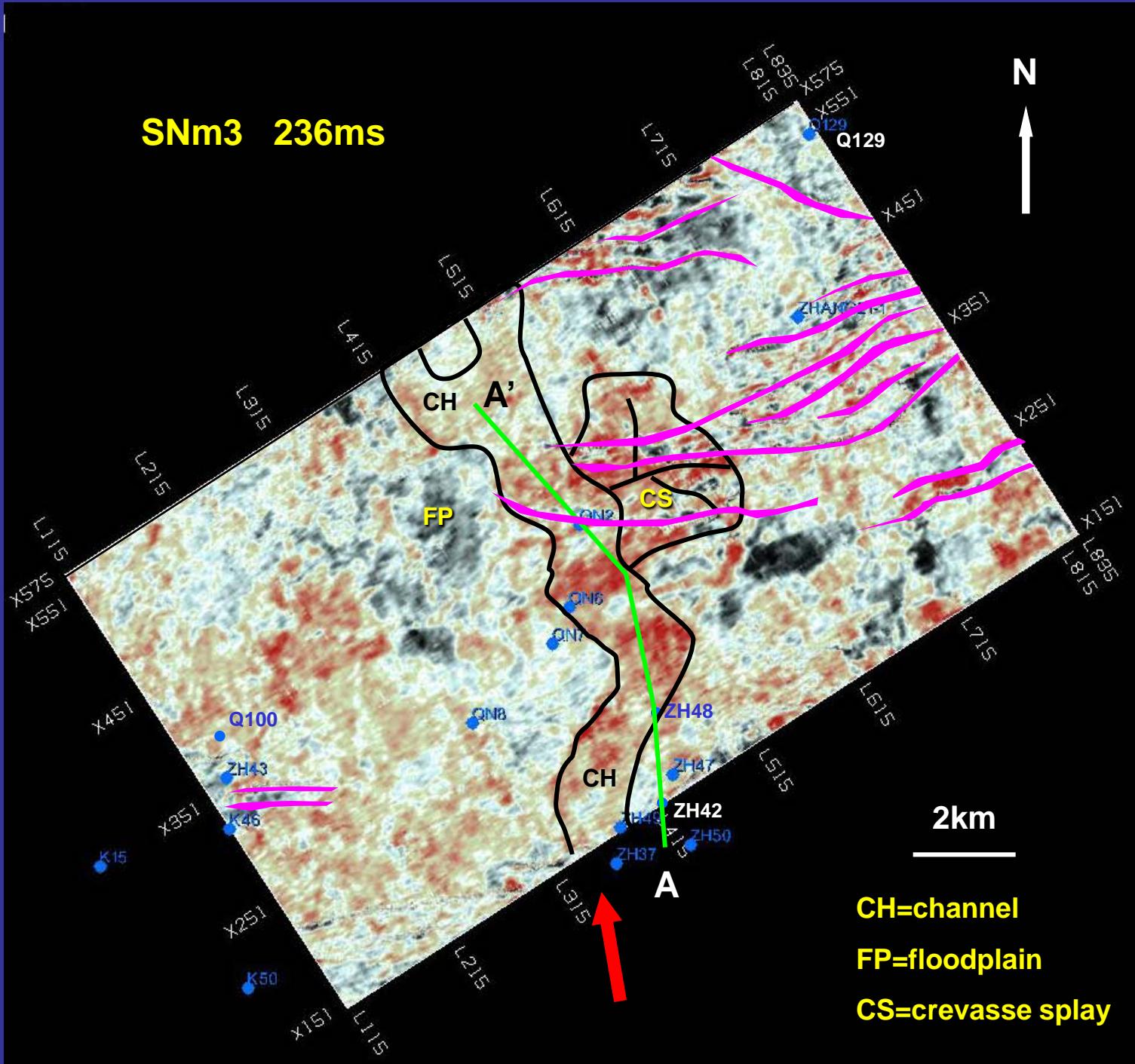
2

**SB4**

1



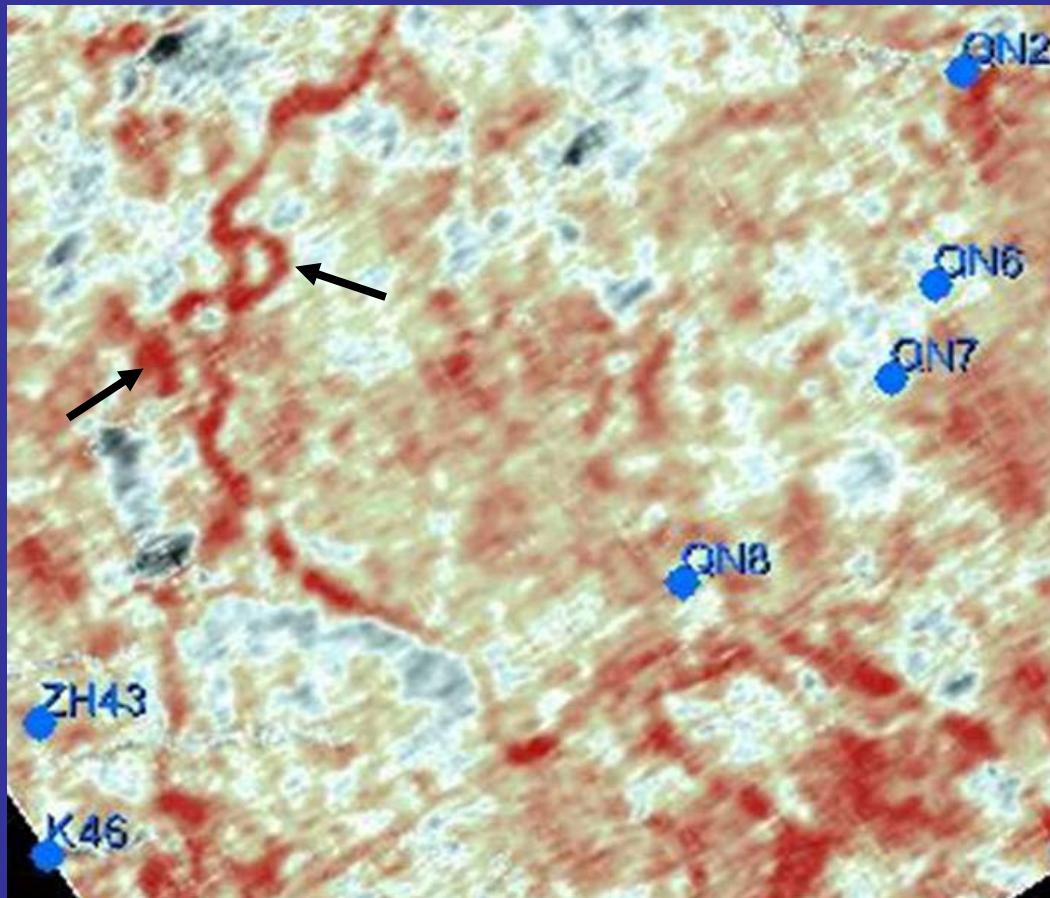
1



cutoff and oxbow lake

Early-stage
Abandoned
Meander loops

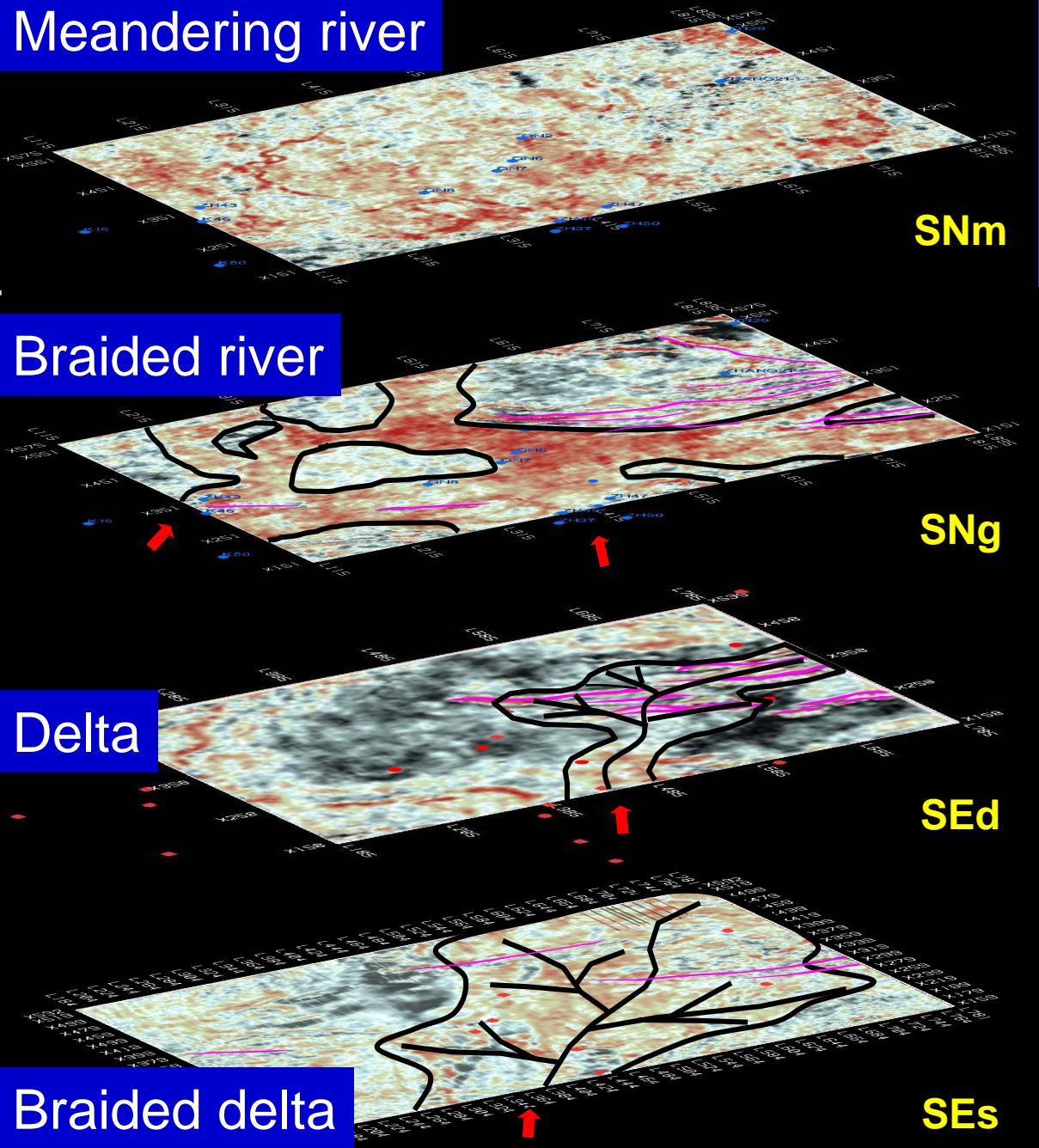
1km



3

SNm3 Pic22 88ms

Depositional evolution for the basin



1. Geologic setting
2. Sequence stratigraphic framework
3. Study of seismic sedimentology
4. Conclusion

Conclusion

1. There are 14 third-order sequences in Cenozoic , Huanghua depression.
2. Seismic sedimentology can be used to characterize fine-scale facies in high frequency sequences

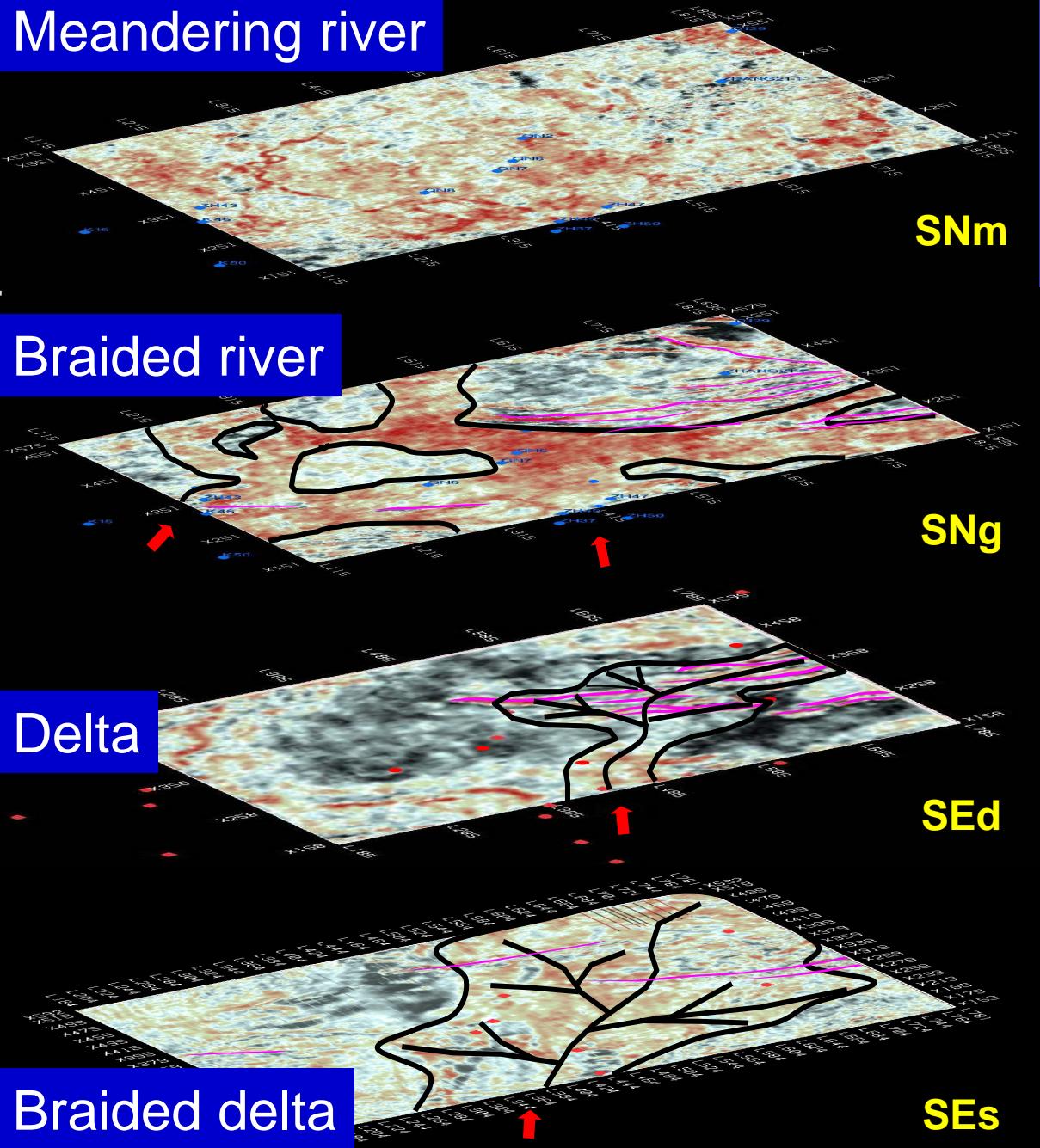
Conclusion

3.The Cenozoic depositional evolution
is from braided delta →delta →braided
river→meandering river in Cenozoic.

Acknowledgments

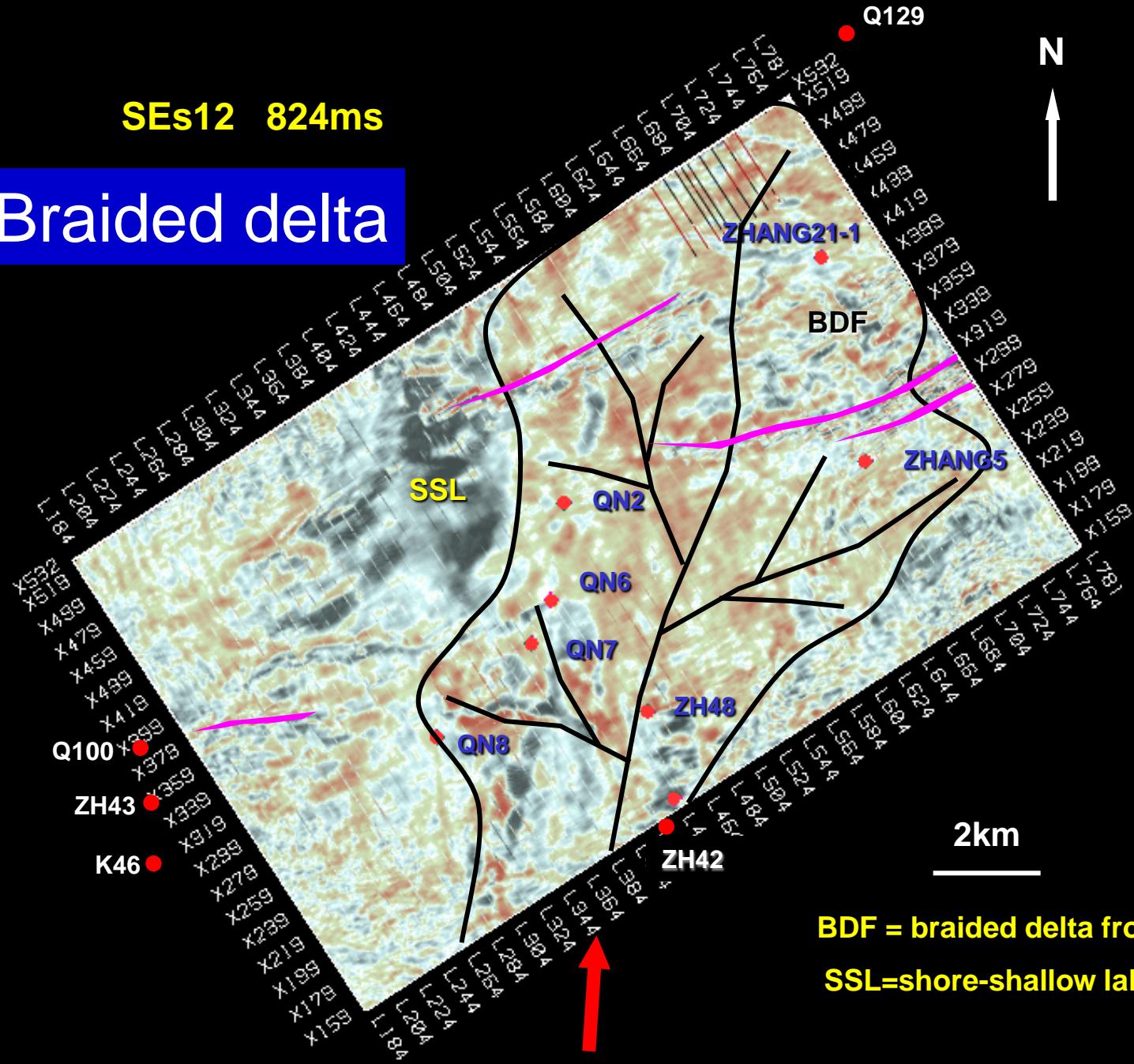
- Thank AGM for free Recon Software.
- Thank Dr Hongliu Zeng for technical consulting and discussion.

Movies of Depositional evolution for the basin



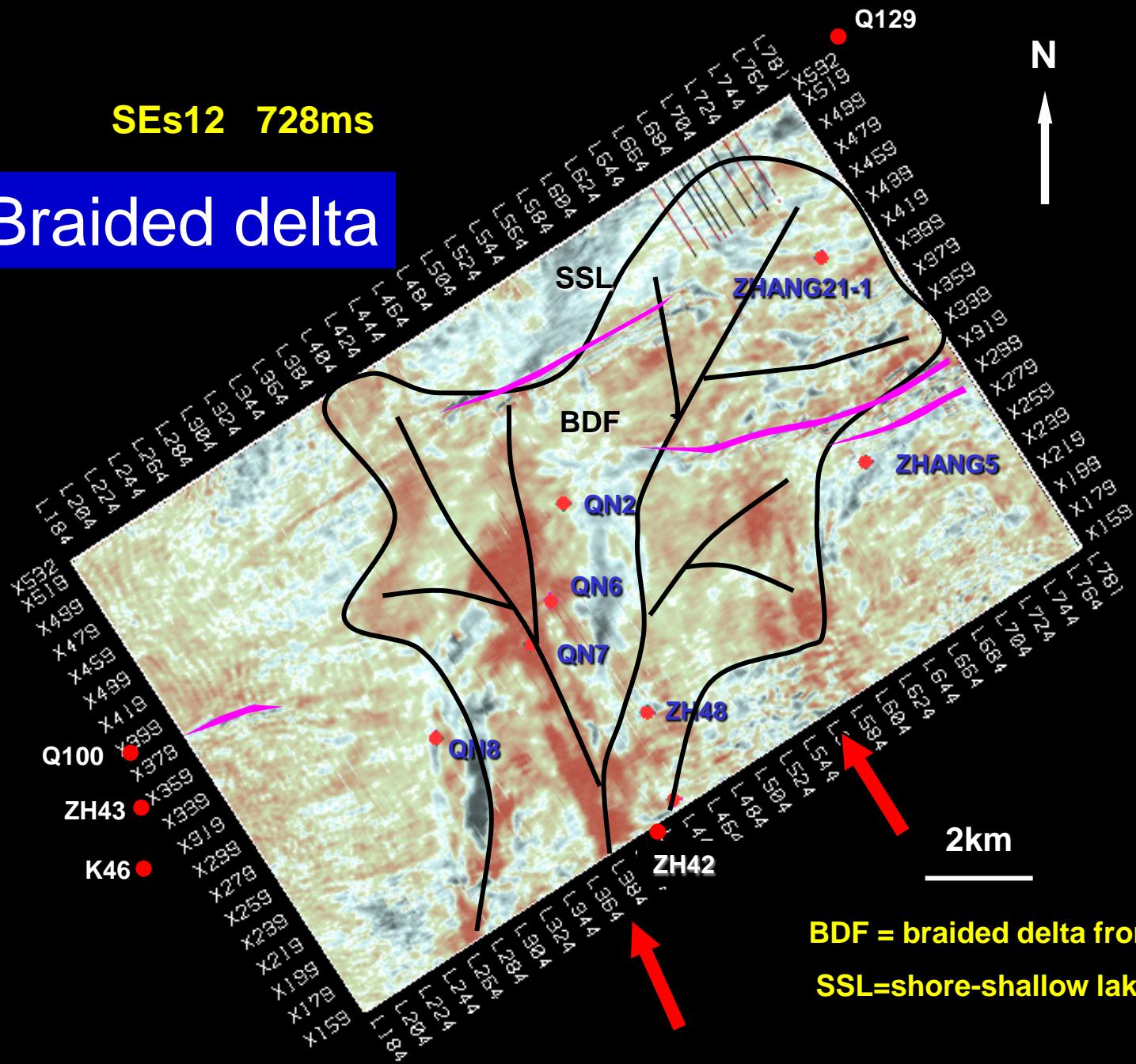
SEs12 824ms

Braided delta



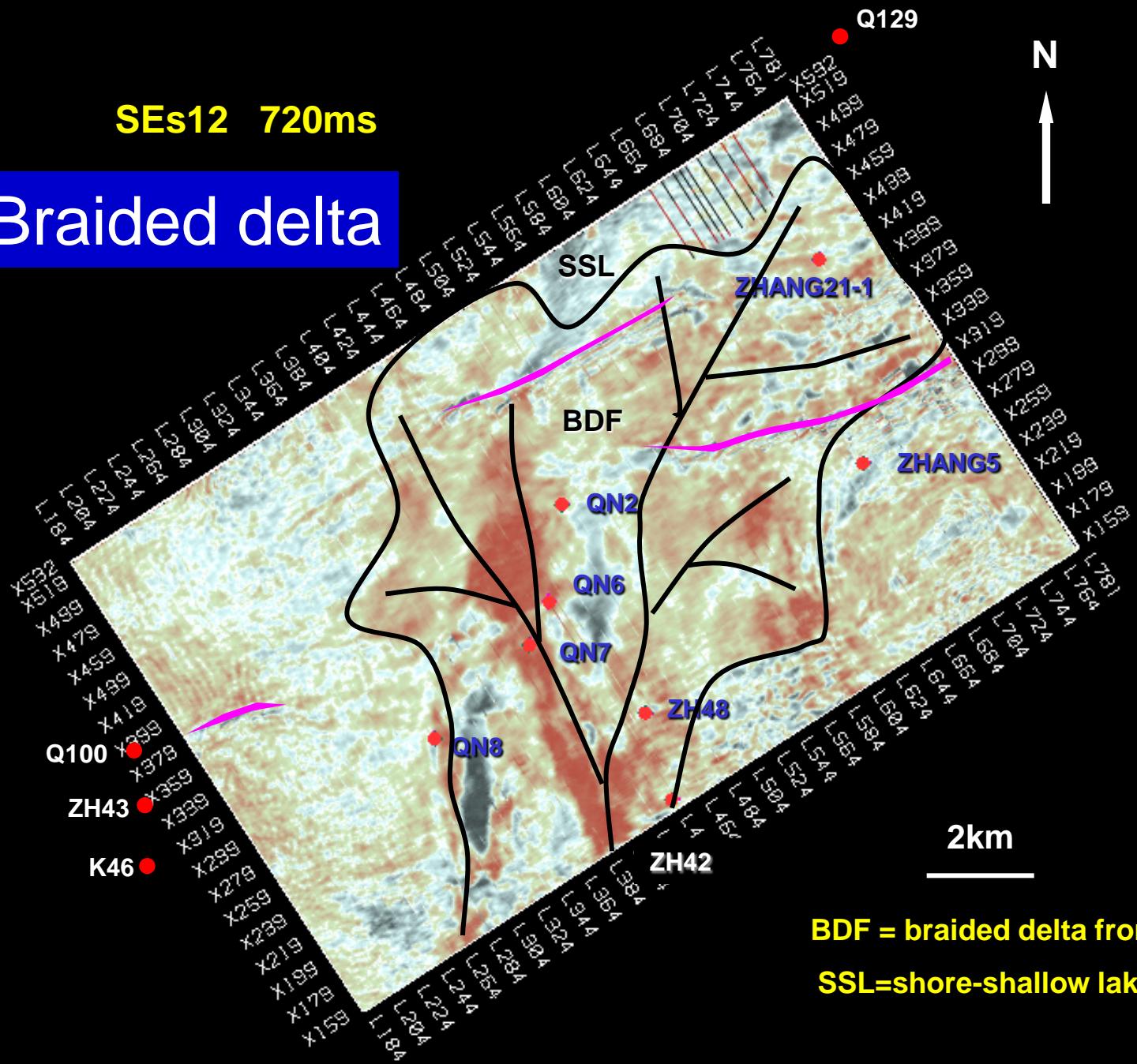
SEs12 728ms

Braided delta



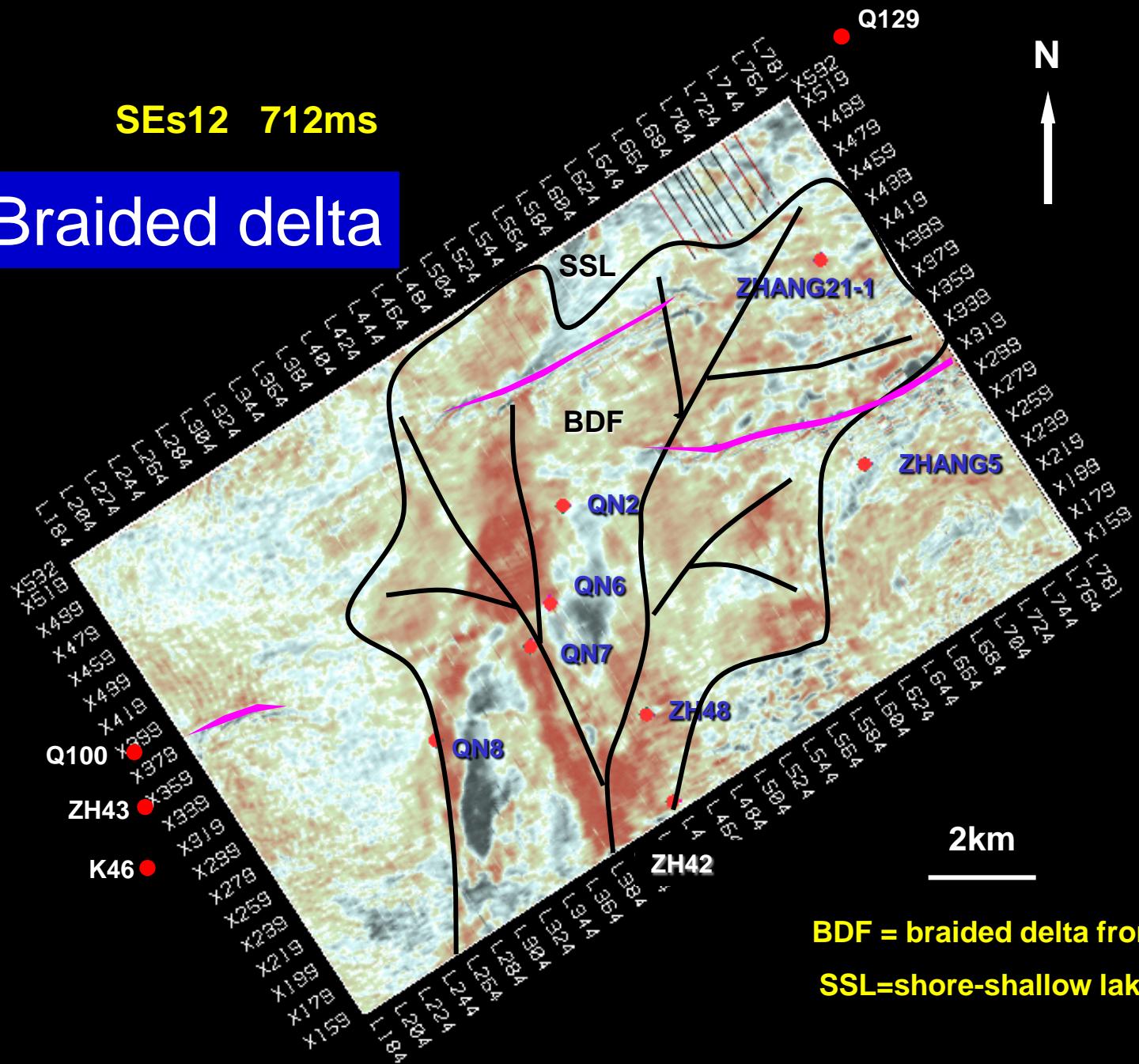
SEs12 720ms

Braided delta



SEs12 712ms

Braided delta

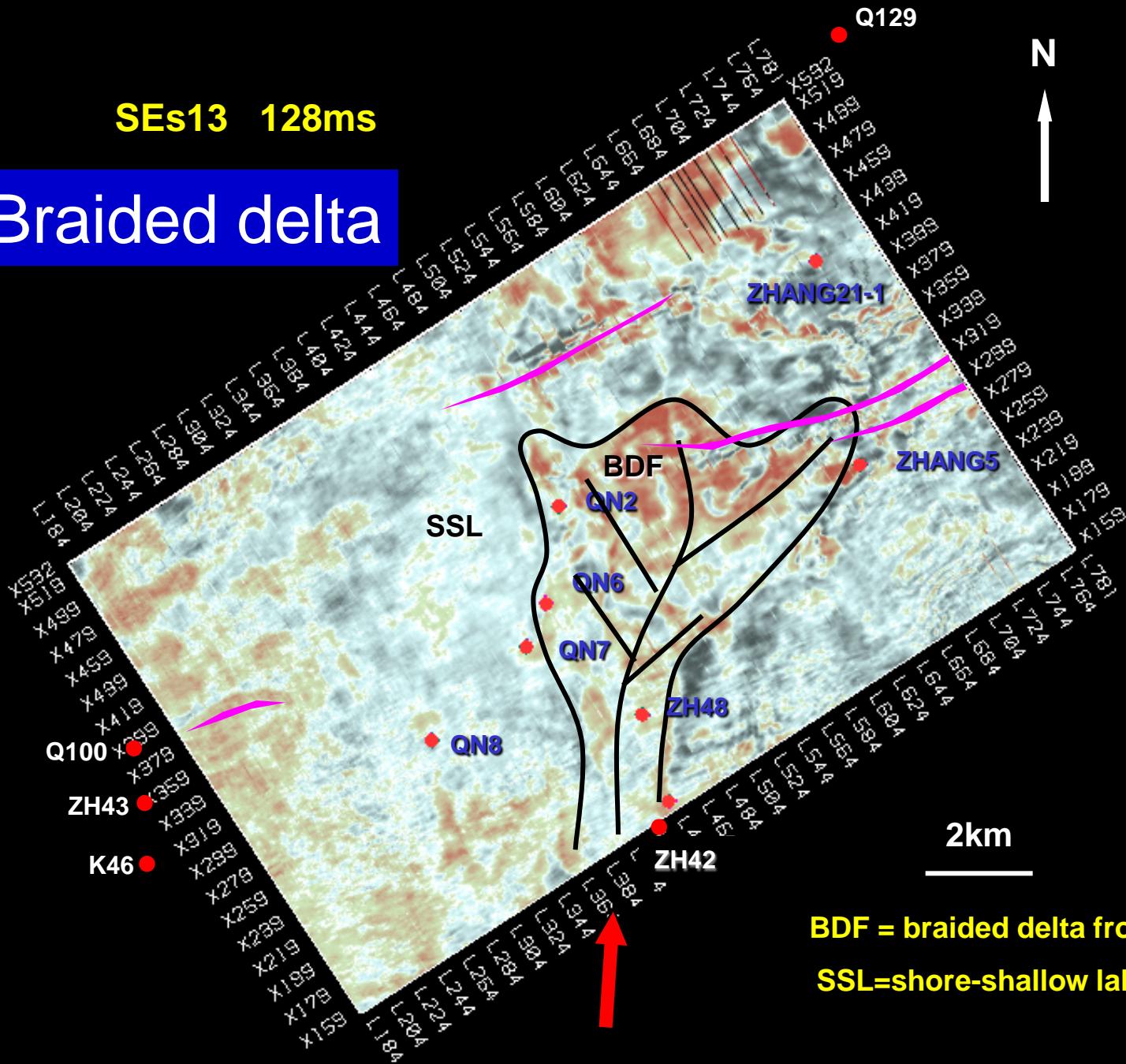


BDF = braided delta front

SSL=shore-shallow lake

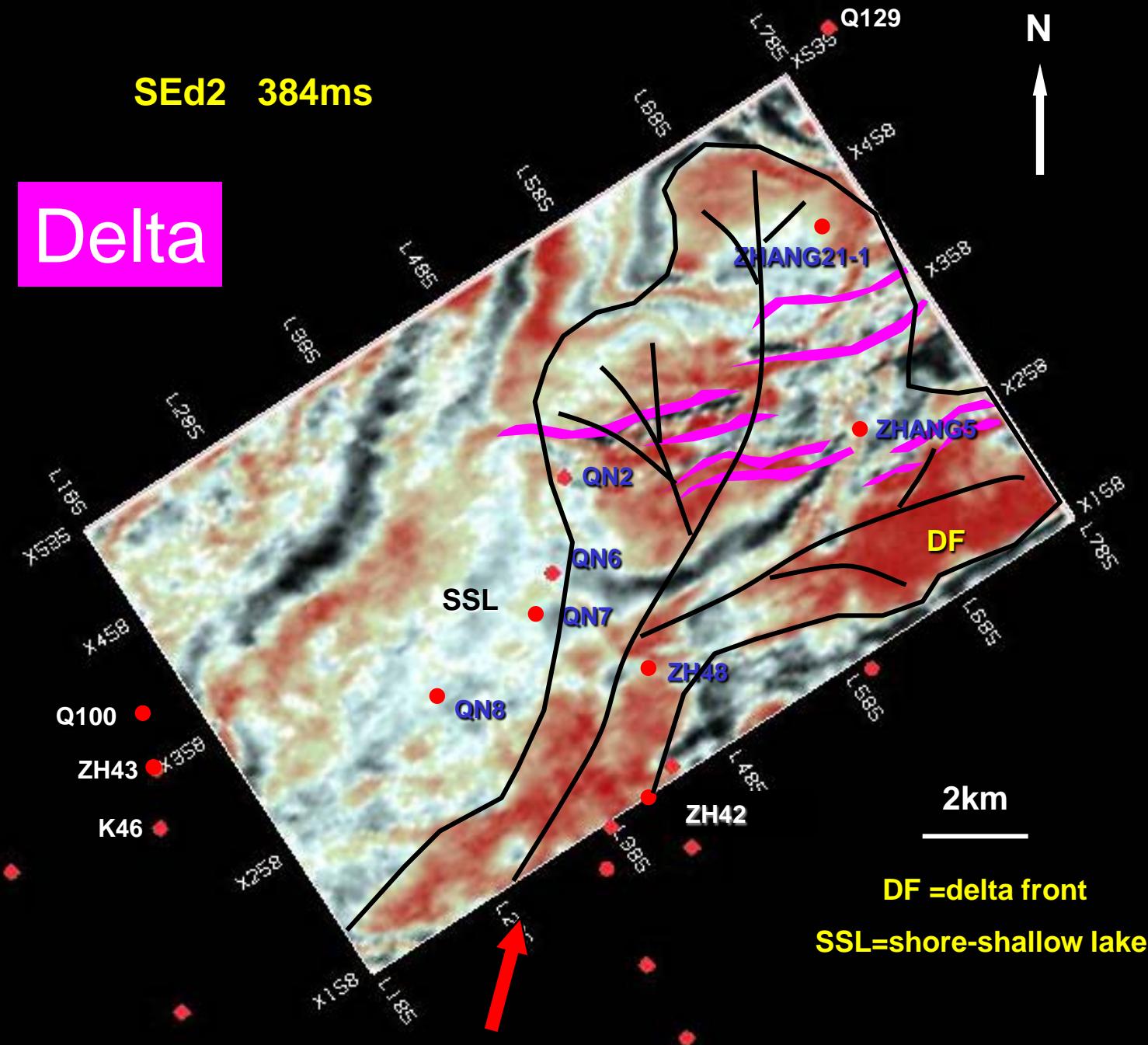
SEs13 128ms

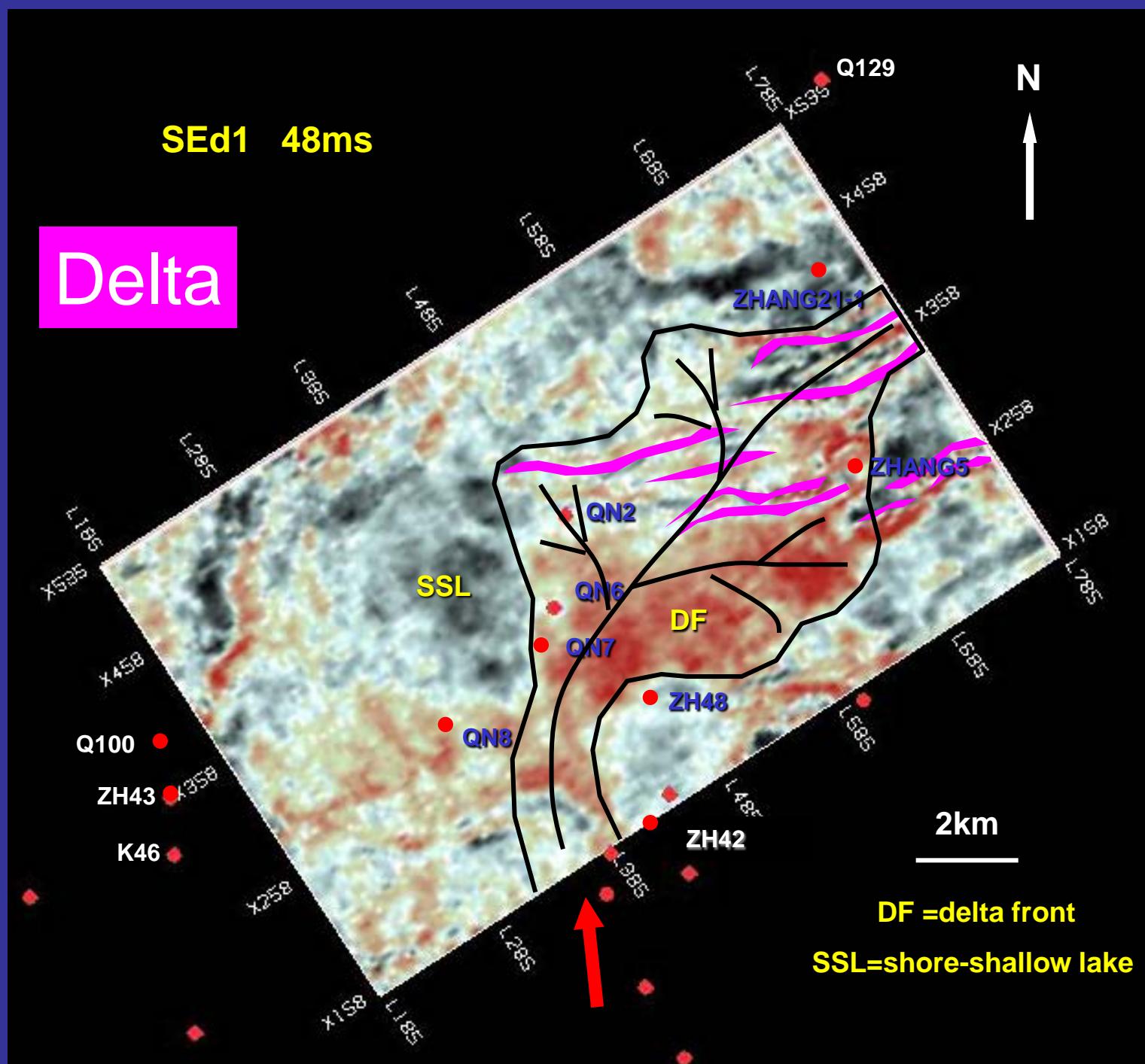
Braided delta



SEd2 384ms

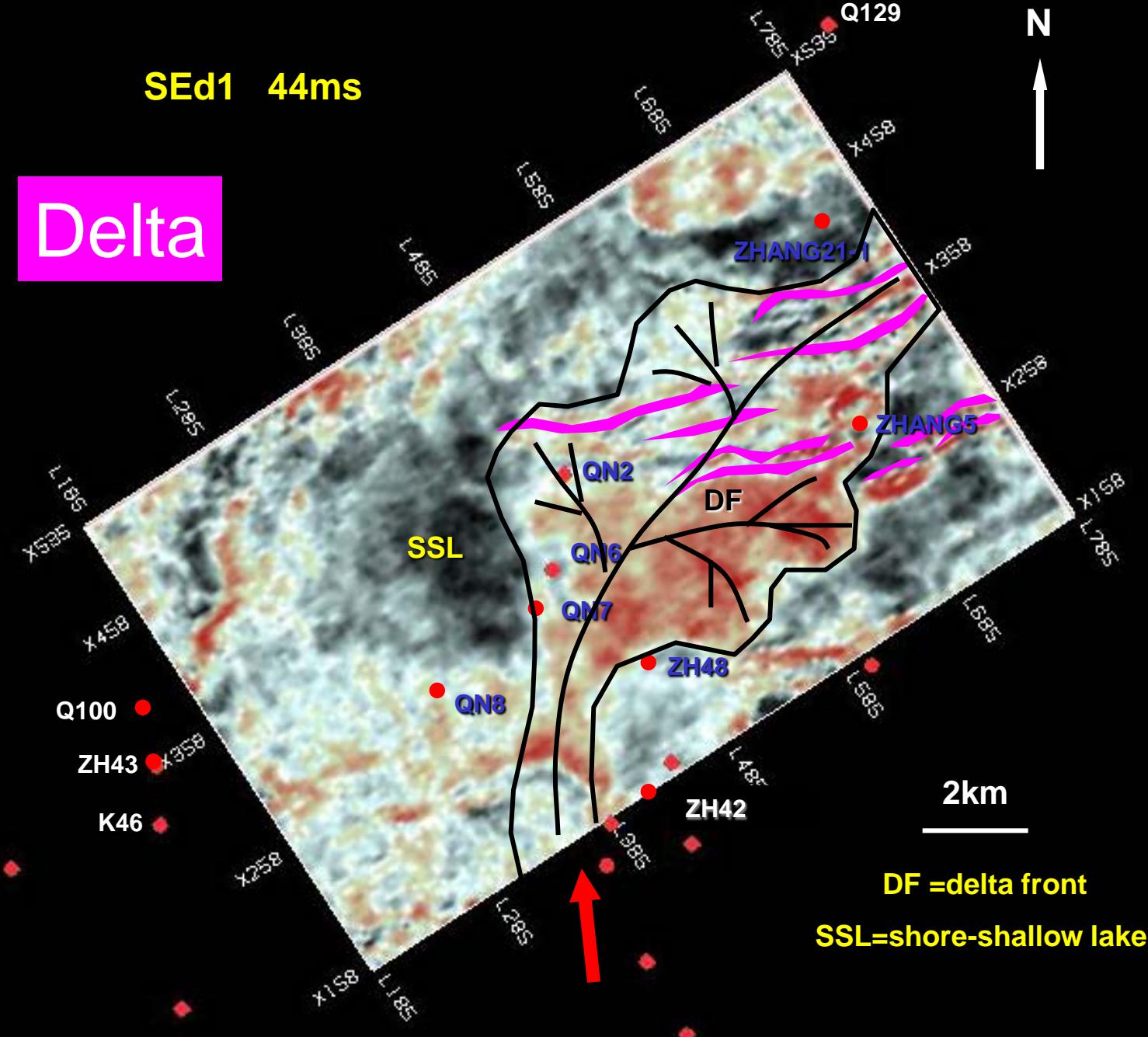
Delta

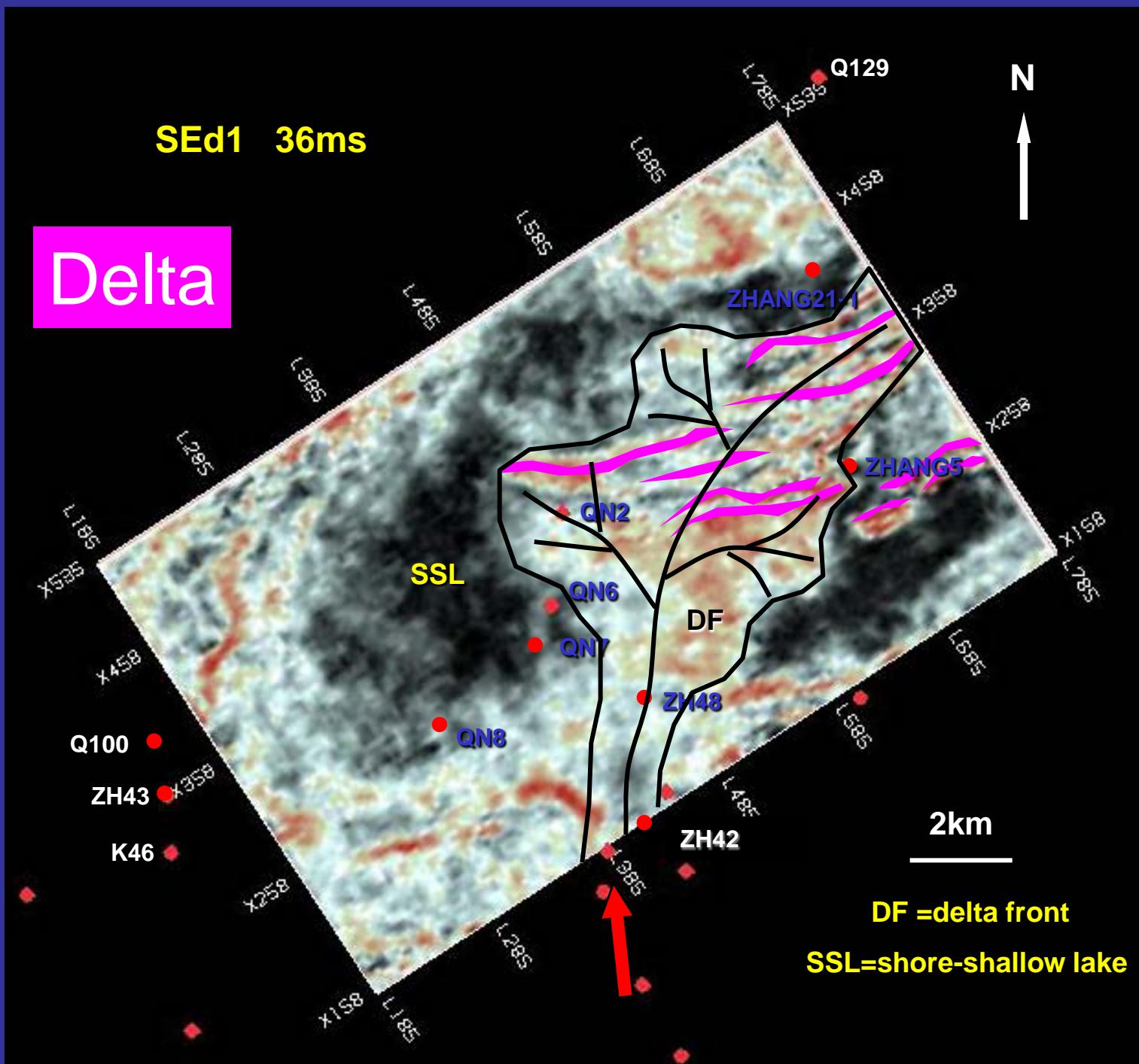


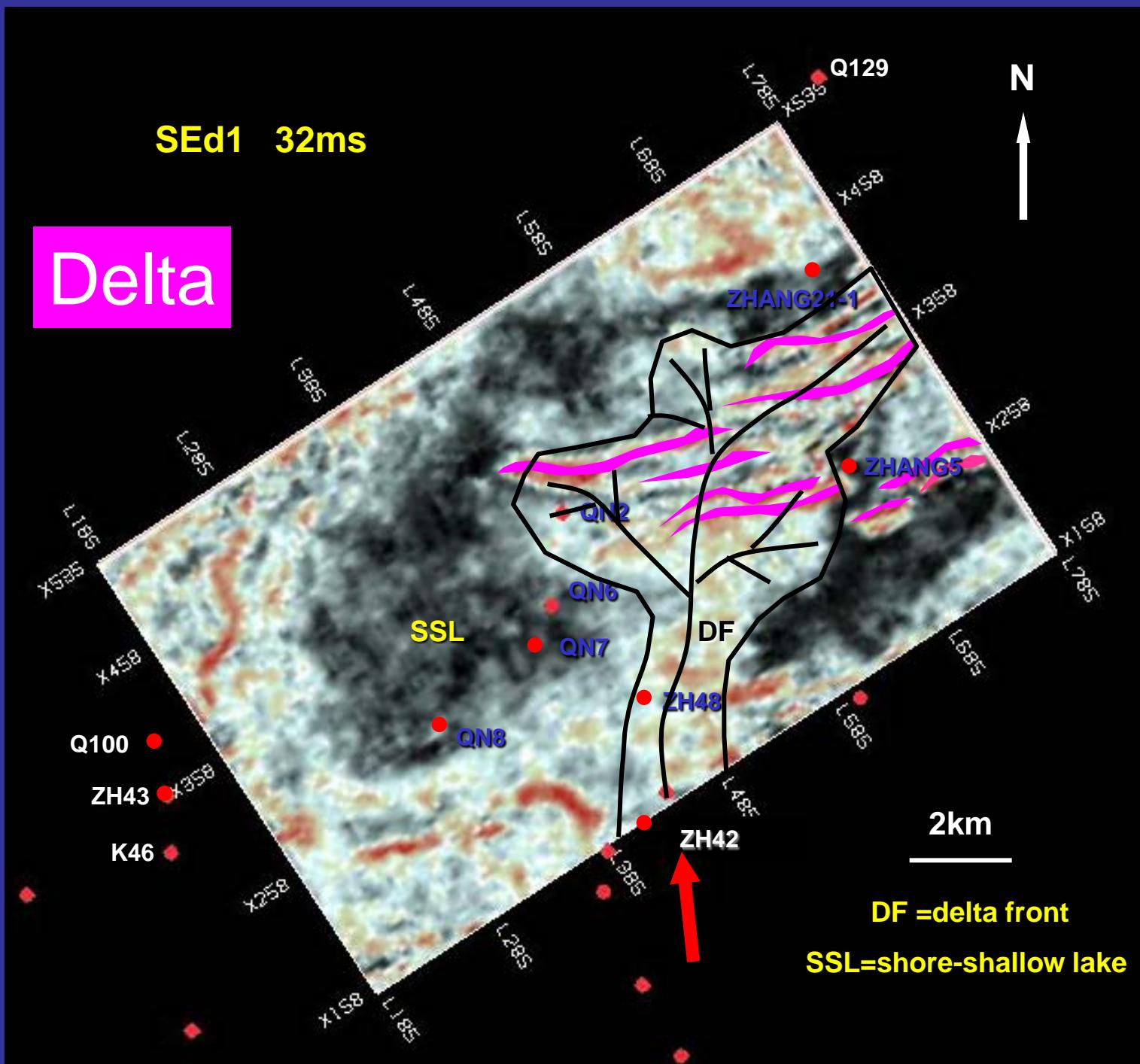


Delta

SEd1 44ms

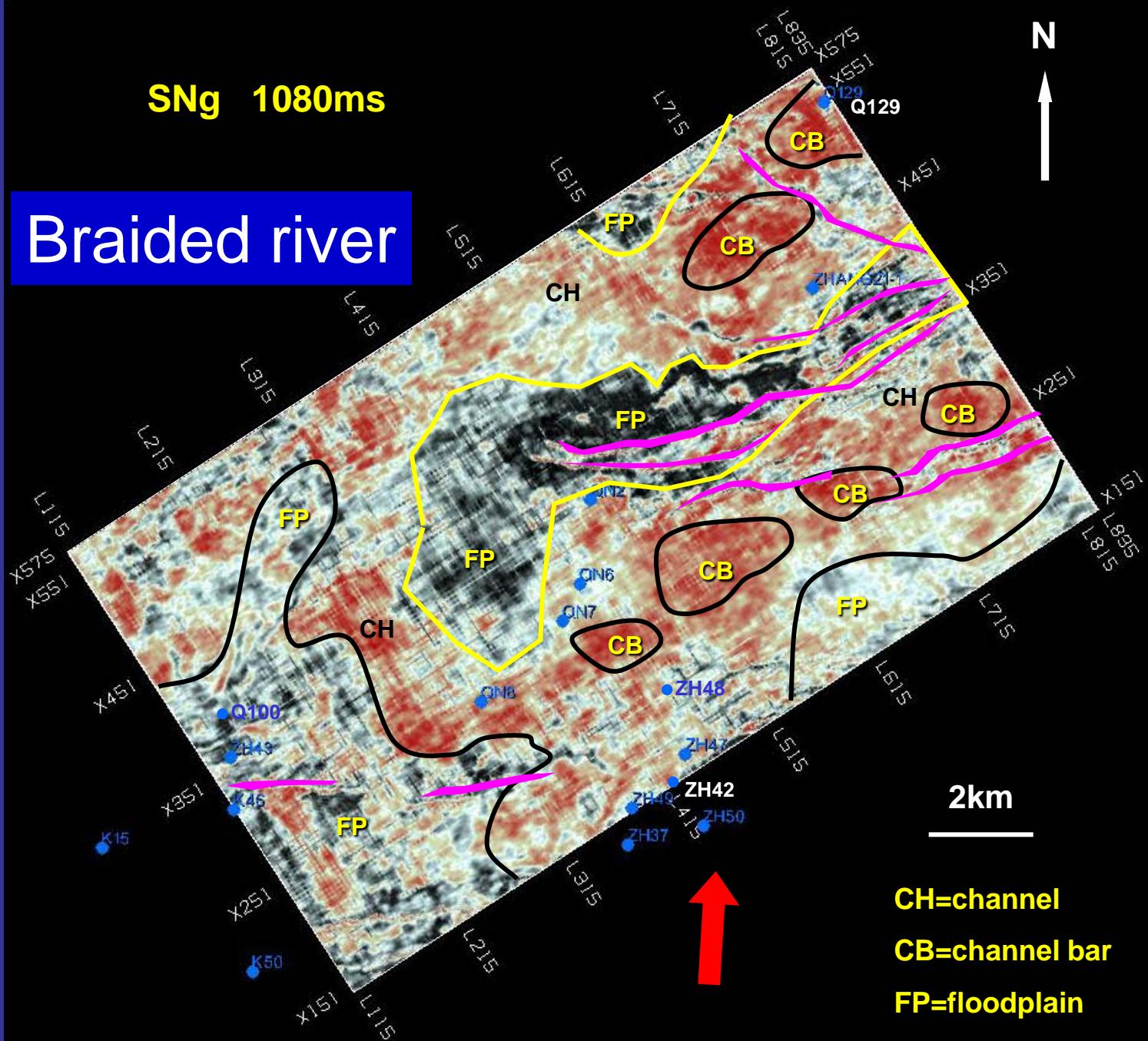






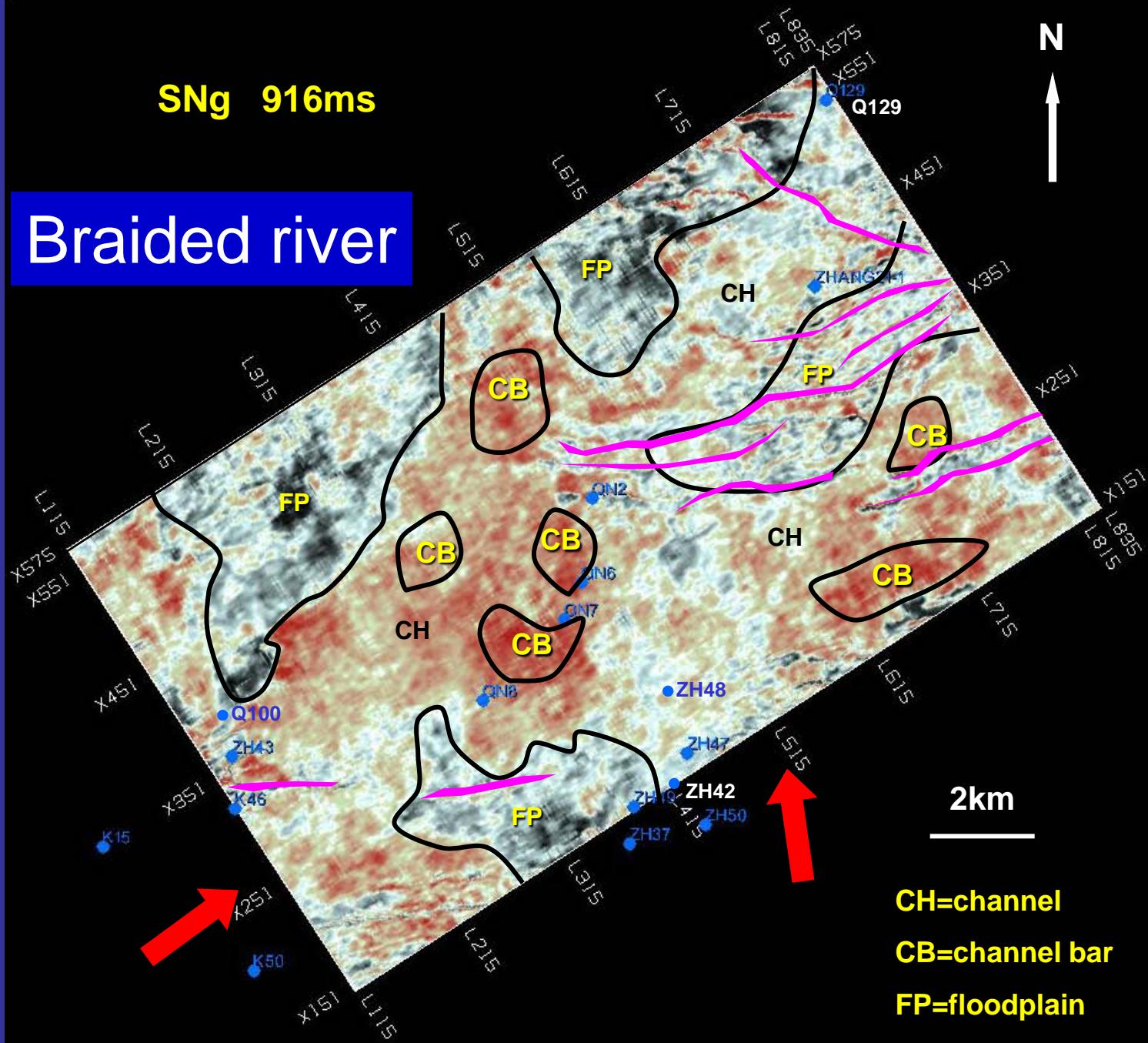
SNg 1080ms

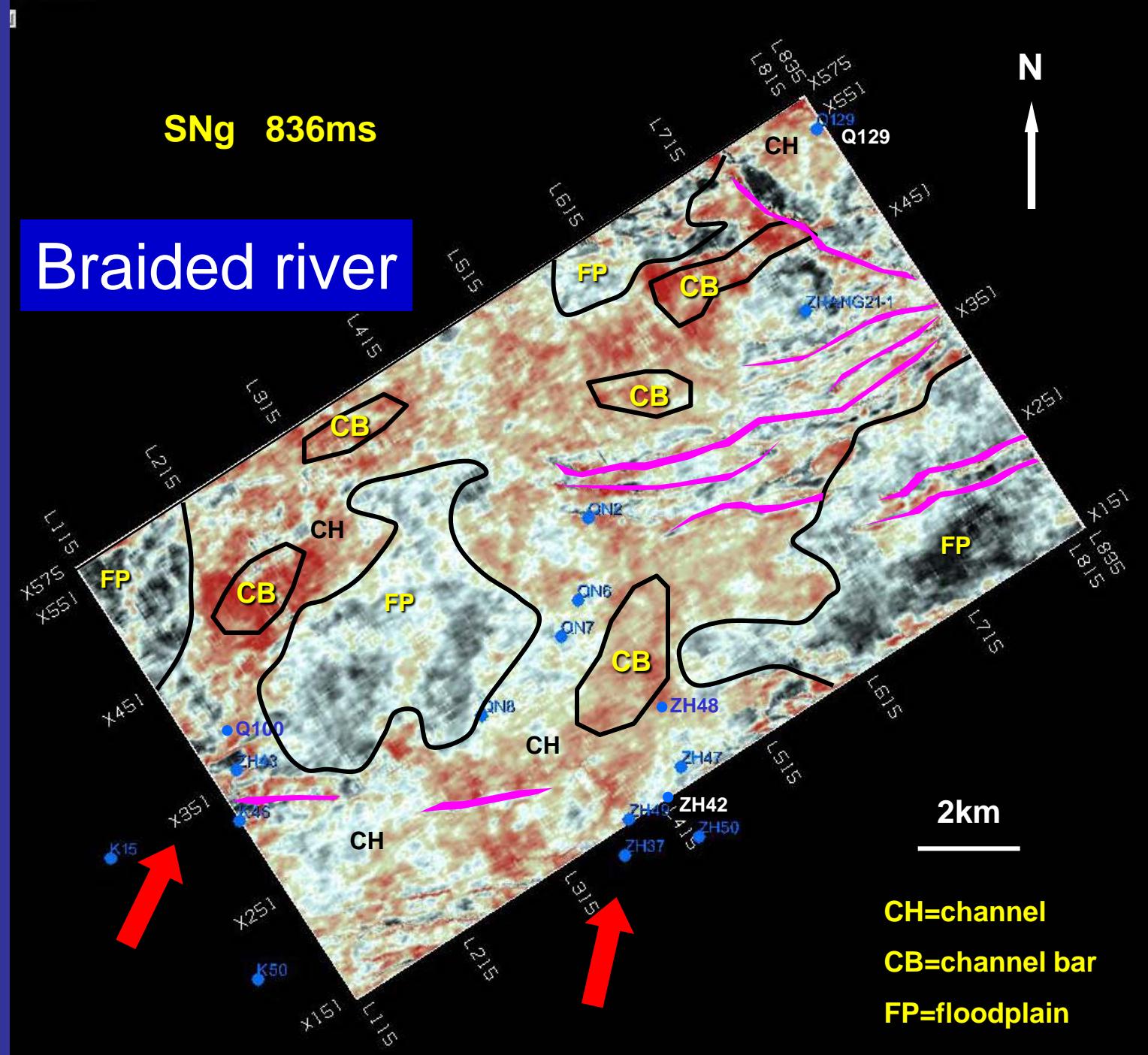
Braided river

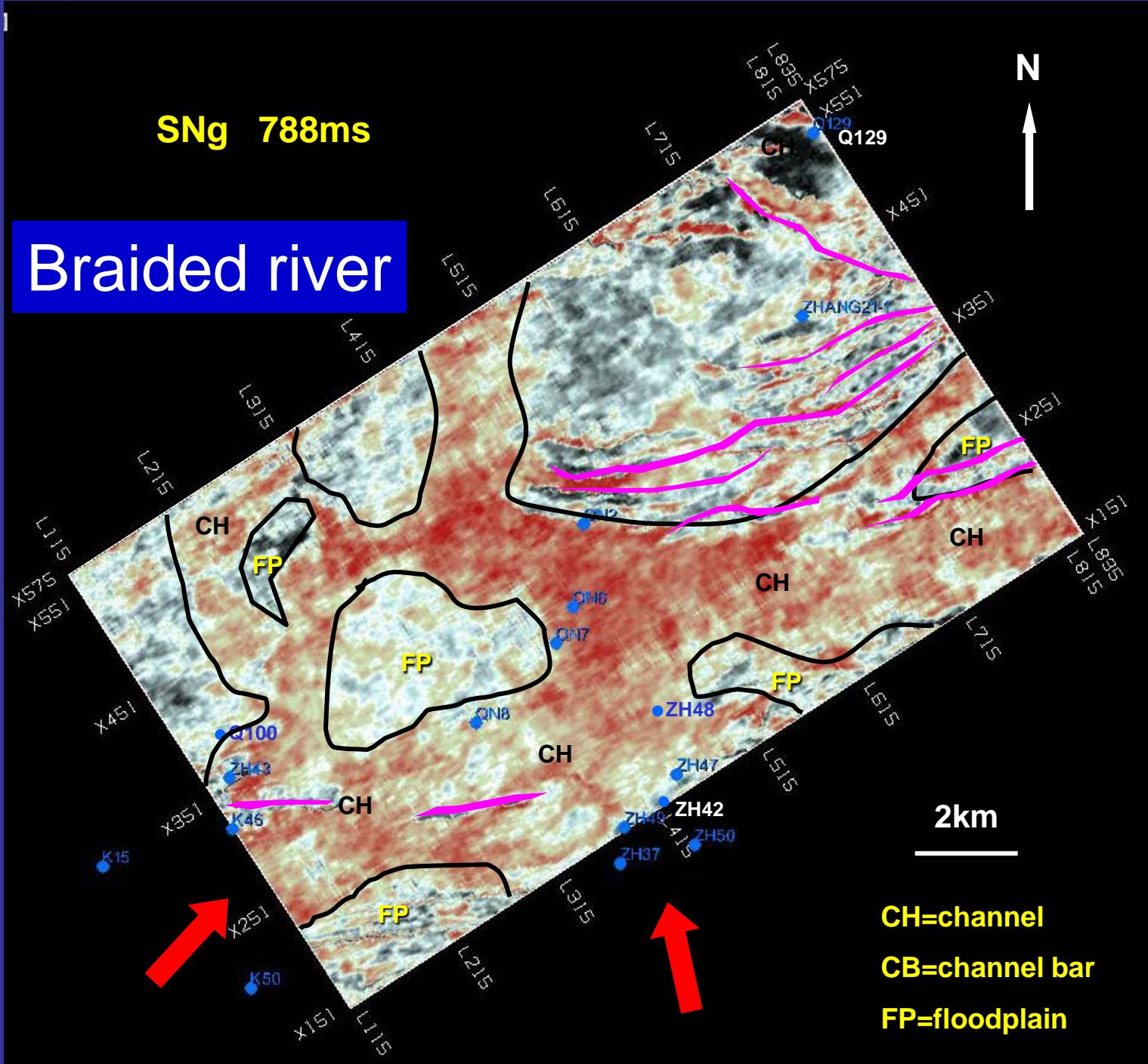


SNg 916ms

Braided river

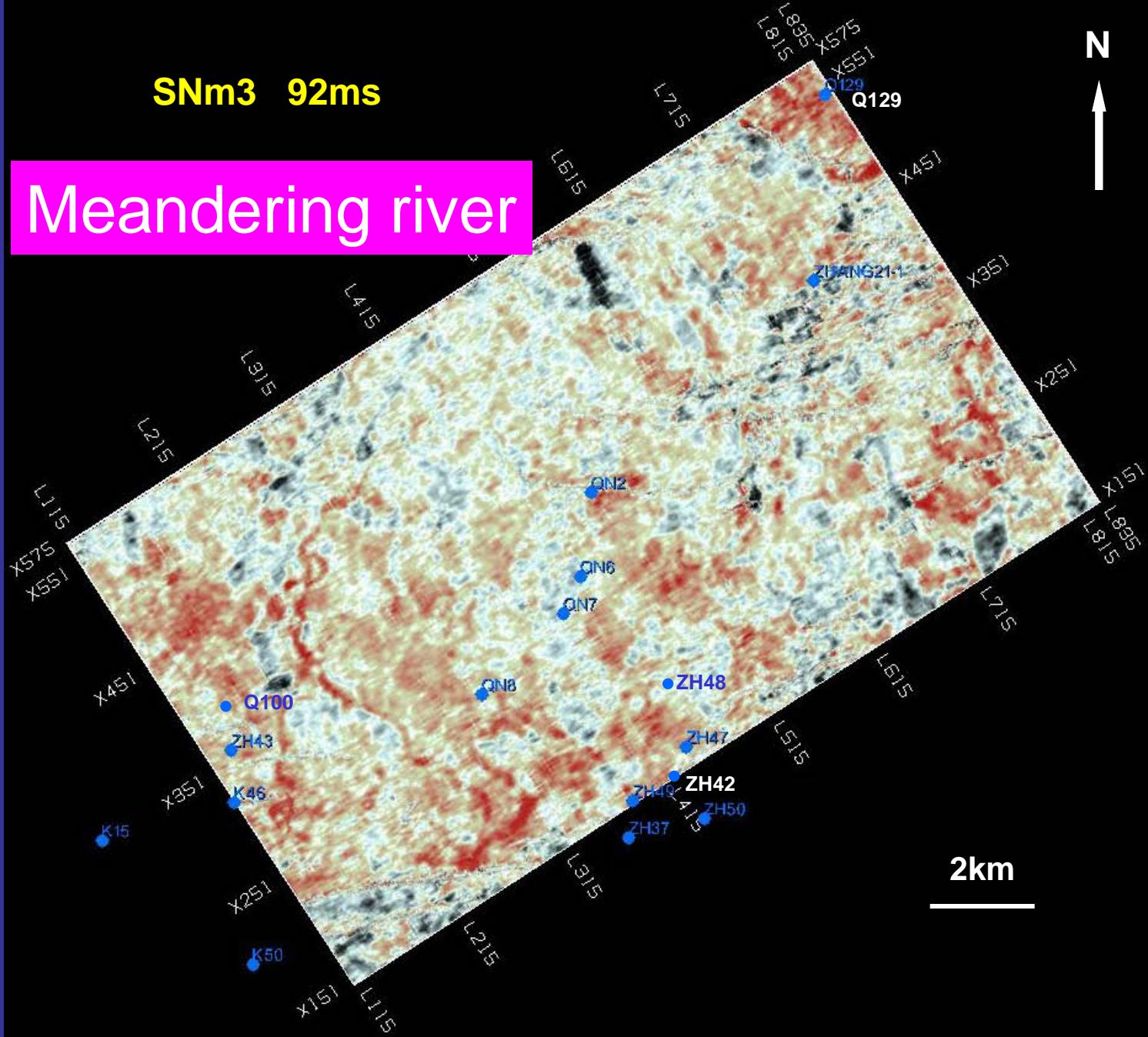






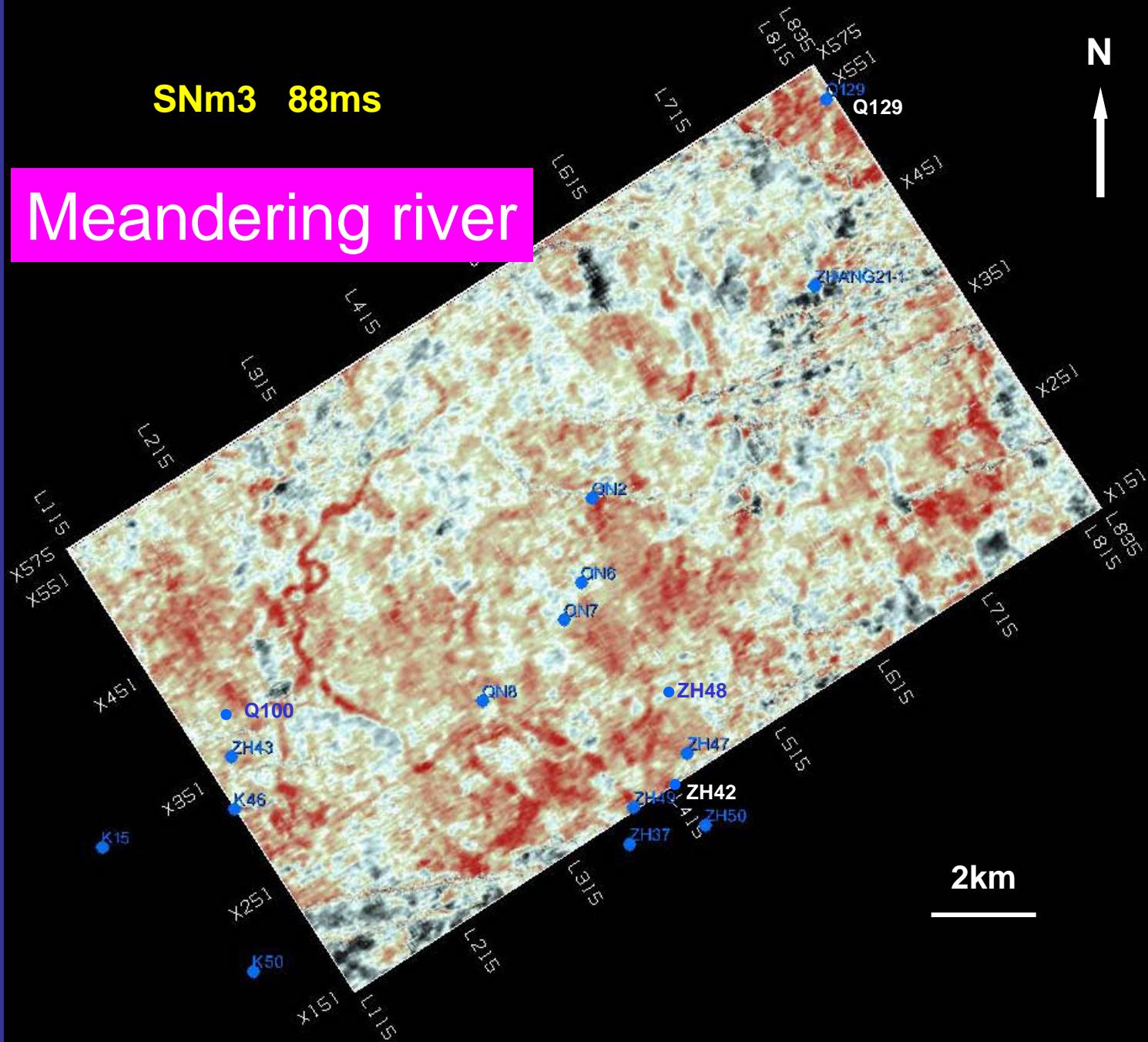
SNm3 92ms

Meandering river



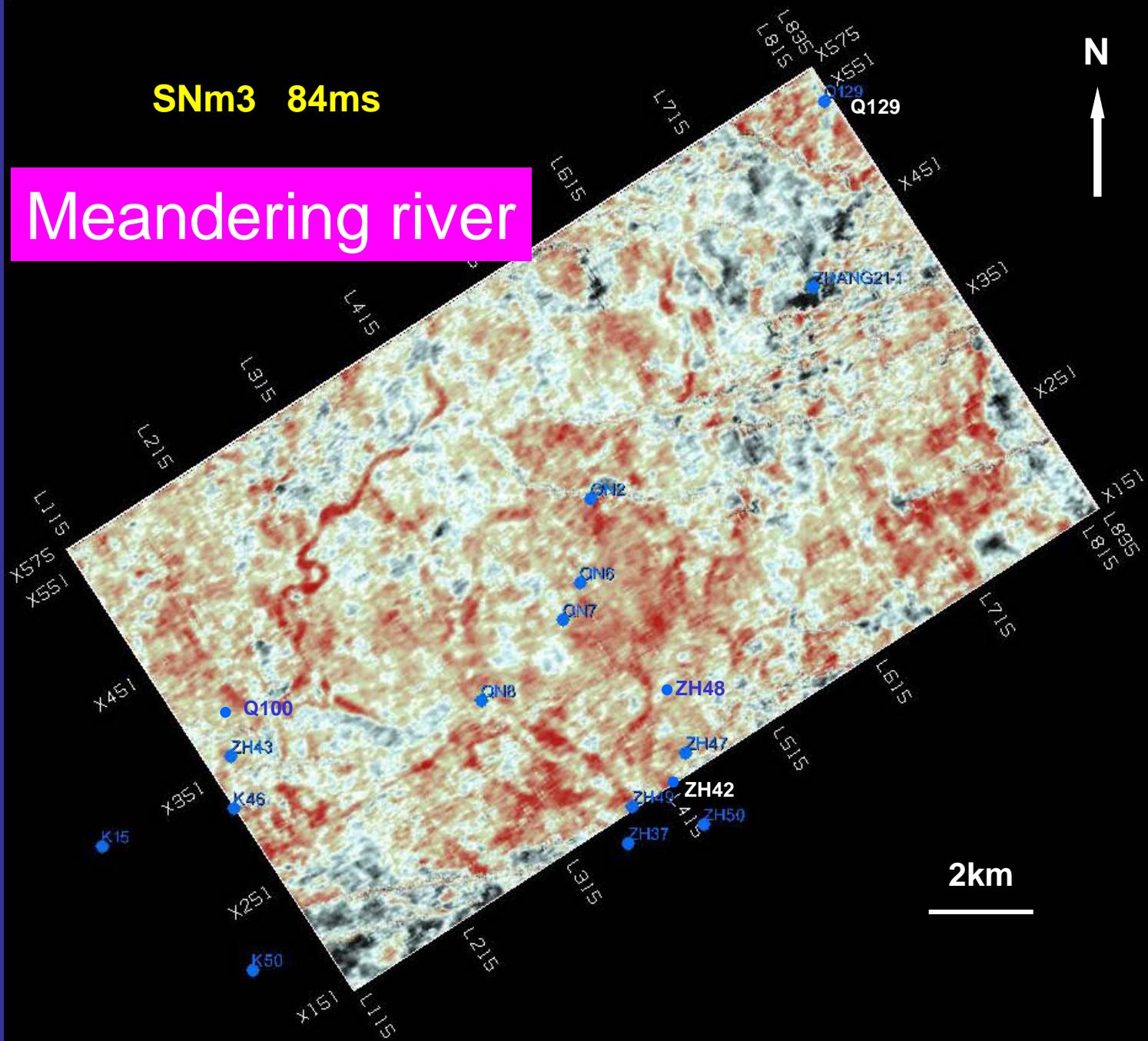
SNm3 88ms

Meandering river



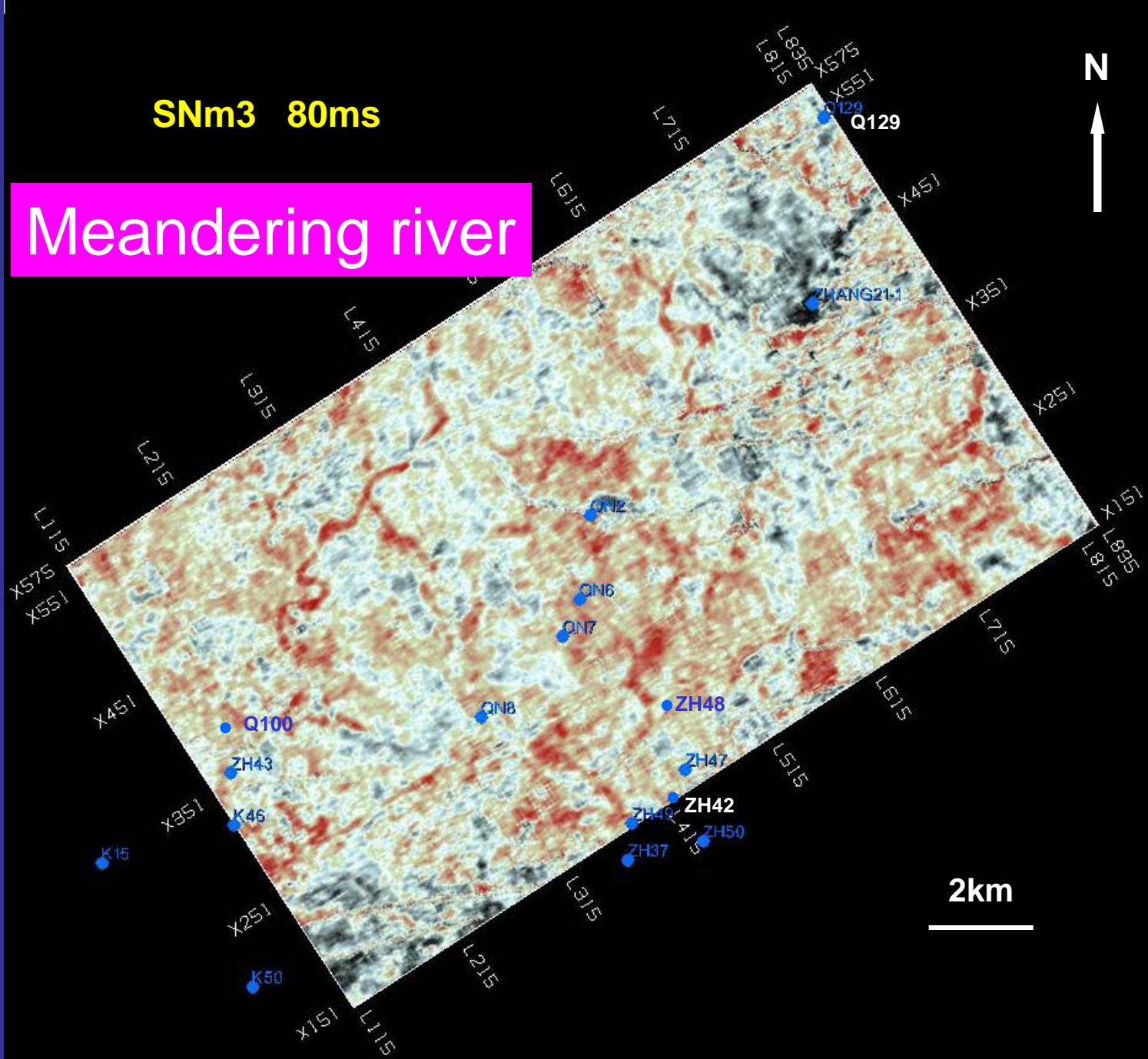
SNm3 84ms

Meandering river



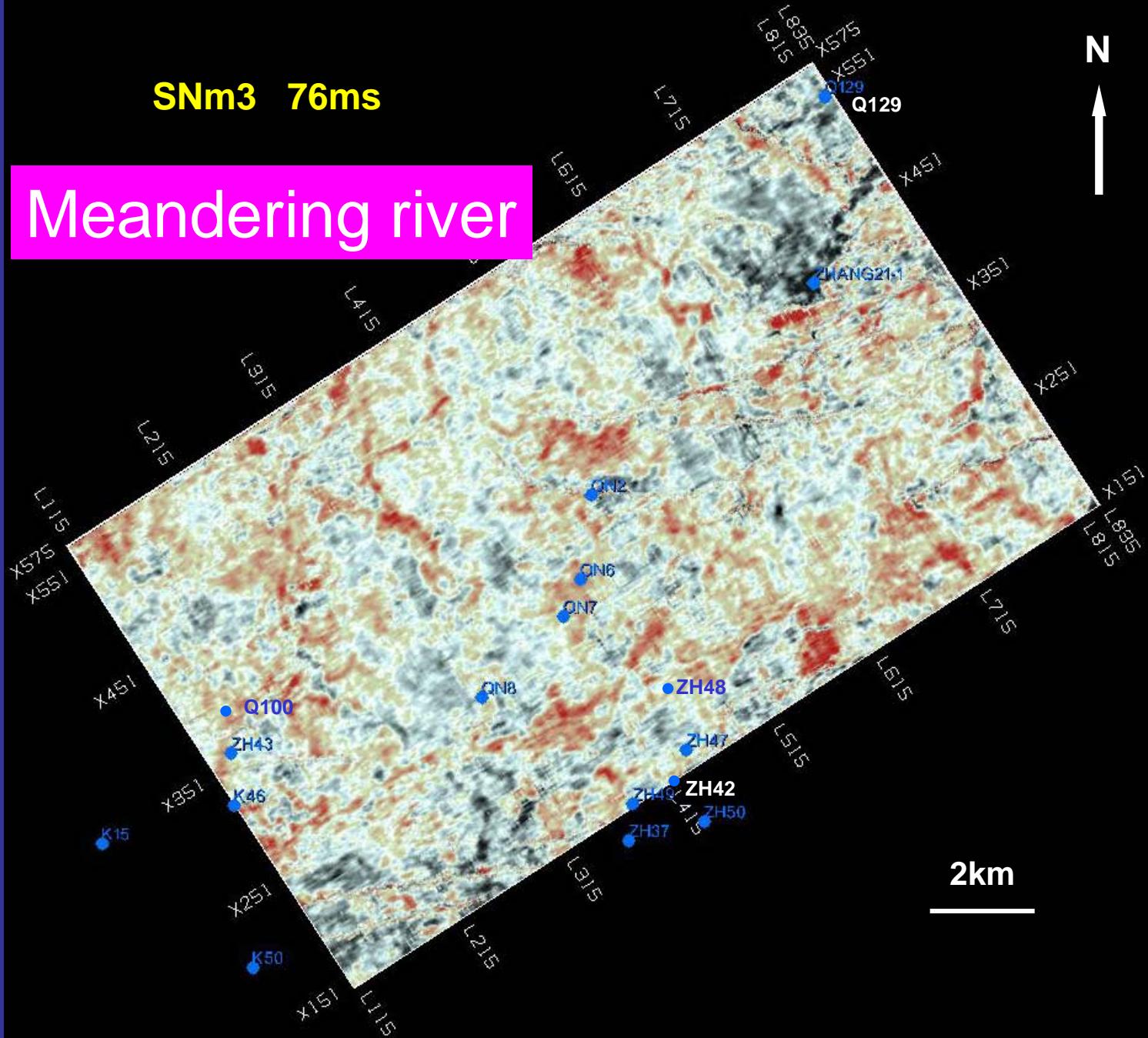
SNm3 80ms

Meandering river



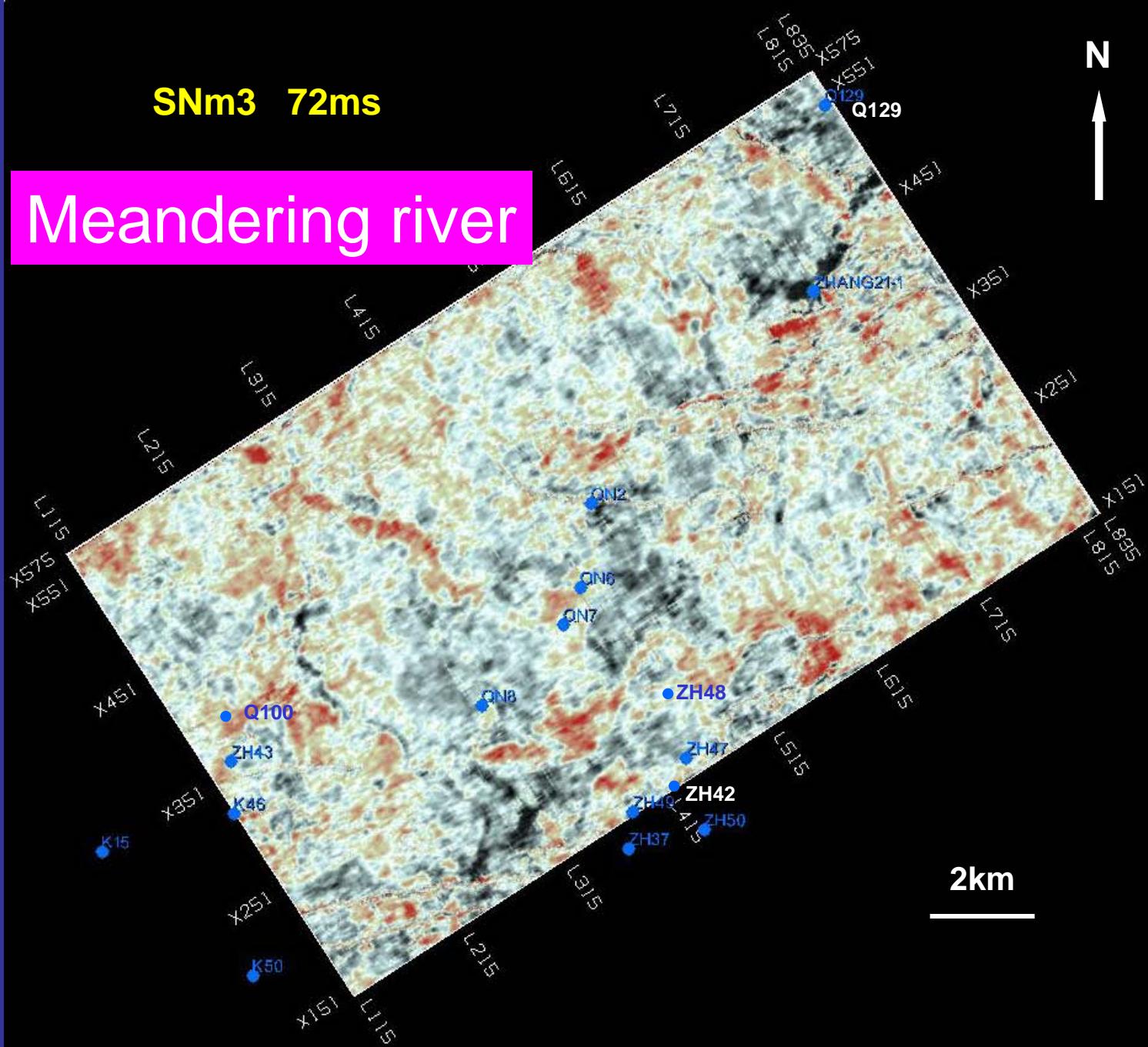
SNm3 76ms

Meandering river



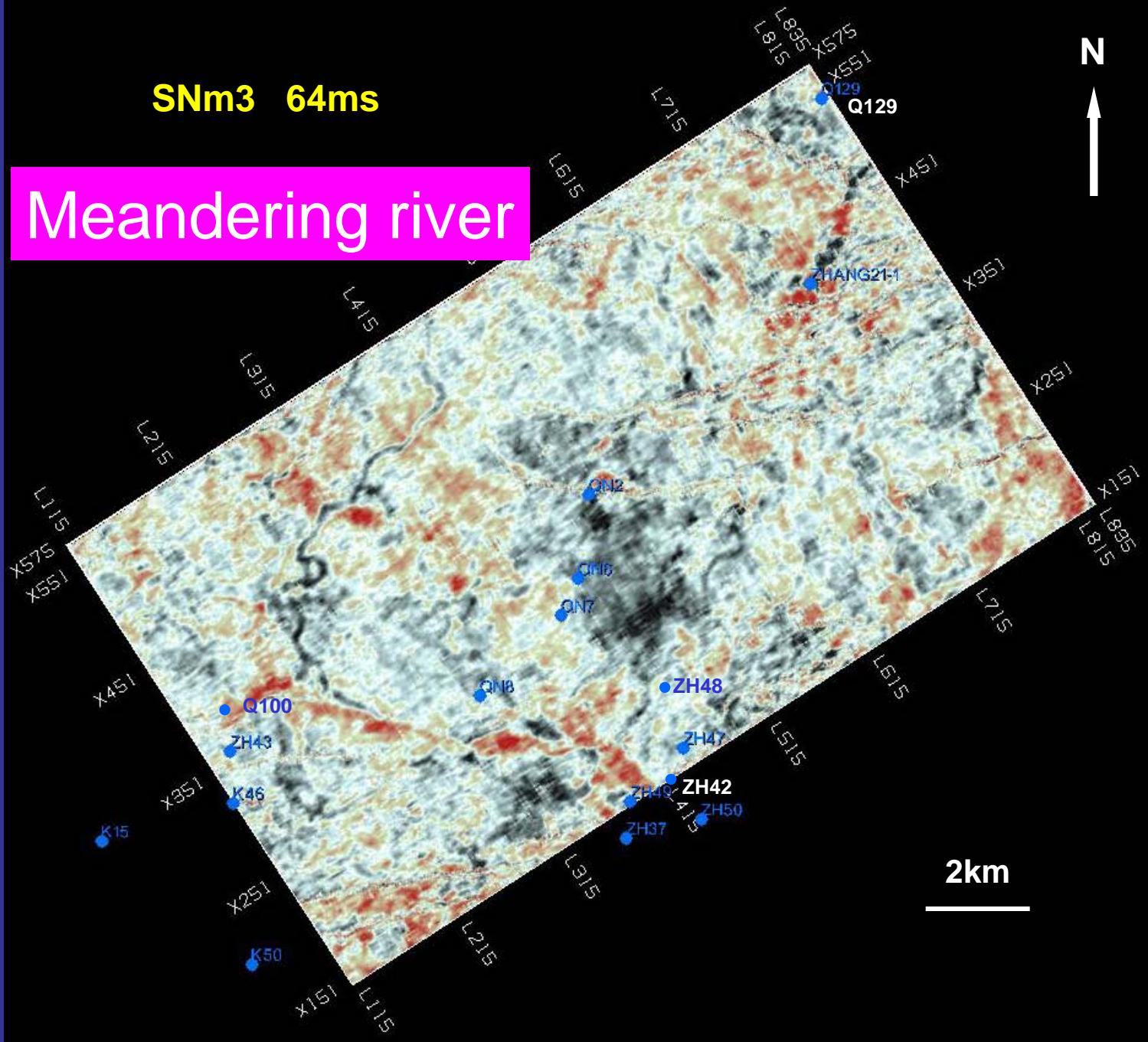
SNm3 72ms

Meandering river



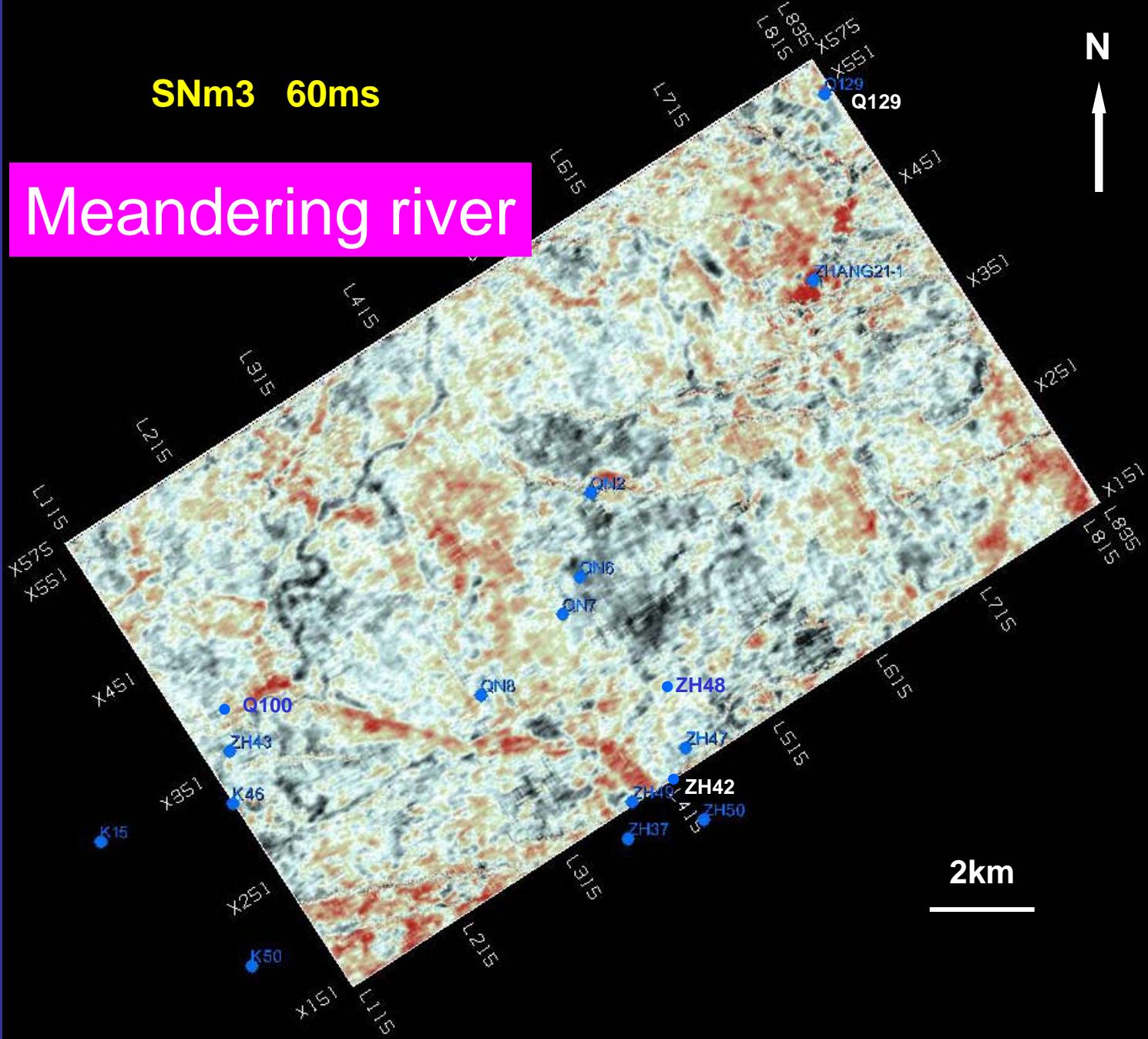
SNm3 64ms

Meandering river



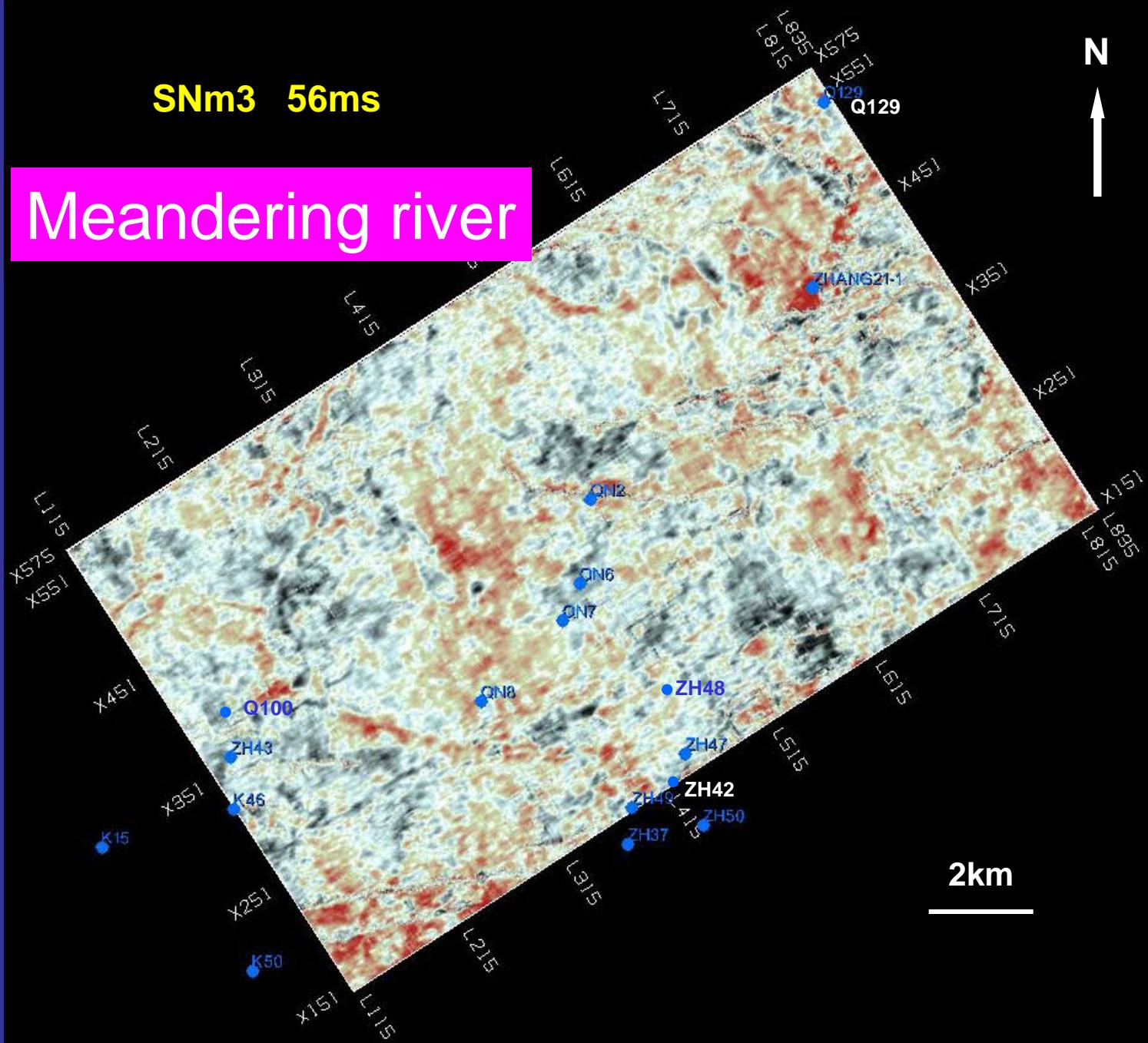
SNm3 60ms

Meandering river



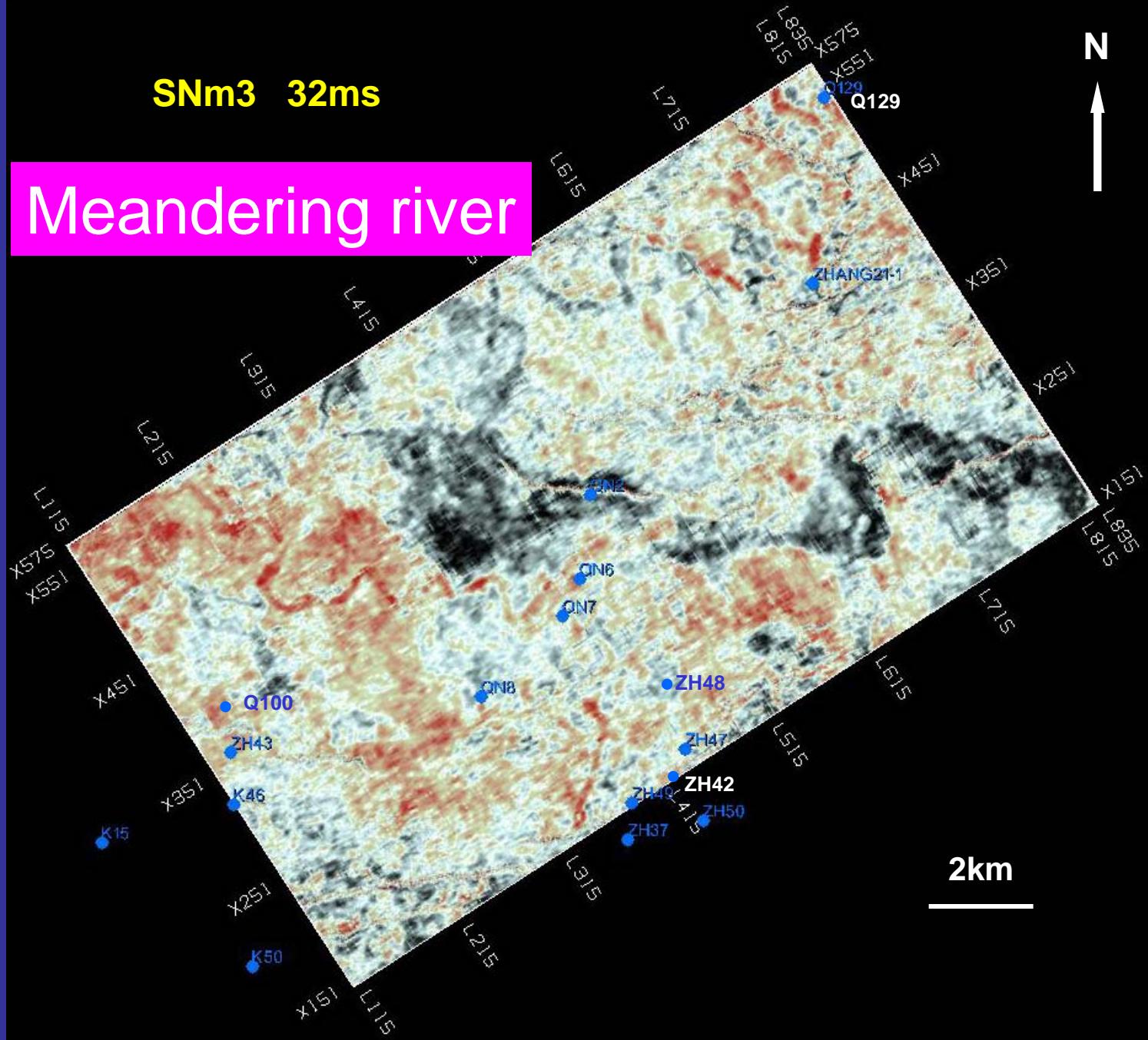
SNm3 56ms

Meandering river



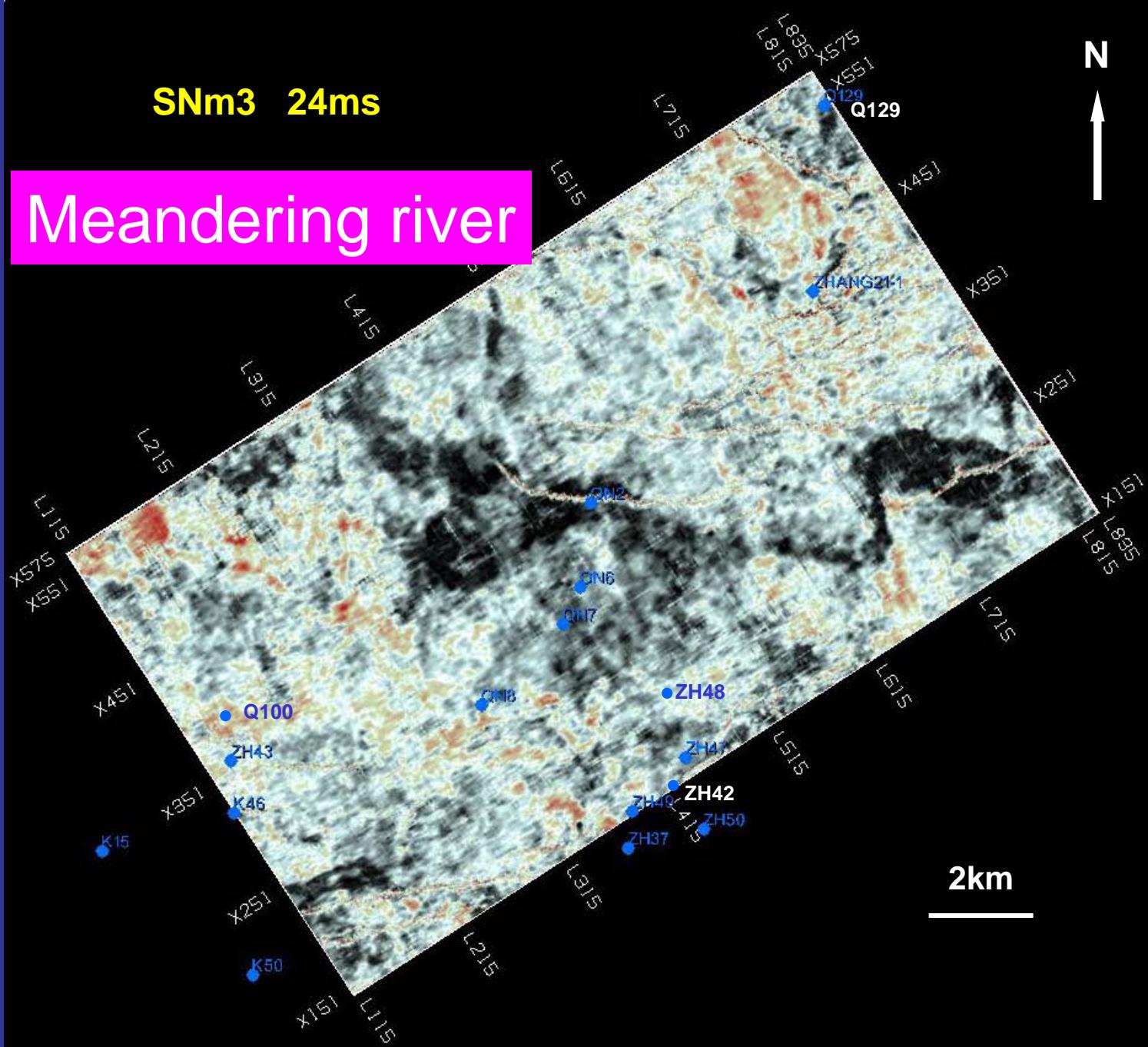
SNm3 32ms

Meandering river



SNm3 24ms

Meandering river



Reference

Zeng, Hongliu, 2001, From seismic stratigraphy to seismic sedimentology: a sensible transition: Gulf Coast Association of Geological Societies Transactions, v. 51, p. 413–420.

Thank you!