***1. Locations and uncertainties of M≥6 earthquakes that occurred in the past millennium in the North China basin.*** Supplemental Table 1 listed locations and magnitudes of all the seismic events (i.e., 1 to 24) shown in Fig. 1B. The uncertainties of locations for pre-instrumentation earthquakes are quoted directly from Min et al. (1995).

***2. Locations and uncertainties of M≤3.9 earthquakes recorded by instruments.*** We used the average values of earthquake locations in earthquake catalogues provided by the China Earthquake Administration and the U.S Geological Survey, respectively. The duration of the earthquakes is from 2009 to 2013 and the magnitudes are constrained to be ≤3.9. We use one half of the distance between the locations of the same earthquake from the two data sets to define the uncertainty of the earthquake location shown in this study. The microseismicity data are from CEA available online at http://www.csi.ac.cn/publish/main/813/3/index.html.

***3. Isoseismal maps:*** In order to test the robustness of earthquake locations provided by Min et al. (1995), we constructed our own isoseismal maps using bench mark objects such as government buildings, temples, mud houses, and brick houses. An example of our reconstruction against the one established by Min et al. (1995) for the 1830 Cixian earthquake is shown in Supplemental Fig. 1. The rating of the benchmark objects is summarized in Supplemental Table 2. All the information on the degrees of earthquake damage was obtained from the narrative description of the earthquake event in various historical sources summarized in Min et al. (1995). As seen in Supplemental

Fig. 1, the locations based on our estimate and that obtained by Min et al. (1995) are essentially the same within the uncertainty of 20 km.

***4. Did the 1830 Cixian earthquake occur on the Tangshan-Hejian-Cixian fault zone?:*** Xu et al. (1996) suggest that the Cixian earthquake ruptured the THC fault zone, whereas Jiang and Zhang (1996) proposed that it occurred on a northwest-striking left-slip fault. Two pieces of evidence favor the first suggestion. First, the proposed northwest-striking fault is too short (only ~50 km) to accommodate an M=7.5 earthquake (Wells and Coppersmith, 1994). Second, the liquefaction sites associated with surface fractures associated with the earthquake are either located along the northeast-striking fault zone or in a northeast-trending zone parallel to the main fault. Because the 1830 M=7.5 Cixian earthquake was followed by a series of powerful aftershocks as reported in the historical records (Min et al., 1995), the surface-rupture features documented by Jiang and Zhang (1996) on a northwest-striking fault could have been resulted from these later seismic events. The distribution of liquefaction sites associated with the 1830 Cixian earthquake (Supplemental Fig. 1B) supports the main shock on the THC fault zone.

***5. Estimating the width of the Tianjin seismic gap and plots shown in Fig. 3:*** We consider both the uncertainties in locating and estimating magnitude of historical earthquakes along the Sanhe-Laishui and Tangshan-Hejian-Cixian faults. The location uncertainty would shift the rupture length along the fault zones whereas the uncertainty in magnitude estimates would elongate or shrink the rupture length of an individual historical event. In order to estimate the minimum length of the seismic gap along the

THC fault zone, we plot the maximum rupture length corresponding to the maximum estimated magnitude on the figure. For the Sanhe-Laishui fault, the rupture length is dominated by the 1679 Sanhe earthquake (M=8) and the uncertainty of the AD 1057 S. Beijing Earthquake (M 6.8) (event 1 in Fig. 1B), we only show the location uncertainties of the two events without considering the effect of uncertainties in magnitude estimates.

Supplmental Table DR1. Locations of major earthquakes in North China basin

| No. | Year | Month | Day | Latitude | Longitude | Magnitude and uncertainty | Location uncertainty (+/- km) | Rupture length uncertainty (+/- km) |
|---|---|---|---|---|---|---|---|---|
| (1) | 1057 | 0 | 0 | 39.7 | 116.3 | 6.75 +/- 05 | 100 | 45/−15 |
| (2) | 1068 | 8 | 14 | 38.5 | 116.1 | 6.0 +/- 0.5 | 50 | 15/−2 |
| (3) | 1144 | 8 | 16 | 38.5 | 116.0 | 6.0 +/- 0.5 | 50 | 15/−2 |
| (4) | 1314 | 10 | 5 | 36.6 | 113.8 | 6.0 +/- 0.5 | 50 | 15/−2 |
| (5) | 1536 | 10 | 22 | 39.8 | 116.8 | 6.0 +/- 0.5 | 20 | 15/−2 |
| (6) | 1624 | 4 | 17 | 39.8 | 118.8 | 6.5 +/- 0.5 | 50 | 20/−10 |
| (7) | 1658 | 2 | 3 | 39.4 | 115.7 | 6.0 +/- 0.5 | 20 | 15/−2 |
| (8) | 1665 | 4 | 16 | 39.9 | 116.6 | 6.5 +/- 0.5 | 20 | 20/−10 |
| (9) | 1679 | 9 | 2 | 40.0 | 117.0 | 8.0 +/- 0.5 | 20 | 300/−160 |
| (10) | 1730 | 9 | 30 | 40.0 | 116.2 | 6.5 +/- 0.5 | 20 | 20/−10 |
| (11) | 1830 | 6 | 12 | 36.4 | 114.2 | 7.5 +/- 0.5 | 20 | 280/−70 |
| (12) | 1882 | 12 | 2 | 38.1 | 115.5 | 6.0 +/- 0.5 | 20 | 15/−2 |
| (13) | 1945 | 9 | 23 | 39.50 | 119.00 | 6.25 +/- 0.5 | 20 | 28/−3 |
| (14) | 1966 | 3 | 8 | 37.37 | 114.94 | 6.8 | 2.9 | |
| (15) | 1966 | 3 | 22 | 37.52 | 115.04 | 6.7 | 4.8 | |
| (16) | 1966 | 3 | 22 | 37.53 | 115.15 | 7.2 | 5.8 | |
| (17) | 1966 | 3 | 26 | 37.71 | 115.22 | 6.2 | 5.2 | |
| (18) | 1966 | 3 | 29 | 37.35 | 115.03 | 6 - | | |
| (19) | 1967 | 3 | 27 | 38.51 | 116.55 | 6.3 | 4.8 | |
| (20) | 1976 | 7 | 27 | 39.50 | 117.94 | 7.8 | 12.4 | |
| (21) | 1976 | 7 | 27 | 39.28 | 117.81 | 6.2 | 9.0 | |
| (22) | 1976 | 7 | 28 | 39.71 | 118.43 | 7.1 | 6.1 | |
| (23) | 1976 | 11 | 15 | 39.44 | 117.72 | 6.9 | 4.5 | |
| (24) | 1977 | 5 | 12 | 39.24 | 117.72 | 6.2 | 4.5 | |

Earthquakes in Sanhe-Laishui Fault Zone

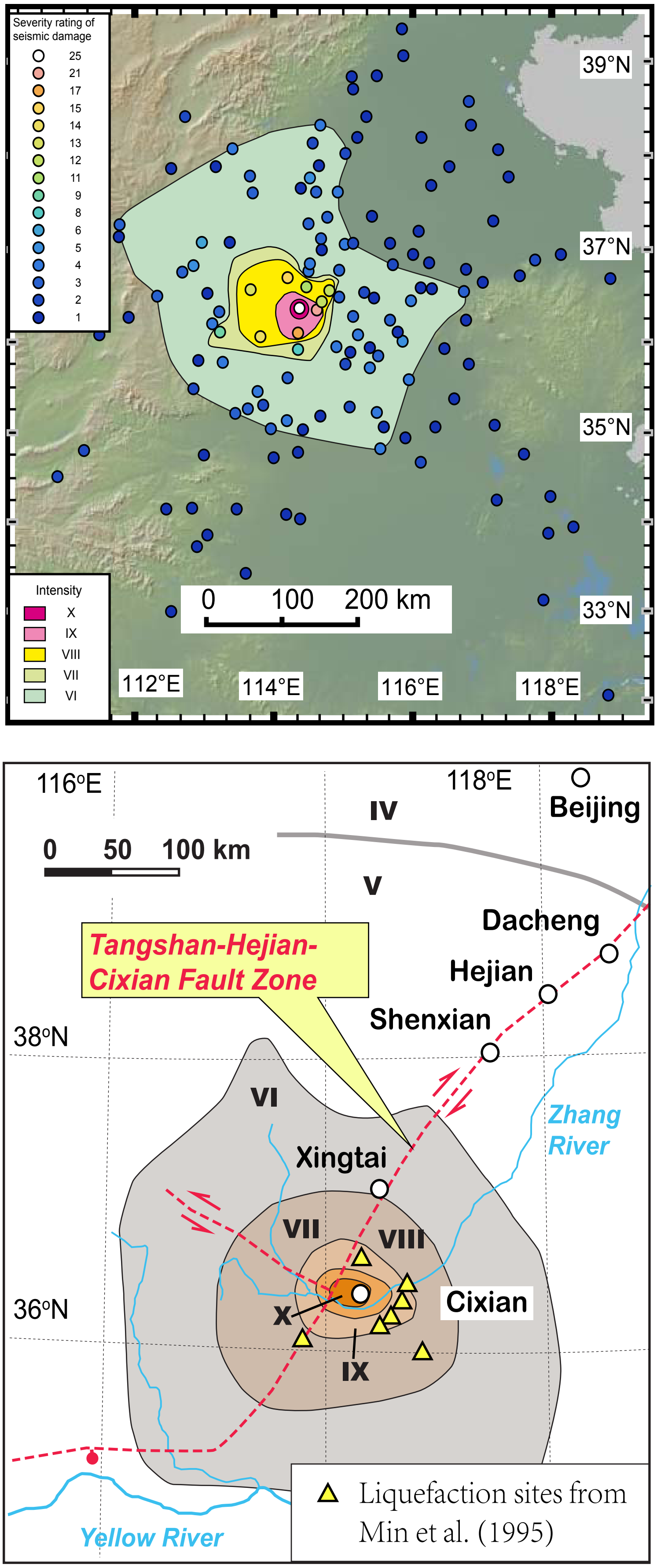
Earthquakes in Tangshan-Hejian-Cixian Fault Zone

Supplemental Table DR2. Ratings of serverity of seismic damage by the 1830 Cixian earthquake.

| Site name | Location | | Benchmark Objects | | | | | | | | | | | | | | | | | Site Geology |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Lat(°) | Long(°) | Private houses | Government buikdinbg | City wall | Temple | Towers | School & Examination hal | Storeage buildings | Worship hall | Bridge | Kiln | Crack | Liquefaction | Well | Landslide | Subsidence | Death | Tremor | |
| Cixian | 36.37 | 114.37 | # | # | # | # | | | # | # | # | # | × | × | × | × | × | # | # | Loose sediments |
| Linzhang | 36.35 | 114.62 | # | # | # | # | | # | # | # | | | × | × | × | | | # | # | Loose sediments |
| Anyang | 36.10 | 114.35 | # | # | × | # | × | # | | × | | | × | | | × | | # | # | Loose sediments |
| Handan | 36.60 | 114.47 | # | # | × | × | | | | | | | | | × | | | # | # | Loose sediments |
| Cheng'an | 36.44 | 114.69 | # | # | | # | × | | | | | | × | × | | | | ? | # | Loose sediments |
| Wu'an | 36.70 | 114.20 | # | × | # | # | × | | | × | × | | | | | × | | # | # | Near bedrock area |
| Shexian | 36.57 | 113.67 | # | × | × | # | | | | # | | | | | | × | | # | # | Intermontane basin |
| Linxian | 36.06 | 113.81 | # | × | × | # | × | | | # | | | × | × | | × | | | # | Near bedrock area |
| Tangyin | 35.92 | 114.35 | × | × | # | | | | × | | | | | | | | | × | # | Loose sediments |
| Feixiang | 36.56 | 114.80 | × | × | × | # | | # | × | # | | | | | | | | | # | Loose sediments |
| Yongnian | 36.77 | 114.50 | × | | | | | | | | × | | | | | | | | # | Loose sediments |
| Pingxiangc | 37.06 | 115.02 | # | | | | | | | | | | | | | | | | # | Loose sediments |
| Shahe | 36.85 | 114.52 | # | | | | | | | | | | | | | | | | # | Loose sediments |
| Renxian | 37.12 | 114.68 | | | | | × | | | | | | | | | | | | # | Loose sediments |
| Guangping | 36.49 | 114.94 | × | | | | | | | | | | | | | | | | # | Loose sediments |
| Daming | 36.28 | 115.14 | × | | | | | | | | | | | | | | | | # | Loose sediments |
| Nanle | 36.08 | 115.21 | # | | | | | | | | | | | | | | | | # | Loose sediments |
| Neihuang | 35.95 | 114.90 | | | | | | | | | | | × | × | | | | | # | Loose sediments |
| Qixian | 35.61 | 114.20 | | | | × | | | | | | | | | | | | | # | Loose sediments |
| Huguan | 36.11 | 113.23 | # | # | # | | | | | | | | | | | | | × | # | Bedrock |
| Changzhi | 36.20 | 113.12 | # | | | | | | | | | | | | | | | | # | Intermontane basin |
| Lingchuan | 35.78 | 113.27 | # | | | | | | | | | | | | | | | | # | Bedrock |
| Lucheng | 36.33 | 113.22 | | | × | | | | | | | | | | | | | | # | Intermontane basin |
| Shouzhang | 36.01 | 115.85 | # | | | × | | | | | | | | | | | | | # | Loose sediments |
| Yuncheng | 35.59 | 115.94 | # | | | | | | | | | | | | | | | | # | Loose sediments |
| Pucheng | 35.72 | 115.38 | # | | | | | | | | | | | | | | | | # | Loose sediments |
| Fanxian | 35.85 | 115.50 | × | | | | | | | | | | | | | | | | # | Loose sediments |
| Liaocheng | 36.45 | 115.97 | × | | | × | | | | | | | | | | | | | # | Loose sediments |
| Shenxian | 36.24 | 115.67 | | | | | × | | | | | | | | | | | | # | Loose sediments |
| Changqing | 36.55 | 116.73 | | | | × | | | | | | | | | | | | | # | Next to bedrock area |
| Heze | 35.23 | 115.48 | × | | | | | | | | | | | | | | | × | # | Loose sediments |
| Caoxian | 34.83 | 115.53 | × | | | | | | | | | | | | | | | × | # | Loose sediments |
| Yuanyang | 35.05 | 113.96 | × | | | | | | | | | | | | | | | | # | Loose sediments |
| Huixian | 35.46 | 113.77 | # | | | | | | | | | | | | | | | | # | Next to bedrock area |
| Xiuwu | 35.22 | 113.45 | × | | | | | | | | | | | | | | | | # | Loose sediments |
| Huojia | 35.27 | 113.63 | × | | | | | | | | | | | | | | | | # | Loose sediments |
| Quzhou | 36.78 | 114.94 | × | | | | | | | | | | | | | | | | # | Loose sediments |
| Ningjin | 37.62 | 114.92 | # | | | | | | | | | | | | | | | | # | Loose sediments |
| Neiqiu | 37.28 | 114.50 | × | | | | | | | | | | | | | | | | # | Loose sediments |
| Wuxiang | 36.83 | 112.85 | | | | | | | | | | × | | | | × | | × | # | Intermontane basin |
| Qinxian | 36.76 | 112.69 | × | | | | | | | | | | | | | | | | # | Intermontane basin |
| Qinyuan | 36.50 | 112.33 | × | | | | | | | | | | | | | | | | # | Bedrock |
| Yushe | 37.08 | 112.97 | × | × | × | | | | | | | × | | | | | | | # | Intermontane basin |
| Pingding | 37.79 | 113.66 | × | | | | | | | | | | | | | | | | # | Bedrock |
| Xiyang | 37.61 | 113.70 | × | | | | | | | | | | | | | | | | # | Bedrock |
| Yuxian | 38.08 | 113.41 | × | | | | | | | | | | | | | × | | | # | Intermontane basin |
| Fenyang | 37.27 | 111.79 | | | | × | | | | | | | | | | | | | # | Intermontane basin |
| Guantao | 36.54 | 115.30 | | | | | | | | | | | | | | | | | # | Loose sediments |
| Yaocheng | 37.35 | 114.77 | × | | | | | | | | | | | | | | | | # | Loose sediments |
| Yuanshi | 37.77 | 114.52 | × | | | | | | | | | | | | × | | | × | # | Loose sediments |
| Linqing | 36.84 | 115.71 | | | | | | | | | | | | | | | | | # | Loose sediments |
| Gaoyi | 37.62 | 114.61 | | | | | | | | | | | | | × | | | | # | Loose sediments |
| Jincheng | 35.49 | 112.85 | | | | | | | | | | | | | | | | | # | Intermontane basin |
| Guangzong | 37.07 | 115.14 | | | | | | | | | | | | | | | | | # | Loose sediments |
| Zhengding | 38.14 | 114.56 | | | | | | | | | | | | | | | | | # | Loose sediments |
| Qingxian | 38.58 | 116.80 | | | | | | | | | | | | | | | | | # | Loose sediments |
| Jinxian | 38.03 | 115.03 | | | | | | | | | | | | | | | | | # | Loose sediments |
| Lingbao | 34.52 | 110.90 | | | | | | | | | | | | | | | | | # | Loose sediments |
| Wenxian | 34.81 | 111.28 | | | | | | | | | | | | | | | | | # | Next to bedrock area |
| Xinzhou | 38.42 | 112.73 | | | | | | | | | | | | | | | | | # | Intermontane basin |
| Baoding | 38.85 | 115.48 | | | | | | | | | | | | | | | | | × | Loose sediments |
| Luancheng | 37.90 | 114.65 | | | | | | | | | | | | | | | | | × | Loose sediments |
| Qinghe | 37.07 | 115.67 | | | | | | | | | | | | | | | | | × | Loose sediments |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Cangzhou | 38.33 | 116.83 | | | | | × | Loose sediments |
| Xianxian | 38.20 | 116.12 | | | | | × | Loose sediments |
| Dongguan | 37.89 | 116.52 | | | | | × | Loose sediments |
| Jingxian | 37.69 | 116.26 | | | | | × | Loose sediments |
| Nangong | 37.36 | 115.41 | | | | | × | Loose sediments |
| Nanhe | 37.00 | 114.69 | | | | | × | Loose sediments |
| Xinle | 38.33 | 114.67 | × | | | × | × | Loose sediments |
| Wanxian | 38.84 | 115.12 | | | | | × | Loose sediments |
| Wangdu | 38.71 | 115.14 | | | | | × | Loose sediments |
| Qingyun | 37.78 | 117.37 | | | | | × | Loose sediments |
| Xinchengz | 39.34 | 115.84 | | | | | × | Loose sediments |
| Rongchen | 39.06 | 115.86 | | | | | × | Loose sediments |
| Shenze | 38.20 | 115.20 | | | | | × | Loose sediments |
| Changyua | 35.19 | 114.67 | | | | | × | Loose sediments |
| Kaifeng | 34.79 | 114.35 | | | | | × | Loose sediments |
| Linru | 34.17 | 112.83 | | | | | × | Next to bedrock area |
| Lushan | 33.74 | 112.90 | | | | | × | Next to bedrock area |
| Ruyang | 34.16 | 112.46 | | | | | × | Next to bedrock area |
| Fengqiu | 35.04 | 114.42 | | | | | × | Loose sediments |
| Nanyang | 33.01 | 112.53 | | | | | × | Loose sediments |
| Wuyang | 33.44 | 113.60 | | | | | × | Loose sediments |
| Yanjin | 35.14 | 114.19 | | × | × | | × | Loose sediments |
| Gongxian | 34.76 | 113.00 | | | | | × | Loose sediments |
| Zhongmou | 34.73 | 114.00 | | | | | × | Loose sediments |
| Yanling | 34.10 | 114.18 | | | | | × | Loose sediments |
| Baofeng | 33.87 | 113.05 | | | | | × | Next to bedrock area |
| Yuxian | 34.16 | 113.47 | | | | | × | Loose sediments |
| Fugou | 34.05 | 114.38 | | | | | × | Loose sediments |
| Jinan | 36.65 | 117.00 | | | | | × | Next to bedrock area |
| Jining | 35.38 | 116.59 | | | | | × | Loose sediments |
| Zhangqiu | 36.72 | 117.53 | | | | | × | Next to bedrock area |
| Huanchen | 36.95 | 118.12 | | | | | × | Loose sediments |
| Boping | 36.59 | 116.11 | | | | | × | Loose sediments |
| Chiping | 36.58 | 116.27 | | | | | × | Loose sediments |
| Guanxian | 36.48 | 115.44 | | | | | × | Loose sediments |
| Gaotang | 36.86 | 116.23 | | | | | × | Loose sediments |
| Feicheng | 36.24 | 116.76 | | | | | × | Next to bedrock area |
| Dongping | 35.93 | 116.45 | | | | | × | Next to bedrock area |
| Wucheng | 37.20 | 116.08 | | | | | × | Loose sediments |
| Xiajin | 36.95 | 116.00 | | | | | × | Loose sediments |
| Ningyang | 35.76 | 116.80 | | | | | × | Loose sediments |
| Tengxian | 35.09 | 117.17 | | | | | × | Loose sediments |
| Yicheng | 34.77 | 117.59 | | | | | × | Next to bedrock area |
| Chengwu | 34.95 | 115.89 | | | | | × | Loose sediments |
| Jinxiang | 35.07 | 116.32 | | | | | × | Loose sediments |
| Zouping | 36.89 | 117.75 | | | | | # | Next to bedrock area |
| Shanxian | 34.68 | 116.11 | | | | | # | Loose sediments |
| Changle | 36.69 | 118.83 | | | | | × | Loose sediments |
| Yanggu | 36.11 | 115.78 | | | | | × | Loose sediments |
| Dongming | 35.29 | 115.09 | | | | | # | Loose sediments |
| Qihe | 36.79 | 116.76 | | | | | × | Loose sediments |
| Shanghe | 37.31 | 117.15 | | | | | × | Loose sediments |
| Guanchen | 35.94 | 115.38 | | | | | × | Loose sediments |
| Taiyuan | 37.87 | 112.53 | | | | | × | Intermontane basin |
| Linfen | 36.08 | 111.50 | | | | | × | Intermontane basin |
| Xiaoyi | 37.14 | 111.78 | | | | | × | Intermontane basin |
| Zuoquan | 37.08 | 113.37 | | | | | × | Bedrock |
| Xiangyuan | 36.53 | 113.05 | | | | | × | Intermontane basin |
| Guxian | 36.27 | 111.92 | | | | | × | Bedrock |
| Gaoping | 35.80 | 112.92 | | | | | × | Intermontane basin |
| Shouyang | 37.89 | 113.17 | | | | | × | Intermontane basin |
| Xuzhou | 34.26 | 117.20 | | | | | × | Next to bedrock area |
| Pixian | 34.30 | 117.97 | | | | | × | Loose sediments |
| Suqian | 33.96 | 118.30 | | | | | × | Next to bedrock area |
| Suining | 33.89 | 117.94 | | | | | × | Loose sediments |
| Wuhe | 33.14 | 117.87 | | | | | × | Loose sediments |

| | | | | |
|---|---|---|---|---|
| Taihe | 33.16 | 115.61 | × | Loose sediments |
| Qingfeng | 35.89 | 115.10 | × | Loose sediments |
| Puyang | 35.76 | 115.03 | # | Loose sediments |
| Nanjing | 32.06 | 118.80 | × | Loose sediments |
| Dingtao | 35.07 | 115.58 | × | Loose sediments |
| Anguo | 38.42 | 115.33 | × | Loose sediments |
| Zanhuang | 37.66 | 114.39 | × | Next to bedrock area |
| Xinxiang | 35.31 | 113.85 | # | Loose sediments |
| Yanshan | 38.07 | 117.22 | × | Loose sediments |




Supplemental Figure DR1. Comparison of isoseismic map made by this study in (A) and the isoseismic map constructed by Min et al. (1995) in (B). Note that the inferred epicenter of the 1983 Cixian earthquake is essentially the same. Constructions in (A) is based on the scoring of benchmark objects listed in Table 2. In (B), we plotted liquefaction sites based on the descriptions of Min et al. (1995). Note that the sites are either on the main strand of the Tangshan-Hejian-Cixian fault (THC) zone or in a northeast-trending zone parallel to the THC fault. Based on this observation and other arguments presented in the main text, we suggest that the Cixian earthquake occurred on the THC fault zone rather than a northwest-striking subsidiary fault.