

## **Appendix 1**

### **Supplementary material of chapter 2 Active Tectonics and Earthquake Potential of the Myanmar region**

**Table S1. Indian-Burma plate convergent rate along the northern Sunda megathrust from various plate rotation models**

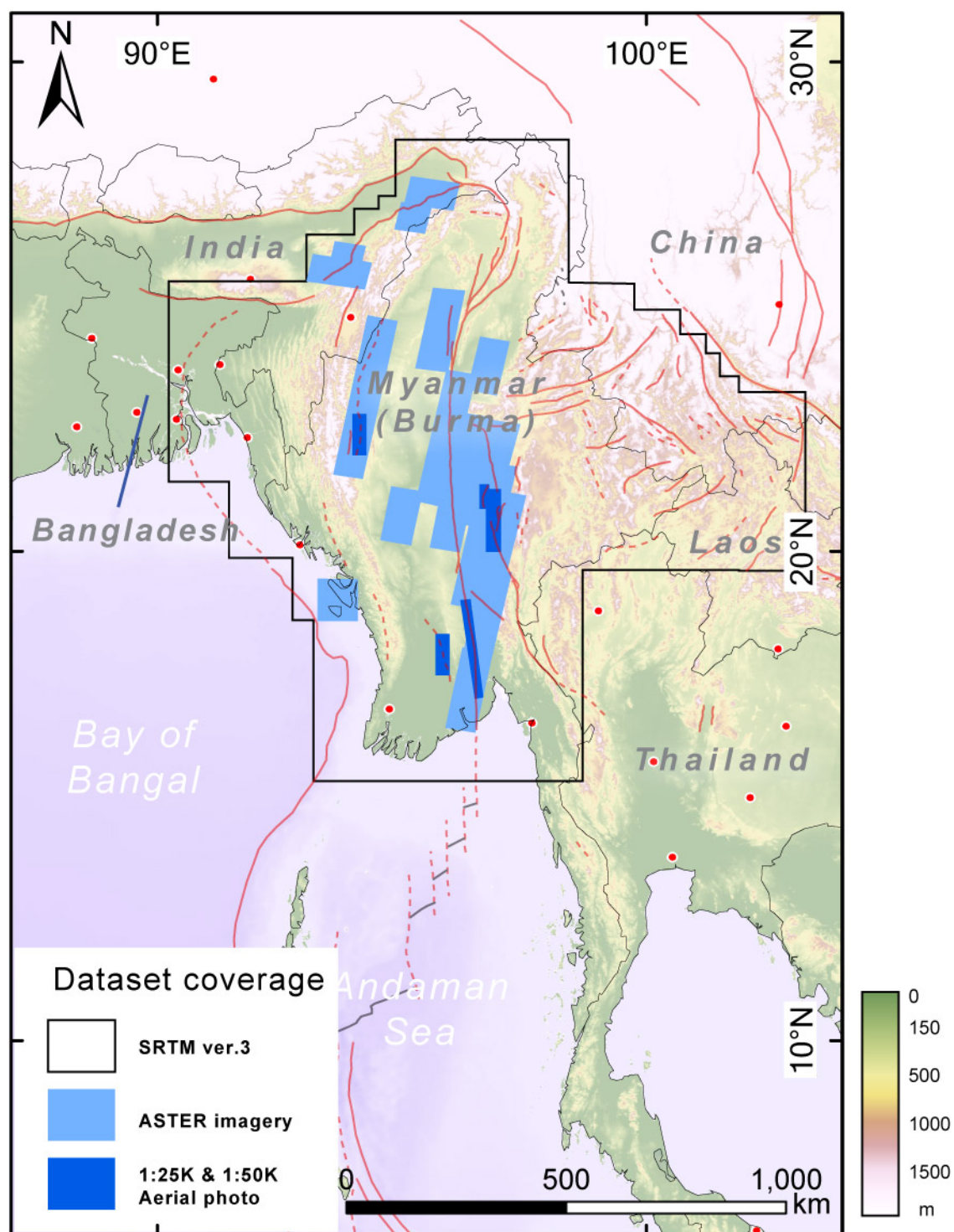
Model	Latitude	Longitude	Speed	Azimuth	N Vel.	E Vel.	Plate	Site	Vector (1) (Remove Sagaing fault motion)				Vector (2) (Remove S.F. and Yunan blk)				Vector (3) (Remove Spreading center motion)	
			mm/yr	(cw)	mm/yr	mm/yr	(reference)	Name	Min	Max	Azimuth		Min	Max	Azimuth		Average	Azimuth
MORVEL 2010	23° 30'	90° 30'	41.58	10.98°	40.82	7.92	IN(SU)	SHIL	20.4	24.2	202.8	199.1	23.4	26.7	216.5	211.4		
GSRM v1.2	23° 30'	90° 30'	33.22	6.16°	33.03	3.56	IN(SU)	SHIL	11.6	15.4	197.9	193.3	14.6	17.8	220.9	212.5		
CGPS 2004	23° 30'	90° 30'	26.05	7.02°	25.86	3.19	IN(SU)	SHIL	5.0	8.5	219.6	202.1	10.0	12.1	247.2	229.5		
REVEL 2000	23° 30'	90° 30'	29.65	8.27°	29.35	4.27	IN(SU)	SHIL	8.5	12.1	210.2	200.6	12.6	15.3	234.4	222.1		
Socquet 2006	23° 30'	90° 30'	35.43	10.46°	34.84	6.43	IN(SU)	SHIL	14.4	18.0	206.6	200.9	17.9	20.9	224.1	216.4		
MORVEL 2010	21° 15'	91° 15'	42.11	12.56°	41.1	9.15	IN(SU)	CHIT	21.2	24.8	205.6	201.6	24.4	27.6	218.4	213.3		
GSRM v1.2	21° 15'	91° 15'	33.67	8.13°	33.33	4.76	IN(SU)	CHIT	12.3	16.1	202.8	197.2	15.6	18.7	223.5	215.1		
CGPS 2004	21° 15'	91° 15'	26.41	8.96°	26.09	4.11	IN(SU)	CHIT	5.8	9.1	225.1	206.9	10.9	12.9	248.0	231.3		

Model	Latitude	Longitude	Speed	Azimuth	N Vel.	E Vel.	Plate	Site	Vector (1) (Remove Sagaing fault motion)				Vector (2) (Remove S.F. and Yunan blk)				Vector (3) (Remove Spreading center motion)	
			mm/yr	(cw)	mm/yr	mm/yr	(reference)	Name	Min	Max	Azimuth		Min	Max	Azimuth		Average	Azimuth
REVEL 2000	21° 15'	91° 15'	30.21	10.65°	29.69	5.58	IN(SU)	CHIT	9.5	13.0	216.0	205.5	13.9	16.5	236.4	224.7		
Socquet 2006	21° 15'	91° 15'	35.83	11.93°	35.06	7.41	IN(SU)	CHIT	15.0	18.6	209.6	203.5	18.7	21.7	225.8	218.2		
MORVEL 2010	19° 30'	92° 30'	42.79	13.84°	41.55	10.24	IN(SU)	SITW	22.1	25.7	207.6	203.5						
GSRM v1.2	19° 30'	92° 30'	34.32	9.73°	33.82	5.8	IN(SU)	SITW	13.2	16.8	206.1	200.1						
CGPS 2004	19° 30'	92° 30'	26.92	10.53°	26.46	4.92	IN(SU)	SITW	6.6	9.8	227.8	210.2						
REVEL 2000	19° 30'	92° 30'	30.97	12.49°	30.24	6.7	IN(SU)	SITW	10.6	14.0	219.1	208.7						
Socquet 2006	19° 30'	92° 30'	36.36	13.16°	35.41	8.28	IN(SU)	SITW	15.8	19.3	211.7	205.4						
MORVEL 2010	18°	93° 30'	43.34	14.84°	41.89	11.1	IN(SU)	RAMR	22.8	26.3	209.2	204.9						
GSRM v1.2	18°	93° 30'	34.84	10.99°	34.2	6.64	IN(SU)	RAMR	13.9	17.5	208.6	202.3						

Model	Latitude	Longitude	Speed	Azimuth	N Vel.	E Vel.	Plate	Site	Vector (1) (Remove Sagaing fault motion)				Vector (2) (Remove S.F. and Yunan blk)			Vector (3) (Remove Spreading center motion)											
			mm/yr	(cw)	mm/yr	mm/yr	(reference)	Name	Min	Max	Azimuth		Min	Max	Azimuth	Average	Azimuth										
CGPS 2004	18°	93° 30'	27.33	11.76°	26.75	5.57	IN(SU)	RAMR	7.3	10.4	229.5	212.5															
REVEL 2000	18°	93° 30'	31.61	13.94°	30.67	7.61	IN(SU)	RAMR	11.5	14.8	221.3	211.0															
Socquet 2006	18°	93° 30'	36.79	14.11°	35.68	8.97	IN(SU)	RAMR	16.4	19.8	213.3	206.9															
MORVEL 2010	15°	93° 6'	43.52	16.35°	41.76	12.25	IN(SU)	FOUL	23.2	26.7	211.8	207.3				28.4	238.7										
GSRM v1.2	15°	93°6′	34.95	12.99°	34.06	7.86	IN(SU)	FOUL	14.4	17.9	213.1	206.1				21.1	250.4										
CGPS 2004	15°	93°6′	27.42	13.71°	26.64	6.5	IN(SU)	FOUL	8.0	10.8	234.5	217.0				18.5	271.1										
REVEL 2000	15°	93°6′	31.81	16.46°	30.51	9.01	IN(SU)	FOUL	12.4	15.4	226.6	215.8				21.3	260.5										
Socquet 2006	15°	93°6′	36.91	15.49°	35.57	9.86	IN(SU)	FOUL	16.8	20.1	216.0	209.3	23.5	248.6													
MORVEL 2010	12° N	92°	43.46	17.81°	41.38	13.29	IN(SU)	ANDM	23.5	26.9	214.4	209.6				29.1	240.4										

Model	Latitude	Longitude	Speed	Azimuth	N Vel.	E Vel.	Plate	Site	Vector (1) (Remove Sagaing fault motion)				Vector (2) (Remove S.F. and Yunan blk)			Vector (3) (Remove Spreading center motion)	
			mm/yr	(cw)	mm/yr	mm/yr	(reference)	Name	Min	Max	Azimuth		Min	Max	Azimuth	Average	Azimuth
GSRM v1.2	12° N	92°	34.82	14.96°	33.64	8.99	IN(SU)	ANDM	14.7	18.0	217.7	209.9				22.0	252.4
CGPS 2004	12° N	92°	27.33	15.64°	26.32	7.37	IN(SU)	ANDM	8.5	11.1	239.6	221.5				19.4	272.0
REVEL 2000	12° N	92°	31.76	18.99°	30.03	10.33	IN(SU)	ANDM	13.1	15.9	232.1	220.7				22.5	262.3
Socquet 2006	12° N	92°	36.85	16.80°	35.28	10.65	IN(SU)	ANDM	17.0	20.3	218.7	211.6				24.1	195.4

1. The Sagaing fault velocity is 18-22 mm/yr northward. 2. The Yunnan block moves 6 mm/yr westward. 3. The opening rate of the Andaman Sea spreading center is 30 mm/yr along 335°



**Fig. S1 The coverage map of the remote sensing dataset that used in this study.**

We also used the Landsat ETM+ imagery that its cover area is identical to the SRTM digital elevation model.



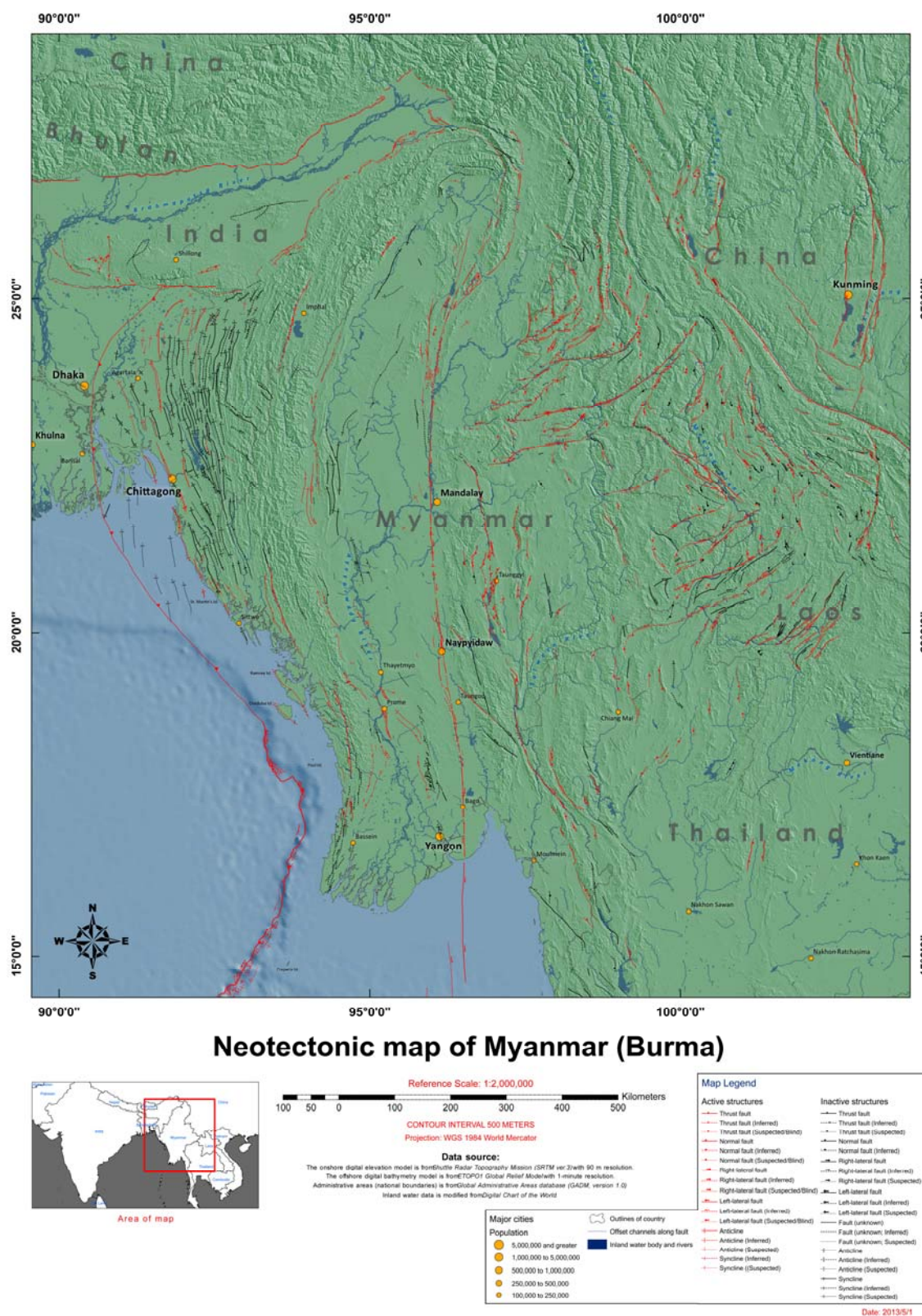
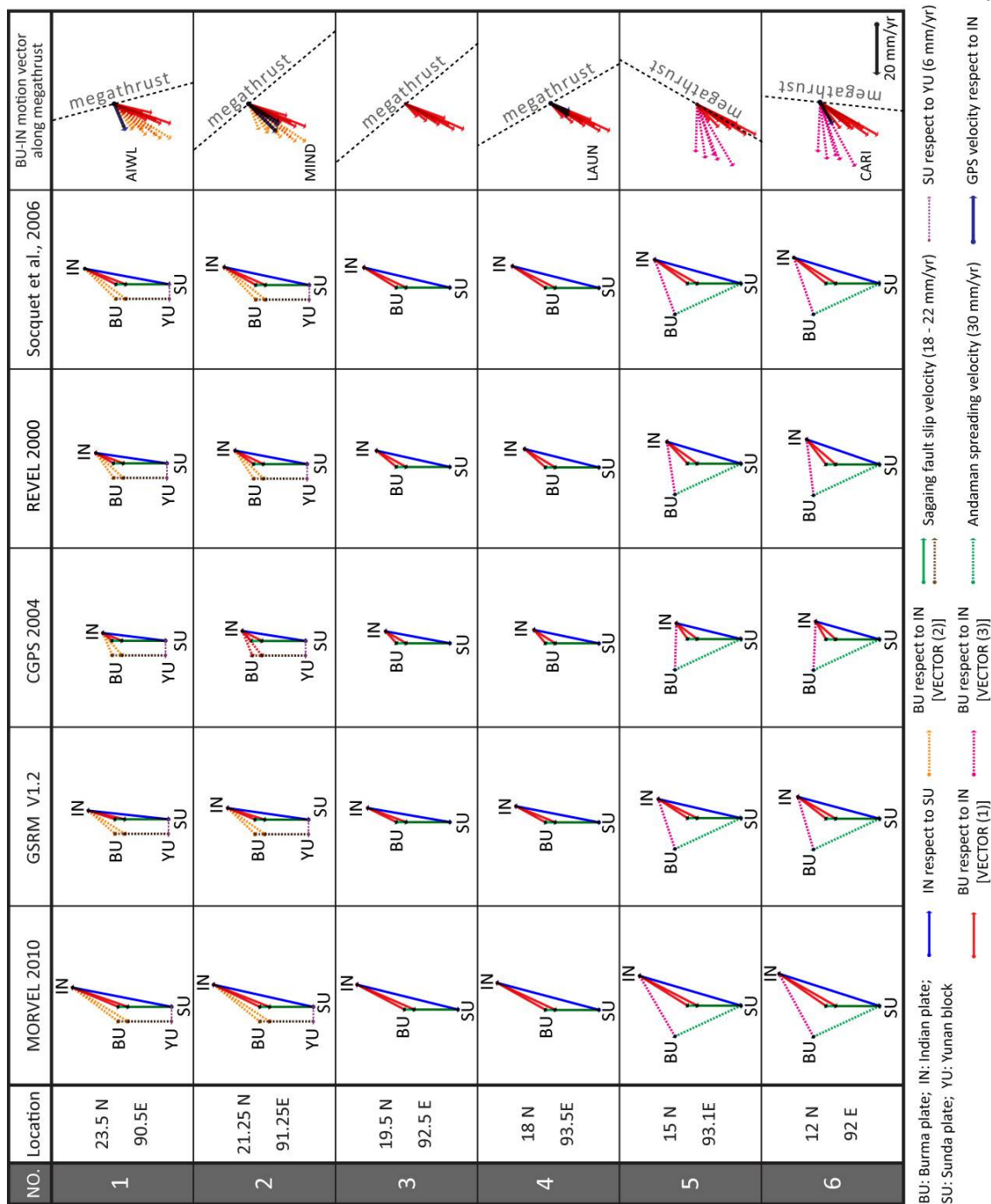


Fig. S2. Neotectonic map of Myanmar (Burma)



**Fig. S3 The plate motion vector diagram along the western Myanmar coast**



## **Appendix 2**

**Supplementary material of chapter 3 Earthquakes and slip rate of the Southern Sagaing fault: insights from an offset ancient fort-wall, Lower Myanmar (Burma)**

<b>Table S1. Stories of the May 1930 earthquake from local villagers near the city of Bago (Pegu)</b>				
Date	Location	Name (age)	Story of earthquake from villager	Note
Apr-8 <sup>th</sup> -2008	Sangdi N17.303 E96.510	U Thien Moun (95)	Ground cracks opened around and south of his village. He traced these ground fractures to another village "Kyad-Pa-Gan," 5 miles south of his village (Sangdi). These fractures ran through Kyad-Pa-Gan village and even further south. He remembers the structure of the old monastery building was displaced 1 to 2 feet in the Pegu earthquake. The sense of displacement is right-lateral.	
July-31 <sup>st</sup> -2008	Kyaikpadainga-ale N17.226 E96.513	U Thaung (88)	He remembered there was an earthquake when he was 5-6 years old in the afternoon or evening of a summer day. There were ground cracks around his village, especially east of the village. He remembers these cracks opened 10-15cm wide, and were 6-10 meters long. No sand and water came out of these cracks.	
Aug-1 <sup>st</sup> -2008	Tawa N17.219 E96.498	U Dama nanda (66)	His master (who would be 88 yrs old, if alive) told him there was an earthquake when he was about 5 yrs old. During the earthquake, ground cracks formed around the village. His master also saw sand blow out with water around the village during the earthquake. The ground cracks were especially abundant west of the village. The ground cracks were about 2 meters wide, next to the Pegu river, west of the village.	

Date	Location	Name (age)	Story of earthquake from villager	Note
Aug-1 <sup>st</sup> -2008	Tawa N17.219 E96.498	Daw Tin Myunt (88)	When she was 10 yrs old, a big earthquake hit her village. Her parents told her that four brick buildings in the village collapsed. She did not notice the ground cracks near the village, but heard from other villagers about those cracks.	
Aug-1 <sup>st</sup> -2008	Kyaikme N17.203 E96.517	U Thuzata (74)	<p>He heard from his relatives a big earthquake struck the village 4 yrs before he was born.</p> <p>During the earthquake, nobody could stand on the ground. The ground wave was easy to see. After the earthquake, the canal in the village became shallower than before. The elevation of village also became higher after the earthquake. Fences were offset inside the village.</p> <p>He also heard from his aunt that cracks opened west of his village. The cracks could be traced all the way to Sangdi and Bago after the earthquake. These cracks were not continuous.</p> <p>His relatives told him that other cracks opened west of Zayaungbin and around Tawa (west of his village).</p>	<p>The remaining of the open fissure is in Table S2-D.</p> <p>The fault trace is in Table S2-E</p>
Aug-1 <sup>st</sup> -2008	Makainggyi N17.174 E96.521	U Ba Than (81)	<p>The earthquake happened when he was 3 yrs old.</p> <p>He claimed that water blew up from a small crack north of his village during the earthquake.</p>	
Aug-2 <sup>nd</sup> -2008	Payale N17.509 E96.533	Daw Phwa Chit (97)	<p>She remembered that a big earthquake hit her village when she was 17-18 yrs old, when the rice field was dry.</p> <p>There were ground cracks in the paddy field northwest of the village after the earthquake. The ground cracks were long and narrow, and water flowed out from these cracks. People could use small cups to get the water from the cracks.</p> <p>She did not notice any damage to the railroad and car track near her village</p>	

Date	Location	Name (age)	Story of earthquake from villager	Note
Aug-2 <sup>nd</sup> -2008	Thabyeyo N17.502 E96.501	U Pan Nait Sa (85)	<p>He remembered there was an earthquake when he was 3 yrs old, during an evening in early May.</p> <p>He heard from his parents that there some ground cracks appeared northeast of the village during the earthquake. Water and sand ejected from these cracks, but not very high.</p> <p>The orientation of these cracks was N-S, and they were continuous.</p> <p>The day after the earthquake, he and his friend checked these cracks from his village to the ancient fortress. The cracks extended both northward and southward from his village.</p> <p>A ground crack passed through the main road south of the ancient fortress, and extended further south, but he did not notice any offset on the main road across the ground crack</p>	
Aug-2 <sup>nd</sup> -2008	Western Shwedan village N17.438 E96.500	U Win Sein (76)	<p>He heard from his father that the railroad was tilted after the earthquake south of Shweden village.</p> <p>The rail was tilted to west near the mile-67 marker. There was no bending and twisting of the rail, just tilting.</p>	The displaced railroad embankment is in Table S2 A
Aug-3 <sup>rd</sup> -2008	Village west of Payagyi N17.479 E96.491	U Soe Tim (82)	<p>He heard from his parents that ground cracks appeared SE of the village after the 1930 Pegu earthquake.</p> <p>He also heard from his parents that the wall of the Payagyi ancient fortress was broken during the earthquake. In the subsequent rainy season, water inside the ancient fortress was able to flow out through the broken wall.</p> <p>There were 5 bridges along the main road from Payagyi to his village. Only the third bridge, south of the ancient fortress failed during the earthquake.</p>	


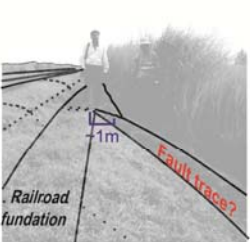
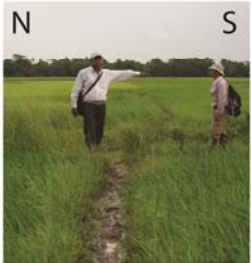
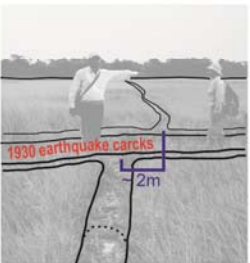

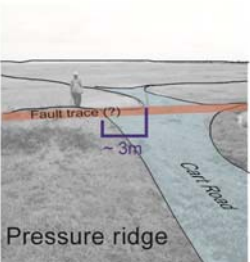




Date	Location	Name (age)	Story of earthquake from villager	Note
Aug-3 <sup>rd</sup> -2008	Payagyi N17.477 E96.525	U Tint Mon Lay (86)	<p>He was about 11 yrs old when earthquake occurred. He noticed a ground crack appeared near his house. Sand and water blew out from the crack about 1 meter high during the earthquake.</p> <p>The ox cart parked near his house moved 2-3 meters to the east during the earthquake because of the earthquake shaking. His parents told him the earthquake in 1930 was stronger at Payagyi than the earthquake in 1917</p>	
Aug-3 <sup>rd</sup> -2008	Awaing-Ywahuang N17.382 E96.501	Daw Kywe May (85)	<p>She claimed she was 6 yrs old when the earthquake happened. She was in Bago during the earthquake.</p> <p>Her father did not notice any damage on the road, which is a dirt-road NE of their village. Her parents also mentioned there were ground cracks near the village, especially west of the village. Her parents also saw the ox cart had fallen into the crack; the crack was more than 2 feet deep. She did not see the ox cart herself, but heard some villagers asking “who’s ox cart fell into the crack” after the earthquake.</p> <p>Her parents also told her that the earthquake in 1930 was stronger than the earthquake in 1917.</p>	

Date	Location	Name (age)	Story of earthquake from villager	Note
Aug-3 <sup>rd</sup> -2008	Awaing-Ywahuang N17.382 E96.501	U Pwa (82)	<p>He was 2 yrs old then the earthquake happened.  He father told him that NE-SW-trending ground cracks appeared after the 1930 earthquake east of the village. There were also a lot of ground cracks SW of the village near the Pegu river.  His father also claimed that some paddy field boundaries were offset right laterally across the ground crack east of his village.  These ground cracks were later connected by excavation to make the canal in the field.  He also heard about the 1917 earthquake from his parents. They told him that ground cracks appeared SW of the village, near the Pegu river. Some water blew out from the crack.  His parents also claimed that the ground cracks in 1930 were not as numerous as the ground cracks in 1917. They also claimed that the intensity of 1930 earthquake was stronger than the intensity of the 1917 earthquake.</p>	The offset paddy field is in Table S2 B
Aug-3 <sup>rd</sup> -2008	Kale N17.367 E96.511	U Ngwe Maung (92)	<p>He heard from others that the rail was bent between Kale and Pegu but did not check it by himself.  Because of the earthquake, one paddy field became two paddy fields. Some water with sand was ejected out from the ground cracks west of the village.  He remembers the land west of the crack moved down in 1930.</p>	



**Table S2. Field photographs of small offsets along the Sagaing fault**

Photographs were taken in Summer 2008

A			<p>Displaced railroad embankment south of the Shwedan village, near the Mileage marker 67 on the railway. (N17.42817 E96.50440)</p>
B			<p>Right-lateral offset (~ 2 m) of a paddy field boundary. Local farmer (U Pwa) claimed the channel between the fields (not visible) was the ground fissure of 1930 earthquake, and separated one paddy field into two in 1930 earthquake. (N17.37892 E96.50408)</p>
C			<p>Right-lateral offset (~ 3 m) of a cart road, 7 km south of Bago. View to the east (N17.26254 E96.51290)</p>
D			<p>"Earthquake crack creek" (Open fissure) south of Kyaikme village. Local villager claims the fissure opened during 1930 earthquake. It was widened by lateral erosion after the earthquake (N17.19751 E96.51411)</p>
E			<p>West-facing fault scarp ~10 cm to ~80 cm high bounding the western margin of a N-S trending pressure ridge, south of Kyaikme village. (N17.19639 E96.51407)</p>

**Table S3. Original description of the temporary palace near the Payagyi pagoda from U Kala's Maha-ya-zawin-gyi ("Great Chronicle")**

<p><b>Original text (in Red box)</b></p>	<p>Ch:] 25-Preparing/Placing Treasure Chest or Reverend Pie for Mahavizara Zedi Stupa 45</p> <p>တွဲး] ၂၅-မဟာဝိဇယစေတီဌာပနာခြင်း ၄၅</p> <p>သုဒဿန နတ်လမ်းကဲ့သို့ အံ့ဘွယ်သရဲသော ခရီးကို တလိုင်း၊ မြန်မာ၊ရှမ်း၊ ကုလား၊သူဌေး၊သူကြွယ်၊အမူးအမတ်၊ဆွေတော်၊မျိုးတော်၊ မင်းညီမင်းသား အပေါင်းတို့သည် အထူးထူး အပြားပြားသော တန်ဆာတို့ကို ဆင်ယင် ဝတ်စားကုန်လျက် ကြီးစွာသော သဘင်တော်ကိုခံ၍ ကောင်းမှုတော်သို့ ပို့ရ သည်။</p> <p>၎င်း သက္ကရာဇ် (၉၃၈) ကိုးရာသုံးဆယ့်ရှစ်ခုနှစ် ပြာသိုလဆန်း ခြောက် ရက် တနင်းလာနေ့ ကောင်းမှုတော် မဟာဝိဇယစေတီ အနောက်တွင် သာယာလှစွာသော သဘင်တံးတော် ဆောက်စေ၍ သဘင် နန်းတော်၌ နေ တော်မူသည်။ ၎င်းနေ့ မဟာဥပရာဇာ အစရှိသော ညီတော်၊ သားတော်၊ မှူးတော်၊မတ်တော်၊ သူဌေးသူကြွယ် အပေါင်းတို့ လက်ဆောင်တော် ဆက် သည်။ ထိုလက်ဆောင်တော်ကို ကောင်းမှုတော် မဟာဝိဇယ စေတီတွင် သုဗ္ဗောစရင်ကို ရွှေထည့်စရာလှူတော်မူသည်။ ပြာသိုလပြည့်ကျော် ၁-ရက်နေ့ ကောင်းမှုတော်ကို ဒုတိယဌာပနာတော်မူသည်။ ၎င်း ပြာသိုလပြည့်ကျော် ဆယ့်နှစ်ရက်တနင်းလာနေ့ တတိယဌာပနာတော်မူသည်။ယင်းသောခါ သဘင် တံးတော်ကသည်ကောင်းမှုတော်သို့ ညီတော်၊သားတော်၊မှူးတော်၊မတ်တော်၊ ကိုယ်လုပ်မောင်းမ အပေါင်းနှင့် မွေးတော် ဓာတ်တော်တို့ကို ကိုယ်တိုင်တော် ပို့ရသည်။ ယင်းသည့်နေ့ပင် ကောင်းမှုတော် ရွှေထည့်စရာ စားတော်ခေါ် သည့် ကွမ်းခွက်၊လက်ဘက်အိုး၊တကောင်းဖိုး၊သောက်တော်မူသော ဖလား နှင့်တကွ ရွှေတဆယ့် သုံးဝိသာခန့်ဆယ်ကို 'မျက်ပါးခတ်ပြီးလျှင် သိမ် ရာဇာ၊ ငဆွေညို၊ ဝမ်းထောင်တို့နှင့် ဆရာတော် နန္ဒသာရ သာသနဂုရုကို ကြပ်မ၍ ရွှေထည့်ရသည်။</p>
<p><b>English Translation by Soe Thrua Tun after Jon Fernquest<sup>1</sup></b></p>	<p>... Within the year 938 (1576 or 1574) on the 6th waning moon of Pyatho monday on the west (back) of Kaunmudo Mahawizaya pagoda (<i>Payagyi pagoda</i>), by building a temporary tent for celebrating the feast the king stayed there in a temporary palace constructed for his enjoyment. ...</p>
<p>1. The original English translation is from Jon Fernquest's webpage. (<a href="http://burmesehistoricalchronicle.blogspot.com/">http://burmesehistoricalchronicle.blogspot.com/</a>)</p>	