Review article

Review of paleoseismological and active fault studies in Taiwan in the light of the Chichi earthquake of September 21, 1999

Yoko Ota a,*, Yue-Gau Chen b, Wen-Shan Chen b

a Yokohama National University, 2-11-13-201, Minamisenzoku, Otaku, Tokyo, 145-0063, Japan
b Department of Geosciences, National Taiwan University, Taiwan

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Abstract

This paper reviews the research on active and earthquake faults in Taiwan conducted prior and after the 1999 Chichi earthquake. The Chichi earthquake plays as a turning point of the relevant studies, since the 1999 coseismic surface rupture exactly follows preexisting fault scarps, created in turn by previous seismic events along the Chelungpu Fault. This fact indicates that the precise mapping on the other active faults is fundamental to predict the location of surface rupture caused by large future earthquakes. Since 1999, many trenching studies have been carried out along the Chichi earthquake fault. A few of them demonstrates that the penultimate event is as young as probably only 2–300 years old; however, some others show a rather old age of several hundreds years or even older for the last faulting event before 1999. More trenching studies are necessary for such a long fault in order to understand the possible segmentation features and the correlation of the paleoseismic events identified along the entire fault length. In addition, we further discuss the offshore faulting associated with seismic event along the eastern coast of Taiwan, where the multiple Holocene terraces are well known.

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Keywords: Paleoseismological study; Active fault; Earthquake fault; Trenching study; Chichi earthquake; Coseismic uplift

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* Corresponding author. Tel.: +813 37285317; fax: +813 37287569.
E-mail address: ota@iceice.com (Y. Ota).

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1. Introduction

Taiwan is located on the active boundary between the Eurasian and Philippine Sea plates, where an arc–continent collision, started in the Late Miocene, is still going on (Fig. 1. inset). Based on its stratigraphy, the island emerged not older than 6 Ma and is continuously growing southward according to the southward moving collision point (Teng, 1987, 1990; Ho, 1988). Since the subducting Philippine Sea plate is moving toward northwest, the major thrust belts are NNE oriented with declining ages westward (Fig. 1).

Reflecting the very high convergence rates at this plate boundary, landforms representing direct products of active tectonics are abundant in Taiwan. For this reason, identification and study of earthquake faults (surface rupture associated with known historical earthquakes), active faults that disrupted Quaternary terraces or deposits repeatedly, and therefore recognition of faults capable for future large earthquake, are the key for understanding of Late Quaternary paleoearthquakes in Taiwan, where documented history covers only the past 300 hundreds years. In addition, paleoseismic events can be analyzed by the study of subdivided Holocene marine terraces that are regarded to be coseismically uplifted. In this paper, we present a short review on the study of Taiwan paleoseismology, introduce the new studies after the destructive 1999 Chichi earthquake, and discuss the problems to be solved in order to characterize the seismogenic area and mitigate the associated hazards.

2. Studies on active faults and earthquake faults before the Chichi earthquake

2.1. Active fault studies

A summary on the active faults in Taiwan was first provided by Bonilla (1975, 1977). The Taiwan Central Petroleum Company also provided detailed geologic maps with active faults and folds (e.g., Central Petroleum Company, 1974a,b,c, 1978, 1981, 1982). Active faults were also studied from the viewpoint of structural geology (e.g., Suppe, 1981, 1983; Deffontaines et al., 1994). Geologic structure, including major tectonic deformation of Quaternary strata was shown and discussed in these maps or papers, but...
deformation of landforms by active faulting was usually not taken into account. In contrast, geomorphologists paid attention to the morphologic expression of recent tectonic displacement and discussed the presence of major active faults. Since the early 1980s, when the first edition of Active faults of Japan-sheet maps and inventories was published by The Research Group of Active Faults of Japan (1980), a few geomorphologists in Taiwan tried to map active faults and to describe the characteristics of faulting, following the same methods and criteria suggested in that book, in which the aerial photograph interpretation, supplemented by field study, has been used as the essential method to identify the active faults in all Japanese islands. For example, Shih et al. (1983a,b, 1984, 1986) published detailed geomorphologic maps with terraces and faults in most areas of Taiwan. Chang et al. (1986) provided an active fault map at the Tsaotun area along the Chelungpu fault, which moved during the 1999 earthquake. Ota, who introduced the Japanese approach for the active fault study to Taiwan, also mapped several active faults, including a part of the Chelungpu fault (Ota, 1999a). However, these results did not draw very much attention of geologists and geophysicists. For instance, they are not evenly considered the geomorphically identified active faults in the recently published maps, compiled by the Central Geological Survey (1998, 2000), Fig. 1). The reason is partly because these papers were not well circulated and also partly the geomorphologists mapped the active faults but they did not pay much attention on the structural and tectonic significance or faulting history. However, we need to re-evaluate these studies and re-establish the concept of geomorphologically identified active faults. It should be strongly emphasized that the evidence for active faulting is the deformation of terraces and landforms that were formed during the Late Quaternary, either in Taiwan or in most seismic regions on the earth.

2.2. Earthquake faults study

From the 1906 Chiayi to the 1999 Chichi earthquake, five major earthquakes in Taiwan generated extensive surface fault ruptures (earthquake faults) (Table 1, Fig. 1). These earthquakes were all larger or equal to ML 7.0, usually 7.1 or 7.3 (except the 1946 ML 6.1 Hsinhua earthquake). Depths of their hypocenters were in general shallower than 20 km. In the following, we summarize the characteristics of the surface rupture associated with these historical earthquake and the principal results of the related paleoseismological studies.

The Meishan fault associated with Chaiyi earthquake in 1906 has oblique strike to that of the known major geological structure, implying that the earthquake fault plays a role of a tear fault (1 in Fig. 1). Although Bonilla

<table>
<thead>
<tr>
<th>Earthquake and date</th>
<th>M</th>
<th>Earthquake fault</th>
<th>Strike</th>
<th>Length (km)</th>
<th>Sense and amount (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>t1.1</td>
<td>t1.2</td>
<td>Major earthquake faults in Taiwan</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>t1.3</td>
<td>t1.4</td>
<td>1906.3.17</td>
<td>7.1</td>
<td>Meishan</td>
<td>NE</td>
</tr>
<tr>
<td>t1.5</td>
<td>t1.6</td>
<td>Central Taiwan 1935/4.21</td>
<td>7.1</td>
<td>Shihtan(Chihhu)</td>
<td>NE</td>
</tr>
<tr>
<td>t1.7</td>
<td>t1.8</td>
<td>Tuntzuchiao</td>
<td>NE</td>
<td>12</td>
<td>$R=0.6$</td>
</tr>
<tr>
<td>t1.9</td>
<td>t1.10</td>
<td>Hsinhua 1946/12.5</td>
<td>6.1</td>
<td>Hsinhua</td>
<td>EW</td>
</tr>
<tr>
<td>t1.11</td>
<td>t1.12</td>
<td>Hualien 1951/10.22</td>
<td>7.3</td>
<td>Milun</td>
<td>NE</td>
</tr>
<tr>
<td>t1.13</td>
<td>t1.14</td>
<td>Taitun 1951/11.25</td>
<td>7.3</td>
<td>Yuli-Chihshang</td>
<td>NE</td>
</tr>
<tr>
<td>t1.15</td>
<td>t1.16</td>
<td>Chichi 1999/9.21</td>
<td>7.3</td>
<td>Chelungpu</td>
<td>NE</td>
</tr>
<tr>
<td>t1.17</td>
<td>t1.18</td>
<td>List of the earthquake faults in Taiwan. $V$, $L$, and $R$ mean the major component of displacement. $V$: vertical offset, $L$: left lateral offset, $R$: right lateral offset.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
(1975) has suggested the possibility of recent faulting, no surface deformation was recorded to show previous activities of the Meishan fault.

The 1935 Central Taiwan earthquake was the largest destructive earthquake in the past century, which brought up more than 3000 fatalities and more than 17,000 collapsed houses. Two earthquake faults, Shihtan (Chihhu) and Tuntzuchio faults appeared (Otuka, 1936) at that time (2 in Fig. 1). The Shihtan fault is a high-angle reverse-oblique fault with a left-lateral component. Coseismic range-facing fault scarps are still locally preserved (Fig. 2). The trace of the surface ruptures does not coincide with any previously known geological faults, however. Tuntzuchio fault consists of en echelon short cracks. There is a 30 km-long gap of discontinuous fissures and cracks between the two coseismic faults mentioned above.

The 1946 Hsinhua earthquake generated a coseismic scarp with a nearly vertical fault plane near Tainan, associated with only 6 km of surface rupture.

Fig. 2. A back-facing scarp associated with the 1935 Central Taiwan earthquake. This scarp appeared on the valley floor (photo by Ota).

Fig. 3. View of the flexural scarp produced by the 1999 Chichi earthquake at Kuangfu Middle School sport ground. Overriding hanging wall on the footwall, and complex deformation on the hanging wall are clearly seen (Kuangfu Middle School sport ground, photo by Ota, September, 1999).
22 (3 in Fig. 1). Damaged buildings were concentrated in a zone of 1–2 km in width along the fault. This victim zone is rather wide compared with the damage zone observed in the 1999 Chichi earthquake. The strike of this fault is oblique to the trend of the major structure, indicating that this fault should be regarded as another tear fault accompanied by the growth of Neogene–Quaternary folding of this area (Biq, 1976).

22 The Milun fault, activated in October, 1951, is a high-angle reverse fault with left-lateral component (Hsu, 1962; Biq, 1976), accompanied by subparallel subsidiary back thrust, and seems to continue seawards (4 in Fig. 1). This fault completely coincides with the seaward extension of a preexisting Holocene fault scarp, which bounds the western margin of the Milun Tableland, a tectonically uplifted upland, composed of Holocene marine deposits. Sense of the 1951 Milun faulting is the same as that of the Holocene faulting. Progressive deformation during the Holocene is also well recorded in the accumulated scarp height of the main Milun and its subsidiary fault (Yamaguchi and Ota, 2002). The Milun fault is the northernmost segment of the Taitung Longitudinal Valley Fault System. Thus, the activity of the Milun fault is important to evaluate the activity of the Taitung Longitudinal Valley Fault System. So far, we have no data on the recurrence interval of the faulting; however, it seems to be rather short, possibly less than 1000 years, when we judge the progressive deformation during the past several thousand years since the emergence of the Milun Tableland.

20 The Yuli–Chihshang fault appeared in November, 1951 along the southern segment of Taitung Longitudinal Fault System (5 in Fig. 1). This is also a high-angle reverse fault with a left-lateral component of slip. The exact relationship of this Yuli–Chihshang fault with the preexisting active faults, which deformed Pleistocene–Holocene terraces nearby, is unknown due to the insufficient post-earthquake investigation.

20 Thus, in terms of paleoseismological study, only the Milun fault is clear enough, because it records repeated activities on the same fault trace. For the other earthquake faults, there was almost no published paleoseismological document before 1999. It is probably because a detailed large-scale fault map, suitable for the comparison with the location of the earthquake faults, was not available before. In addition, recognition of active faults by geomorphological method was not established in the past. Nor any information on recurrence time of faulting was also available. In summary, the paleoseismology study on active faults as well as earthquake faults were not working well before the 1999 Chichi earthquake.

3. Progress on paleoseismological study after the Chichi Earthquake

3.1. Earthquake fault

20 The 1999 Chichi earthquake created the longest surface earthquake fault in Taiwan and is a result of...
a reactivation of the already known Chelungpu fault (6 in Fig. 1). It also showed the largest amount of offset in the modern earthquake faults of Taiwan. Nearly 9-m vertical offset in the north of Tachia River (Table 1), it is one of the largest offsets by a single event in the world. People certainly recognize that the Chelungpu Fault is really an active fault, and this earthquake makes a turning point of paleoseismological study in Taiwan. Most of the coseismic displacement associated with the Chichi earthquake appeared as flexural scarps with upthrown side on its eastern side, accompanied by complex secondary deformation, including back tilting or back thrusting, on the hanging wall (Fig. 3). The earthquake fault trace shows a very sinuously and complex pattern (Fig. 4). This is the surface expression of a low angle reverse fault dipping eastward, reflecting the compressional stress field and corresponding to the mountain building. The earthquake fault trace and style of faulting were reported immediately after the earthquake (e.g., Ota and Yamaguchi, 1999; Ota, 1999b; Ma et al., 1999) and documented in detail

Fig. 5. Photo showing the coincidence of pre-existing fault scarp and the 1999 earthquake scarp at the Tsauton area (photo by Ota, Sept. 24, 1999).
by Central Geological Survey (1999, Fig. 4). A lot of work was done by cooperation not only within Taiwanese scientists but also by international joint research teams (e.g., Kao and Chen, 2000; Rubin et al., 2001; Chen et al., 2001a,b,c,d,e; Chen, W.S. et al., 2001f; Chen, Y.G. et al., 2002; Lee et al., 2002). Here we avoid duplicating the detailed discussion of the earthquake fault, but we note some important points. One of the important things to be noted is that the earthquake fault exactly follows the preexisting active fault trace (Figs. 5 and 6), as emphasized in recent papers (Ota, 1999b,c; Ota et al., 2000b; Chen, Y.G. et al., 2002, Ota et al., in press); (please see next section). This indicates that the detailed mapping of the active fault is a key in identifying the location of future ruptures. In other words, study of the past earthquakes is a key for understanding future surface faulting events. This seems to be obvious, but in Taiwan this concept has not been widely accepted till the Chichi earthquake.

Another phenomenon associated with the surface deformation is that the destruction of the buildings is limited to a very narrow zone (less than ca. 50 m) of the hanging wall. Nearly no damage occurred on the footwall although the buildings are located very close to the fault (Fig. 7). This finding is important for the urban planning related to the ground rupture hazards. Of course damage by shaking can occur at sites far from the surface trace of the causative fault, depending on the subsurface ground condition.

In any case, the earthquake fault by the Chichi earthquake is the most carefully mapped and measured. Very useful map of 1:1000 scale along the faulted zone was provided by Huang et al. (1999) who also discuss its relationships with the preexisting fault.

Fig. 6. Map showing the coincidence of the earthquake fault and pre-existing fault trace at the Tsauton area. Numbers show the terrace order from the older one. Dots represent the 1999 earthquake fault and active fault, showing their close coincidence in the location (Ota, 2000). TW: Tsauton west fault (main Chelungpu fault), and TE: Tsauton east fault as a back thrust. See Fig. 8 for the location.
3.2. Active fault study

After the Chichi earthquake, many papers on active faults were published from the viewpoint of structural geology (e.g., Suppe et al., 2001; Deffontaines et al., 2001; Lacombe et al., 1999, 2001). Active faults, locally showing clear evidence for aseismic creep surface fault, were discussed by Angelier et al. (2000).

After the 1999 Chichi earthquake, we particularly examined the relationship between the earthquake fault trace and preexisting fault trace. Ota (1999b) and Ota et al. (2000) raised this question since immediately after the Chichi earthquake and accomplished the comparison using aerial photographs of 1:20,000, taken in 1970s. The results demonstrates that about 80% rupture exactly followed the preexisting active fault scarp (Ota et al., 2003). An example is shown in Figs. 5 and 6. They also described the progressive deformation on the same fault trace by the accumulated scarp height, which records at least several paleoearthquakes during the Late Quaternary. This is particularly well documented on a series of fluvial terraces east of Tsauton, central part of the Chelungpu fault (Ota et al., 2000), TW in Figs. 6 and 8). Here, it is possible to observe the coincidence between the surface rupture and the preexisting fault not only for the

Fig. 7. Contrasting damages on the hanging wall and footwall at Tsaotun (photo by Ota, Sep. 1999).
main fault (TW in Fig. 6) but also for the subsidiary back thrust (TE of Fig. 6). Such a coincidence is now recognized by Chang (2001), and even in another subsidiary fault located along the Tachia River (Hsieh et al., 2001).

Coincidence between fault traces and identified repeated activity are both very important, because the precise mapping by geomorphological method (Ota et al., 2001) for other active faults can predict the location of future rupture. For this purpose we need to work on the deformation of terraces. Some of the 1999 surface rupture appeared on the young alluvial lowland where no surface trace is found. This is because the alluvial lowland is too young to record the pre-1999 event.

3.3. Trenching studies for understanding faulting history

Even if the progressive faulting is very clear along the Chelungpu fault, it is still difficult to know the recurrence interval of the faulting, because the written history in Taiwan is too short (no historical earthquake has ruptured twice the same fault segment) and age determination of offset terraces is sometimes impossible because of lack of datable material. Thus trenching across the fault is very necessary for understanding faulting history and also for estimating the timing of future faulting.

Along the 1999 earthquake twelve sites have been excavated in the past two years (up to Decem-

Fig. 8. Profiles showing progressive deformation of the Chelungpu fault (TW) at the Tsauton area (Ota et al., 2000). Numbers with * are the vertical displacement by the Chichi earthquake. Numbers with dot are the minimum amount of offset since the time of formation of each terrace. See Fig. 6 for the location.
In addition at least three trenches were excavated across the Chelungpu fault by December 2002, and several trenches were excavated on other active faults, mainly on the Tainan area. At most of interpreted sites, trench logs show evidence of paleo-earthquake events (Table 2). Trenching sites are, so far, mainly located on the central part of the Chelungpu fault (Fig. 4), where the earthquake fault is clearly traced and amount of offset is not too much (less than 5 m). Low-angle thrust fault (Figs. 9 and 10), with secondary back thrust or deformation of hanging-wall, as well as overriding of hanging-wall on the footwall were clearly recognized at several trench logs (e.g., Ota et al., 2001; Lee et al., 2001). It was not easy to find out multiple events and their age to compute recurrence intervals, however. Multiple faulting was recently identified from some of the trenches (see Table 2).

Trench exposures excavated so far appear to be also characterized by distinct carbonaceous paleo-soils and multiple fault traces. The soils provide numerous charcoals for radiocarbon dating, which improved the paleoseismological study very much. Also, soil horizons can be used as strain markers that help us to recognize the paleo-earthquake events. On the other hand, multiple faults usually interplay each other and mask the order of paleo-events (Figs. 10 and 11). In this case, the trench restoration need more age determinations to be successfully accomplished. Although multiple faults are common, they are distributed in a narrow zone (i.e., several meters), which corresponds to the topography change very well. This result is valuable for earthquake hazard mitigation.

### Table 2

<table>
<thead>
<tr>
<th>No.</th>
<th>Trenching site</th>
<th>Description and results</th>
<th>References</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fengyuan</td>
<td>Multiple fault traces in a narrow zone. One event prior to 1999 has been found and can be dated.</td>
<td>Chen et al., 2001a</td>
<td>○</td>
</tr>
<tr>
<td>2</td>
<td>Wenshan Farm</td>
<td>Two shallow trenches have been excavated. Multiple fault traces are recognized. The last two events can be determined by radiocarbon ages.</td>
<td>Chen et al., 2001a</td>
<td>○</td>
</tr>
<tr>
<td>3</td>
<td>Chienmin Bridge</td>
<td>Two events are found including 1999 Chichi earthquake. Penultimate event occurred later than 150 years BP.</td>
<td>Lee et al., 2000</td>
<td>●</td>
</tr>
<tr>
<td>4</td>
<td>Peikouchi</td>
<td>Four trenches were excavated in this site. Also multiple fault traces. More than four events have been identified.</td>
<td></td>
<td>○</td>
</tr>
<tr>
<td>5</td>
<td>Pineapple Field</td>
<td>Two deep trenches with four levels were excavated. Except for the 1999 fault, there are three burial faults. At least four events occurred during the past 1.8 ka.</td>
<td>Chen et al., 2001c</td>
<td>●</td>
</tr>
<tr>
<td>6</td>
<td>Wufeng</td>
<td>Only 1999 event can be identified in two trenches. Many radiocarbon dates worked out to give age control in this district.</td>
<td>Chen et al., 2001a</td>
<td>●</td>
</tr>
<tr>
<td>7</td>
<td>Kuangfu School</td>
<td>Only 1999 event is recorded in this site.</td>
<td></td>
<td>○</td>
</tr>
<tr>
<td>8</td>
<td>Fengying Bridge</td>
<td>Two fault traces separates 10m. The western one is 1999 fault. The eastern one is an old fault that moved later than 300 yr BP based on radiocarbon age.</td>
<td>Lee et al., 2001,</td>
<td>●</td>
</tr>
<tr>
<td>9</td>
<td>Tsao lun</td>
<td>One event prior to 1999 may be older than 300-500 yr BP.</td>
<td>Chen et al., 2001d</td>
<td>●</td>
</tr>
<tr>
<td>10</td>
<td>Chungshin</td>
<td>Four separated trenches have been done. One of them showed 6 successive colluvial wedges along the major thrust fault. The penultimate event happened younger than 200 yr BP.</td>
<td>Ota et al., 2001</td>
<td>●</td>
</tr>
<tr>
<td>11</td>
<td>Shijia Field</td>
<td>A 8 m deep trench demonstrates that the surface scarp actually is a fold-scarp based on continuous but deformed underlying sedimentary strata. Tilting angle of the paleo-soils increasing downward from top implies that at least three events have been recorded. Radiocarbon ages demonstrate that the last two events occurred in the past 700 years.</td>
<td>Streig et al., 2001</td>
<td>●</td>
</tr>
<tr>
<td>12</td>
<td>Mingchien</td>
<td>A trench shows double faults including 1999 rupture and one already buried. Radiocarbon ages illuminate the corresponding event of the old fault is also younger than 200 years.</td>
<td>Chen et al., 2001c</td>
<td>●</td>
</tr>
</tbody>
</table>

- ○ Study has been already done.
- ● Study is still on-going.
So far the recurrence interval remains unknown for all of the segments of the Chelungpu fault due to insufficient age control. However, some of the studies have reported that the penultimate event occurred later than the lower age limit of radiocarbon method, 200 to 300 yr BP. This implies that the coseismic faulting of the Chelungpu is probably repeating in a very short time relative compared to other place in the world. However, some trench site shows a much older age for the timing of the penultimate event (for example, more than several hundreds years ago at loc. 9 (Ota et al., 2001), and ca. 2000 yr BP at loc. 1 (Ota et al., in prep. Fig. 4). Thus, more locations should be excavated to possibly establish the simultaneity of a fault event; this is necessary in understanding the distance affected by

Pineapple Site

Fig. 9. Trench wall at loc. 9 (TW of the Tsauton area) showing deformation of terrace deposits younger than ca. 300–500 yr BP. (photo by Ota, July, 2000).

Fig. 10. Trench wall at loc. 5. See caption of Fig. 10 for details (photo by Chen et al., 2001a,b,c,d,e).
one event. Estimating earthquake rupture lengths is in turn critical for fault segmentation and seismic potential. Trenching is also necessary for other active faults that have no record of paleoearthquakes in historical time.

4. Coseismic uplift along the coast of eastern Taiwan

In addition to the onshore active fault, the tectonically rising eastern coast of the Coastal Range, eastern Taiwan, provides a great potential for paleoseismological study. The 100-km long coastal area between Hualien to Taitung is characterized by the presence of very high Holocene marine terraces, up to 80 m above the sea level, and of subdivided multiple terraces, locally including up to 10 steps. The formation of these terraces is regarded to record repeated coseismic uplift during the Holocene (e.g., Liew et al., 1990, 1991, 1993, Yamaguchi and Ota, 2002), judging from the relative height between each successive steps (usually more than 3 m, some are more than 5 m). Compared to the sea-level fluctuation during the Middle to Late Holocene, the recorded uplift is too large to be attributed only to the Holocene sea level change. Since some of the terraces are capped by coral reefs, timing of the emergence of terraces can be dated. However, it is still difficult to establish the entire uplift history, because of the inconsistency between the age and terrace order at some place, and of the lack of datable material at other places. Even so, the recurrence interval is estimated to be several hundreds to thousand years. Discontinuities of the height of the Holocene transgressive terrace and different ages of lower terraces (Fig. 12), indicate that there are three tectonic subregions in this coastal area (Liew et al., 1993; Yamaguchi and Ota, 2002), although division boundaries are slightly different in both papers. The tectonic framework, responsible for the observed subregions, is still not well understood. Yamaguchi and Ota (2002) propose that the formation of northernmost subregion A is due to the activity of the onshore Milun fault. In contrast, the causative seismogenetic faults for the other two subregions are still unknown. It is quite unlikely that offshore faults can play a role in causing the coastal uplift. It is also unsolved when such high uplift has started. This is one of the most important topics to be resolved for the understanding of paleoseismic history of the area. The identification and analysis of Late Quaternary...
terraces in the east coast of Taiwan should give a key
for this problem.

5. Summary and conclusions

The great importance of geomorphological iden-
tification of active faults in Taiwan has been clearly
illustrated by the coincidence between the 1999
earthquake surface rupture and the preexisting
fault scarps. This suggests that similar relations
should characterize other faults in Taiwan, and
shows the need for detailed mapping of all the
active faults. Actually, this process has already
started just after the Chichi earthquake. Trenching
study along the Chelungpu fault after the 1999
earthquake shows a rather short recurrence interval
relative to the other places of the world. This is still
insufficient to give a precise answer because of
limited number, leading to poorly constrained seg-
mentation models along the Chelungpu fault. We
believe more and more paleoseismological studies
not only for the Chelungpu fault but also on the
other faults that have no clear faulting history will
allow us eventually find out the answer. In particu-
lar, a large amount of trench studies and paleoseis-
mic interpretation, especially along trench exposures
with high resolution stratigraphy, is very important
in the local tectonics setting because faulting com-
plexity of typical earthquake surface rupture along
low-angle thrust, which can make paleoseismic
event histories very difficult to understand, and
the need of discriminating between coseismic slip
and aseismic fault creep, which both are known to
characterize the behavior of some active faults in
Taiwan (e.g., Angelier et al., 2000).

In addition to onshore active faults, our data
emphasize the relevance of studying the clear evi-
dences of recent offshore faulting which can be
observed along the eastern coast of Taiwan. Here a
sequence of Holocene marine terraces capped by cor-
als provides an opportunity for further constraining
the paleoseismic catalogue of the region after precise
dating of each terrace.

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