

2013/7/3 Paleotsunami

workshop at NSC

Concluding Remarks :

**Current and Future Paleotsunami Studies
in Taiwan**

Yoko OTA (NTU)

Thank you very much for all the invited speakers giving valuable information on paleotsunami studies.

“Prospects and challenges in Taiwan” already by Yen,

Considering the contents presented by invited speakers:
What we did or can do, or should do in Taiwan?

For example, **tsunami history, tsunami magnitude, tsunami height distribution, hazard, reconstruction of earthquake,** etc are indicated topics

Do we have material to reply to these problems in Taiwan ?

We have not enough data replying for these problems, because paleotsunami study in Taiwan has started very recently and the study area is very limited

Common questions on tsunami in Taiwan

- 1) Have tsunamis ever attacked the east coast of Taiwan ? *very negative when we started the work in 2009; because of deep submarine morphology and no long written history and no major tsunami in historical time***
- 2) How can we identify paleotsunami?**
- 3) How can we distinguish tsunami deposits and storm deposits?**

Replies

- 1) Yes, there are some evidences of paleotsunami**
- 2) Yes, we have some criteria**
- 3) Yes, but not easy**

Brief summary of paleotsunami study based on geological evidence on the east coast of Taiwan

2009,10; Excavation at Chenggong terrace (submitted)

2010; Observation of tsunami boulders at east of Hengchun Peninsula (Matta et al., 2013)

2011; Preliminary observation of tsunami boulders at Green Island

2012; Excavation of 1886 tsunami deposits on Ho-ping Island (CGS)

Tsunami and paleotsunami are now seriously concerned after 2011 Tohokuoki earthquake: new phase of the study

2013; Session on paleotsunami, TGA; Subproject by Academia Sinica, This workshop supported by NSC, New project in future?

Example on geological evidence for paleotsunami are introduced

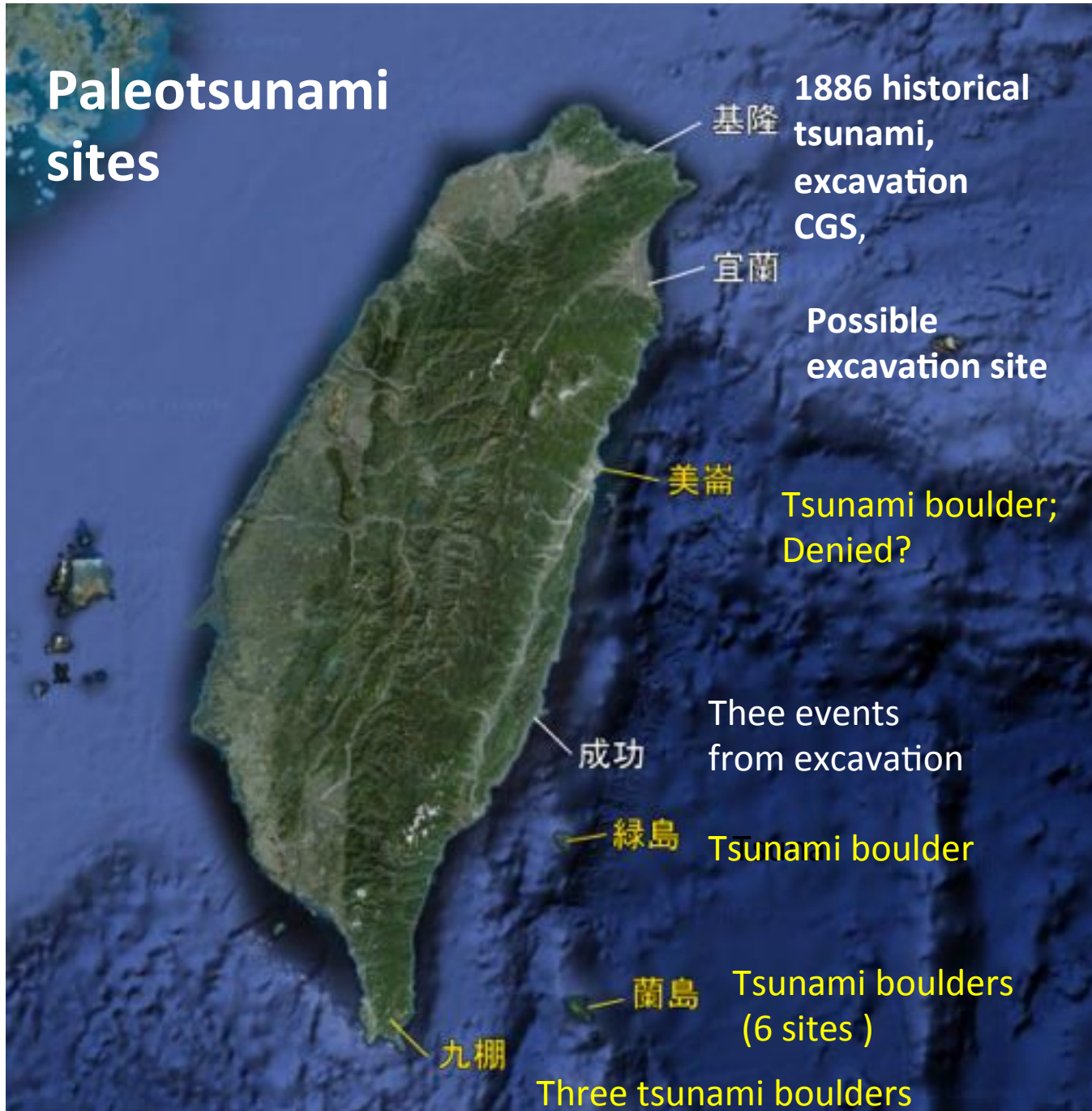
1) Tsunami boulders

- * Henchuan peninsula (first site for the finding of tsunami boulder, Target for the field trip)**
- * Lanyu Island (Multiple boulders in the northern coast, under working)**

2) Facies change of deposits

- * Ho-ping Island (already presented)**
- * Chenggong coast (the first excavation for Holocene deposits to find out paleotsunami)**

Paleotsunami sites



Tsunami boulders

Jepeng (Matta et al., 2013,TAO)

Lanyu Island (Ota et al., under working)

Green Island (Ota et al., under working)

Milun Tableland (Ota et al., tsunami possibility probably denied)

Facies changes by excavation

Chenggong coast (Matta et al., submitted)

Ho-ping Is. (CGS, 2012)

I-lan coast (will be studied)

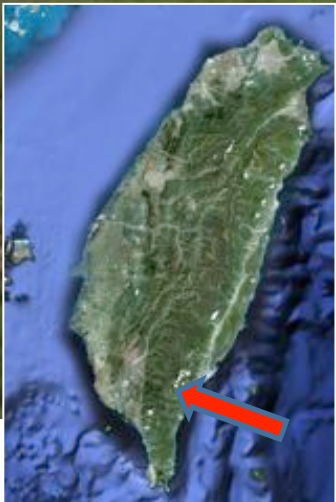
West

East

Coral boulder on Holocene coral terrace

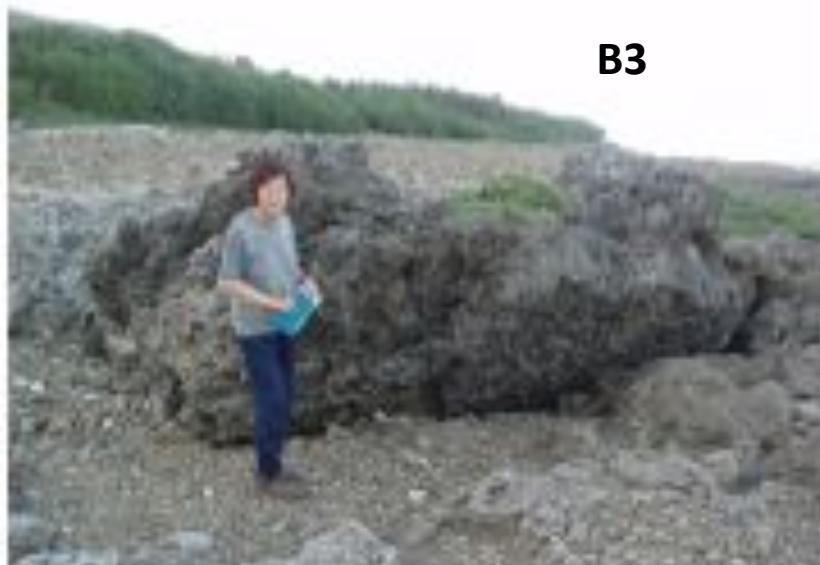
Coral boulder

Holocene Terrace



2009.06.26

Three coral boulders on Holocene coral terrace



Timing of tsunami ?

Green Island



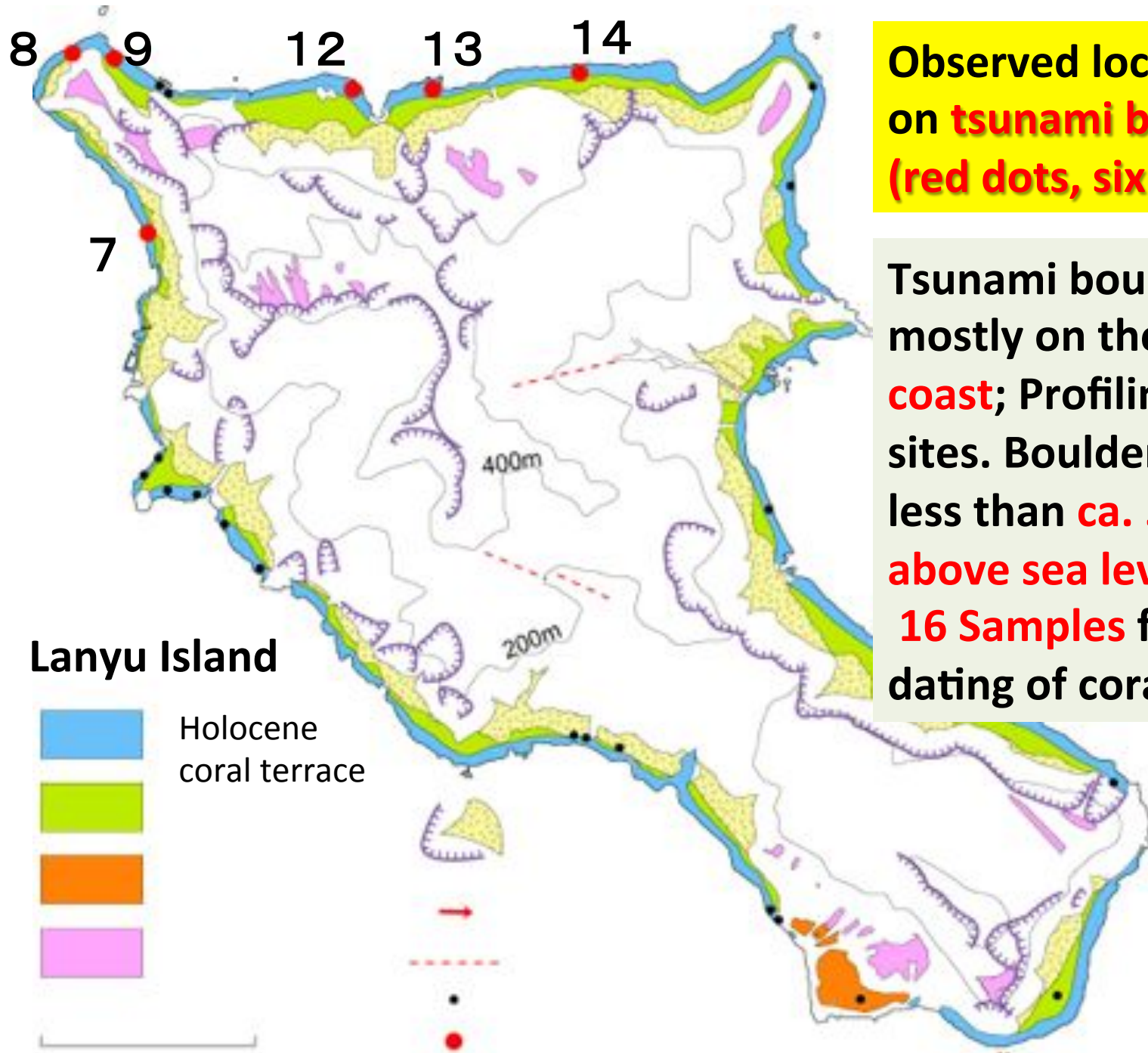
**Boulders on the east coast
of Green Island on Holocene
coral terrace**

**Further field work is planed on
next week**

**Tsunami boulders (?) are
found at only one location
(Ota et al., 2011). Younger
than ca. 5ka (Chen and Liu,
1992)**

**Photo interpretation
suggests the presence of
other several boulders.
Need mapping,
measurement and sampling**





Observed locations on **tsunami boulders** (red dots, six sites)

Tsunami boulders are mostly on the **north coast**; Profiling at six sites. Boulders are less than **ca. 5m** above sea level. **16 Samples** for dating of coral



Examples of tsunami boulders, Lanyu island



Fallen blocks and storm boulders are excluded

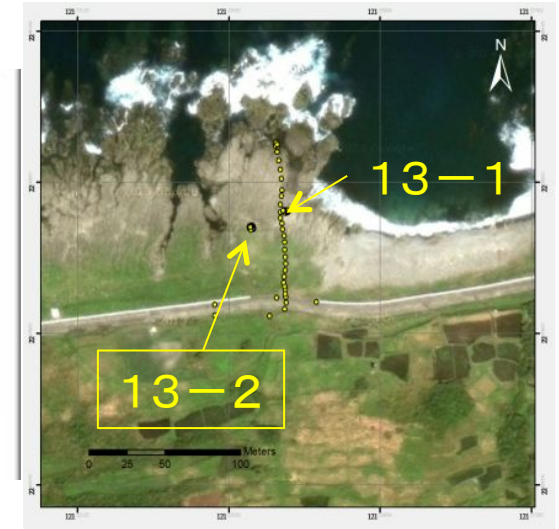
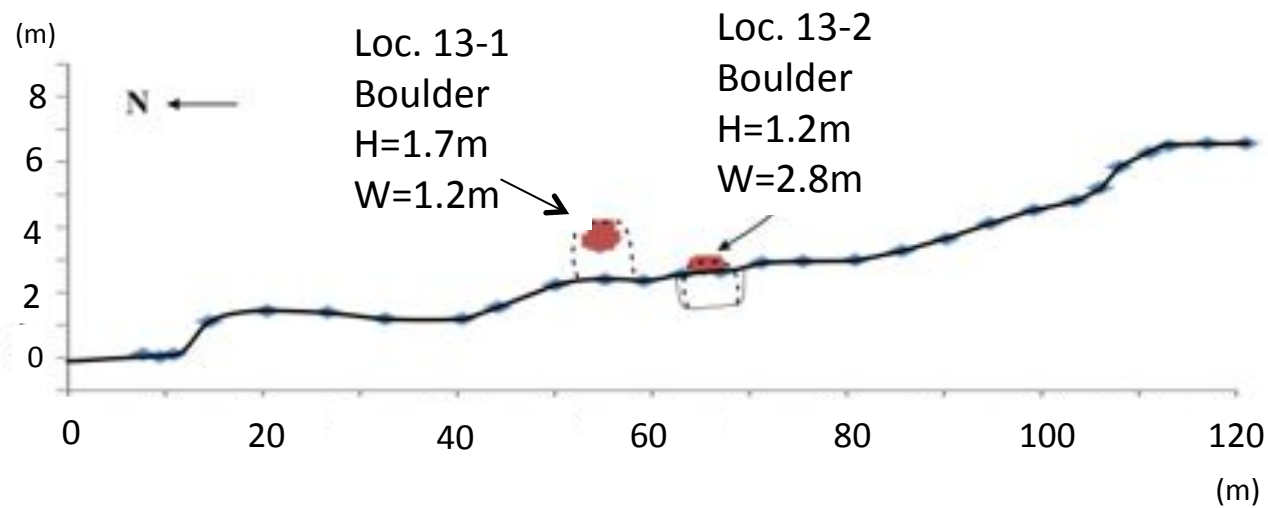
How can we identify tsunami origin for boulders?

- 1) Excluding fallen rocks: many fallen blocks, composed of debris flows (volcanic rocks and older coral limestone)**
- 2) Excluding many blocks transported by typhoons (Many, but usually, less than 2m across)**

Then, tsunami boulders are composed of coral limestone, usually 4-5 m across, often with attached corals:

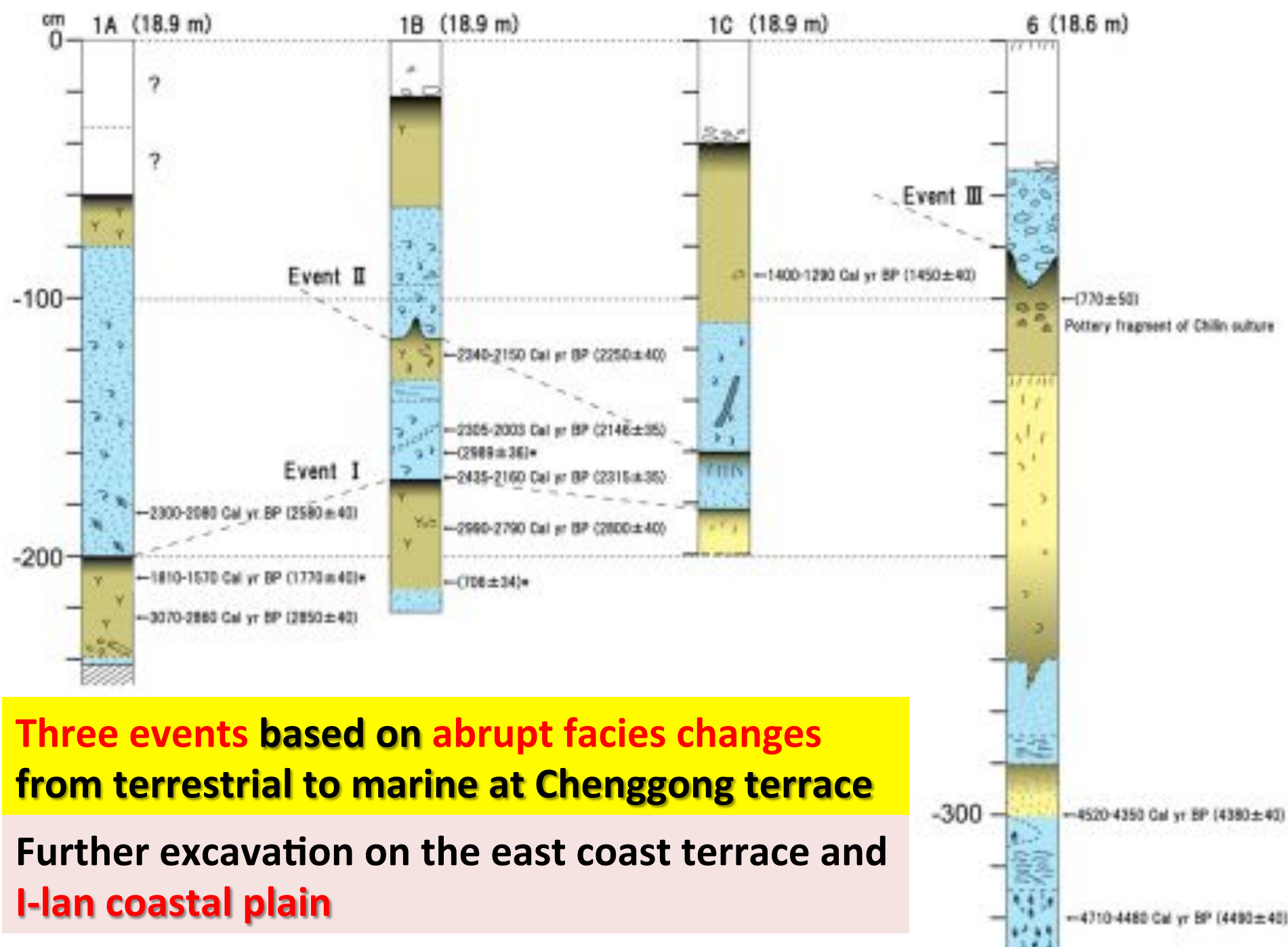
Do attached corals represent the timing of tsunami event? Problem!

Measurement of profile across the Holocene coral terraces where possible tsunami boulders are found



Presence of tsunami boulders at six sites on the north coast, lower than ca. 5m above sea level.

How old are they?
Multiple events or single event?



Three events based on abrupt facies changes from terrestrial to marine at Chenggong terrace

Further excavation on the east coast terrace and I-lan coastal plain

Possible tsunami deposits at site 1 and 6 at a closed environment

Three even since ca. 3000 yr BP.

Only beach deposits at site 2 and 5

Preservation of tsunami deposits is very local



No micro relief remains corresponding to different facies of deposits

RESULTS

Geological evidence for the presence of **plaelotsunami** implying occurrence of future tsunami in coastal area

- * **Tsunami boulders**

 - Henchuan Pen.

 - Green Is.

 - Lanyu Is.

- * **Facies change**

 - 1867 historical tsunami (Ho-Ping Island)

 - Three events during the last 3000 years (Chenggong coast)

Study sites are very limited, leaving many unsolved problems

Towards the future studies

***Areal extent attacked by tsunami, and location and magnitude**

of tsunamigenetic earthquakes

Increase the study sites: We have only spot data

***Timing of tsunami, single event or multiple event ?**

Accurate dating of sediment

Does attached corals represent the timing of tsunami?

***Estimation of inundation height**

How high above the presence of tsunami boulder or above facies change height?

Important areas to be studied

Densely populated coast

The coast near critical facilities

The coast facing probable large earthquake

Proposed area:for example

Ilan plain, east coast

Our paleotsunami works have just started several years ago.

There are many unsolved problems.

Let us start for the next step together !

Thank you for your joining this workshop.