



Lumpur Sidoarjo - LUSI Expert Gathering and  
Mud Volcanoes in Indonesia and Their Implications - Symposium  
(Humanitus Sidoarjo Fund & Badan Penanggulangan Lumpur Sidoarjo-BPLS)  
Sidoarjo-Surabaya, 25-26 May 2011



***Presumed Mud Volcanic Disasters in Jenggala  
and Majapahit Periods of 11<sup>th</sup> – 15<sup>th</sup> Centuries,  
East Java: Constraints from Historical  
Chronicles, Folklore, and Geology***

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Republic of Indonesia*



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*The Present is the Key to the Past*

*What is happening today,  
happened in the past*

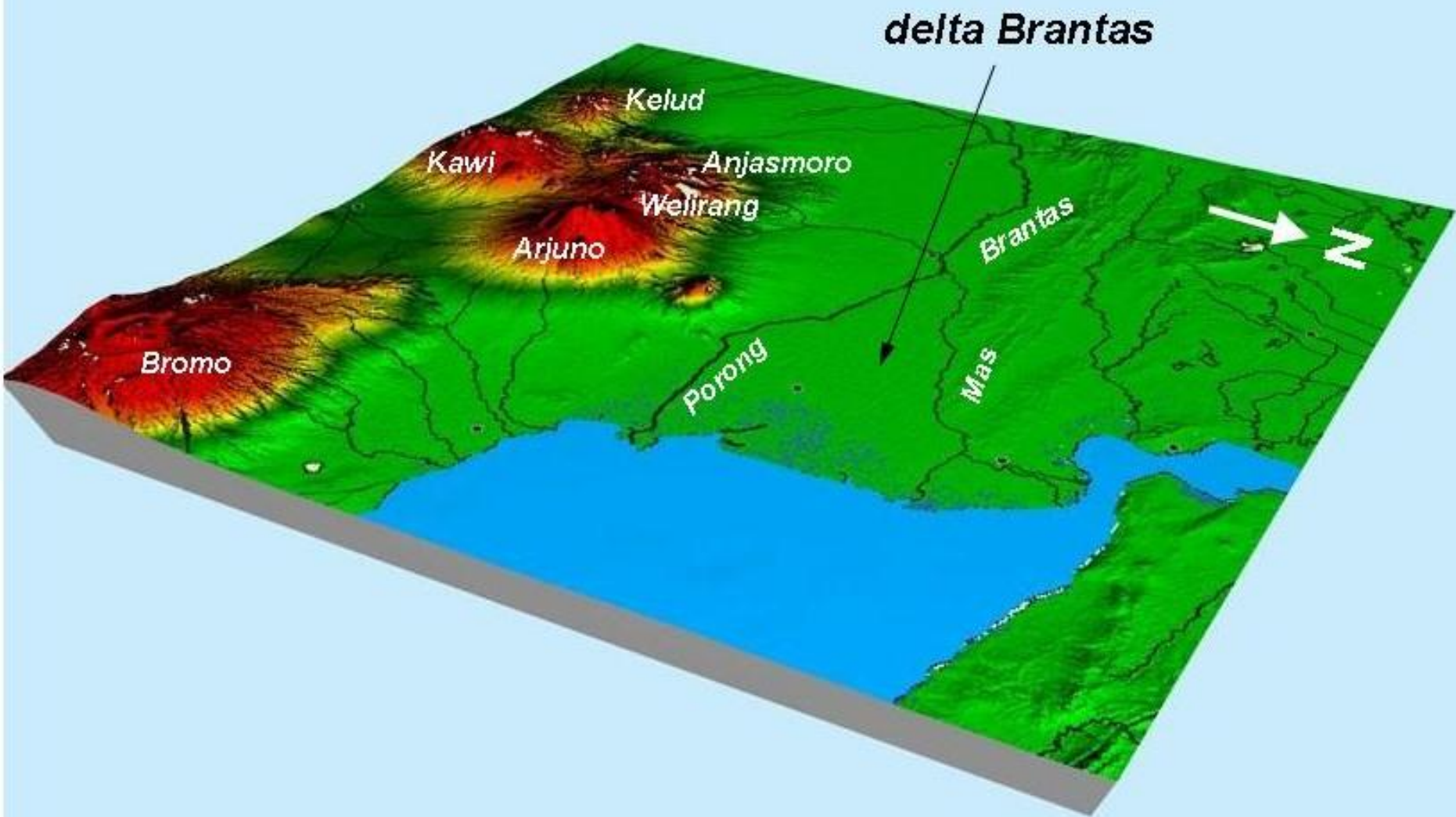
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- **Historical Roles of Brantas Delta**
- **Jenggala Kingdom and Majapahit Empire**
- **Eruption of LUSI (Lumpur Sidoarjo)**
- **Presumed Mud Volcanic Eruptions in Jenggala and Majapahit Periods**
- **Conclusions**



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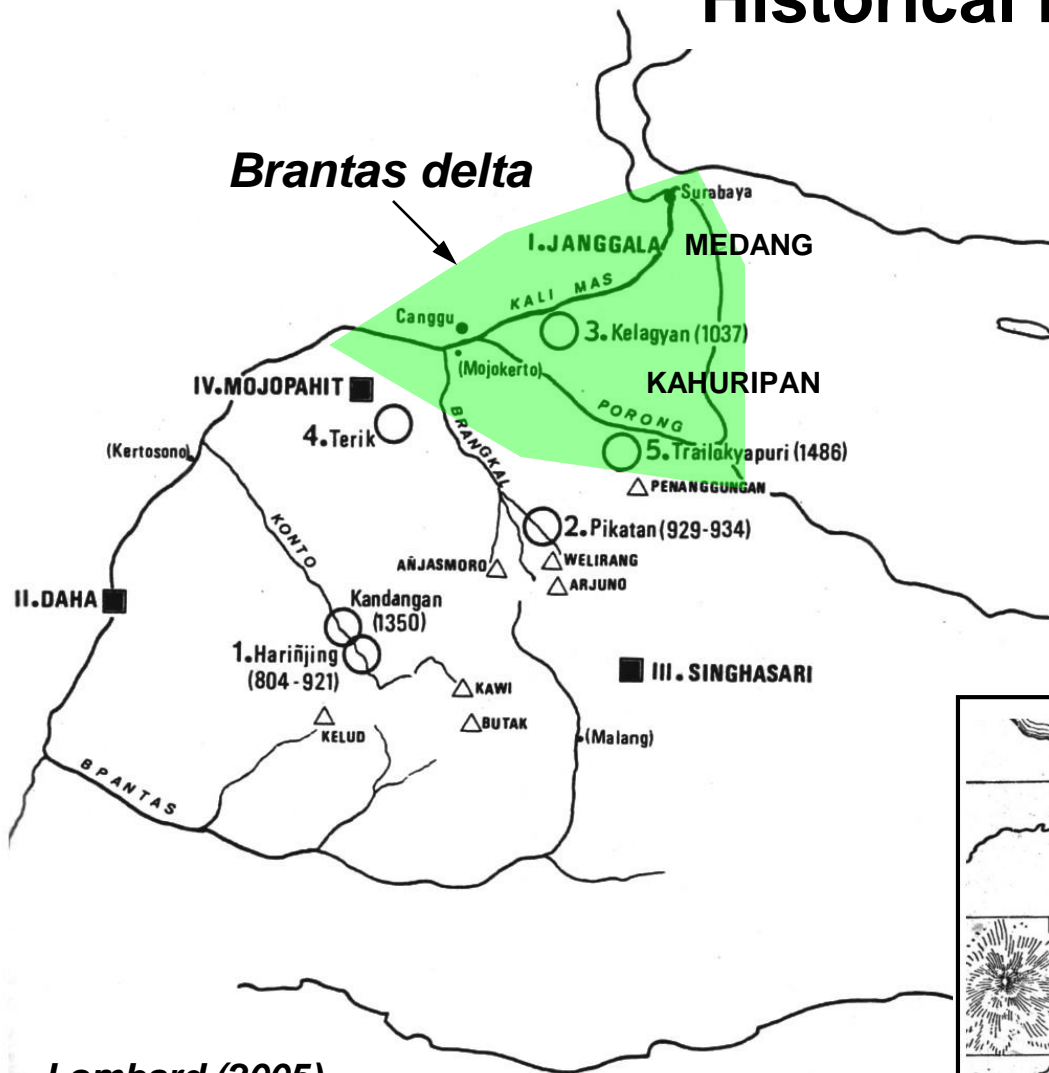
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**Brantas Delta, East Java**

# Historical Roles of Brantas Delta

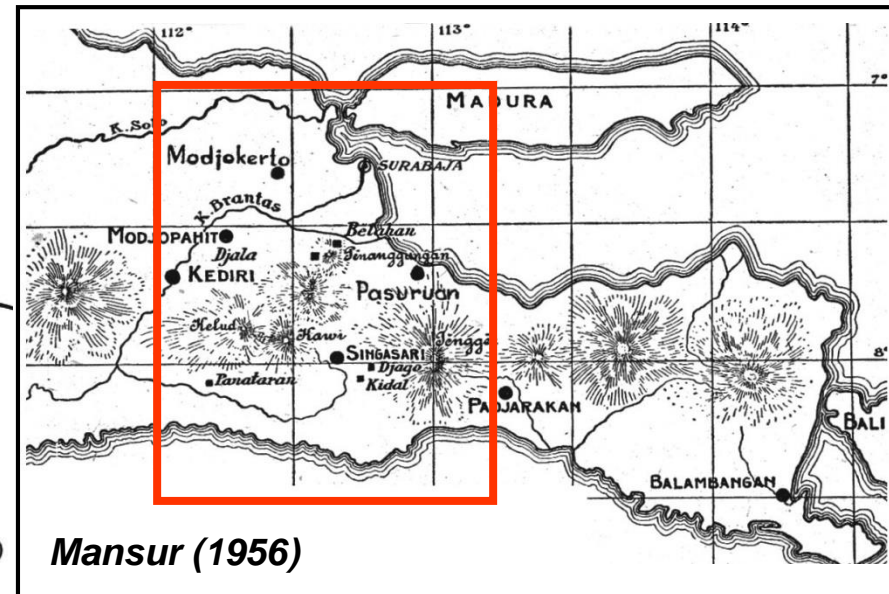
50 km



- **Medang** 929 - 1006 AD
- **Kahuripan** 1019 - 1042 AD
- **Jenggala** 1042 - 1116 AD
- **Majapahit** 1293 - 1518 AD

*Lombard (2005)*

- △ Gunung-gunung berapi yang terpenting
- I-IV Keraton-keraton menurut urutannya (tempat Janggala tidak pasti)
- 1-5 Rencana besar penyaluran air



*Mansur (1956)*

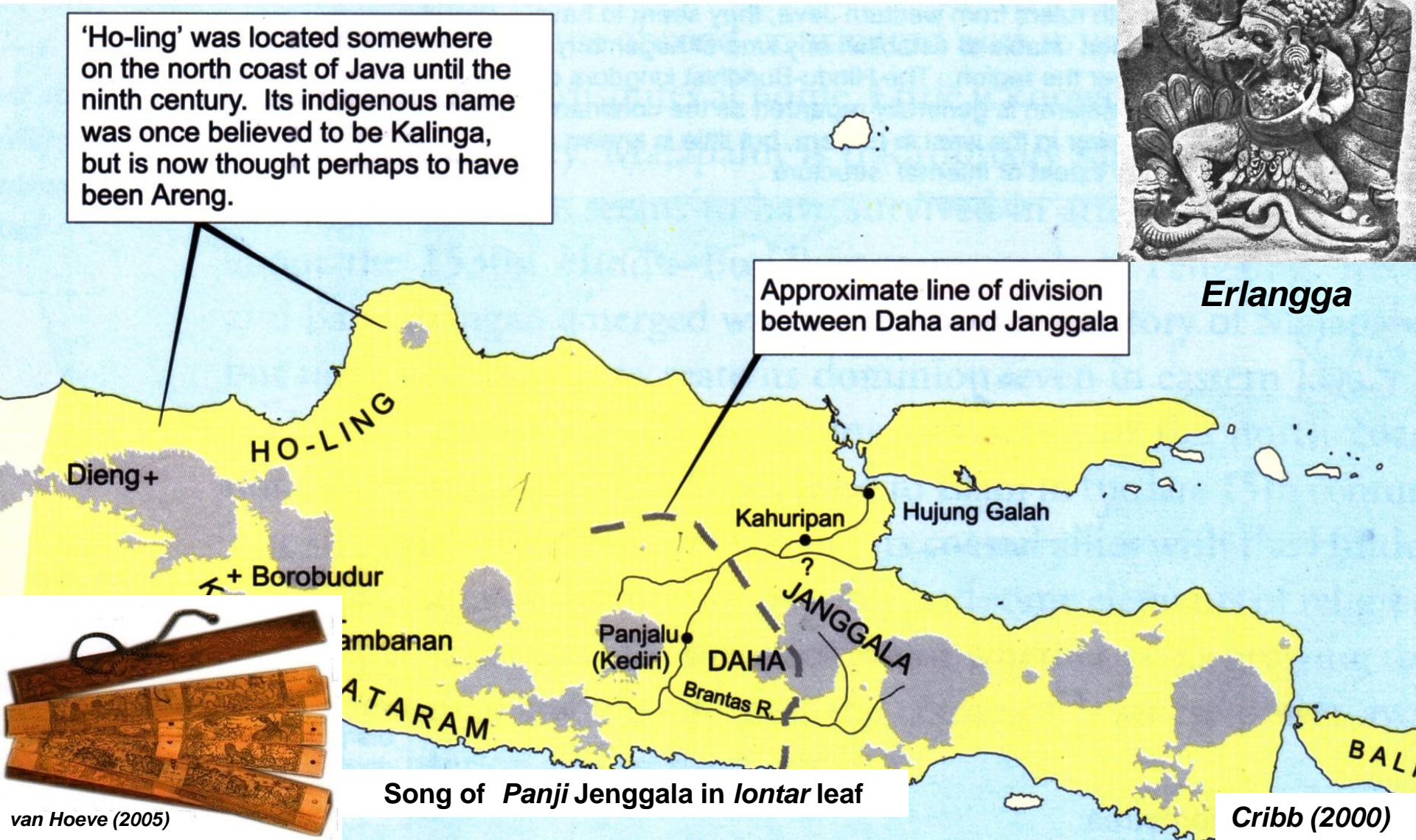


# Jenggala (1042 - ?1116 AD)

'Ho-ling' was located somewhere on the north coast of Java until the ninth century. Its indigenous name was once believed to be Kalinga, but is now thought perhaps to have been Areng.

Approximate line of division between Daha and Janggala

*Erlangga*



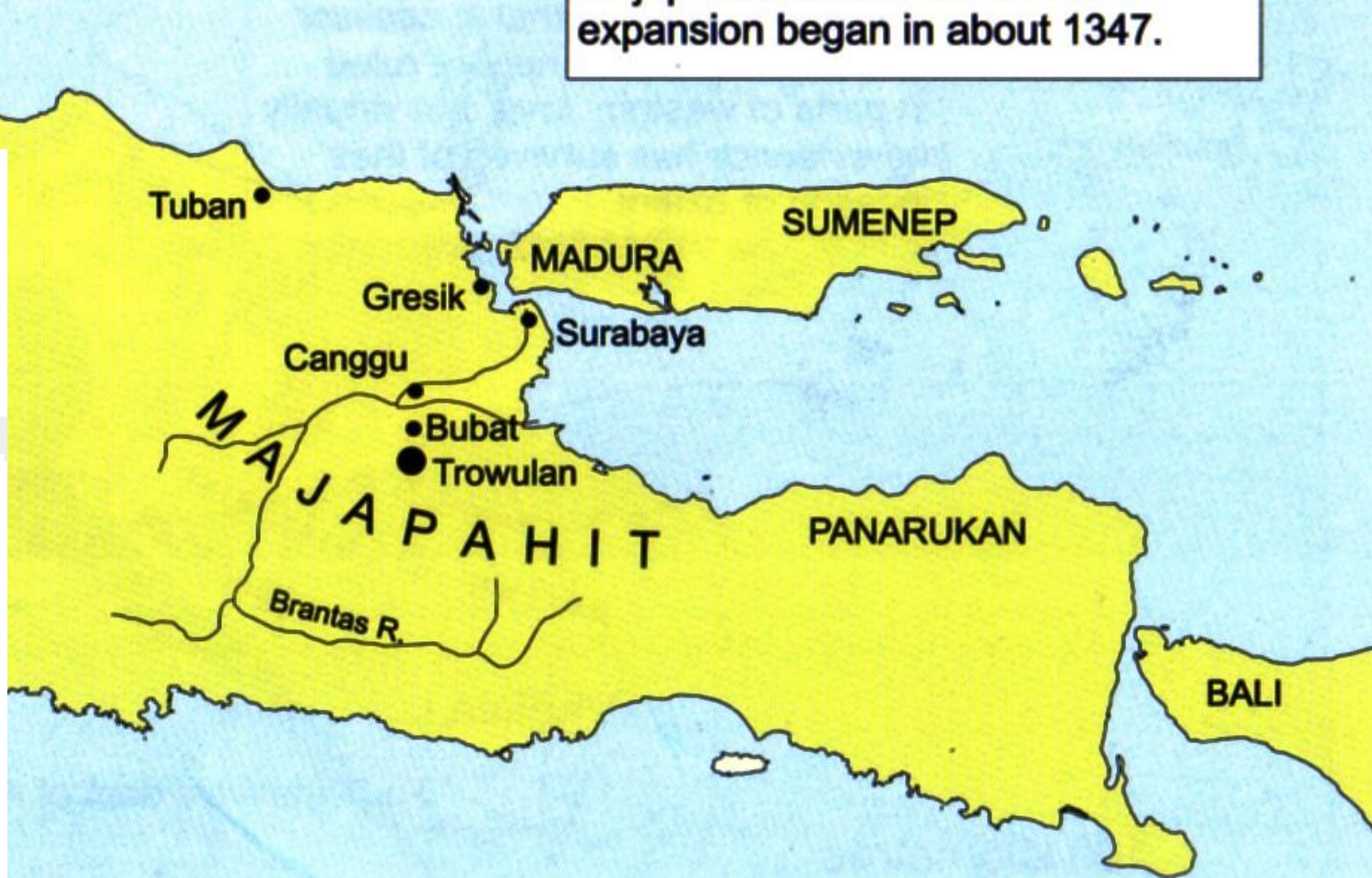
Song of *Panji Jenggala* in *lontar* leaf

*Cribb (2000)*



# Majapahit Empire (1293-1518 AD)

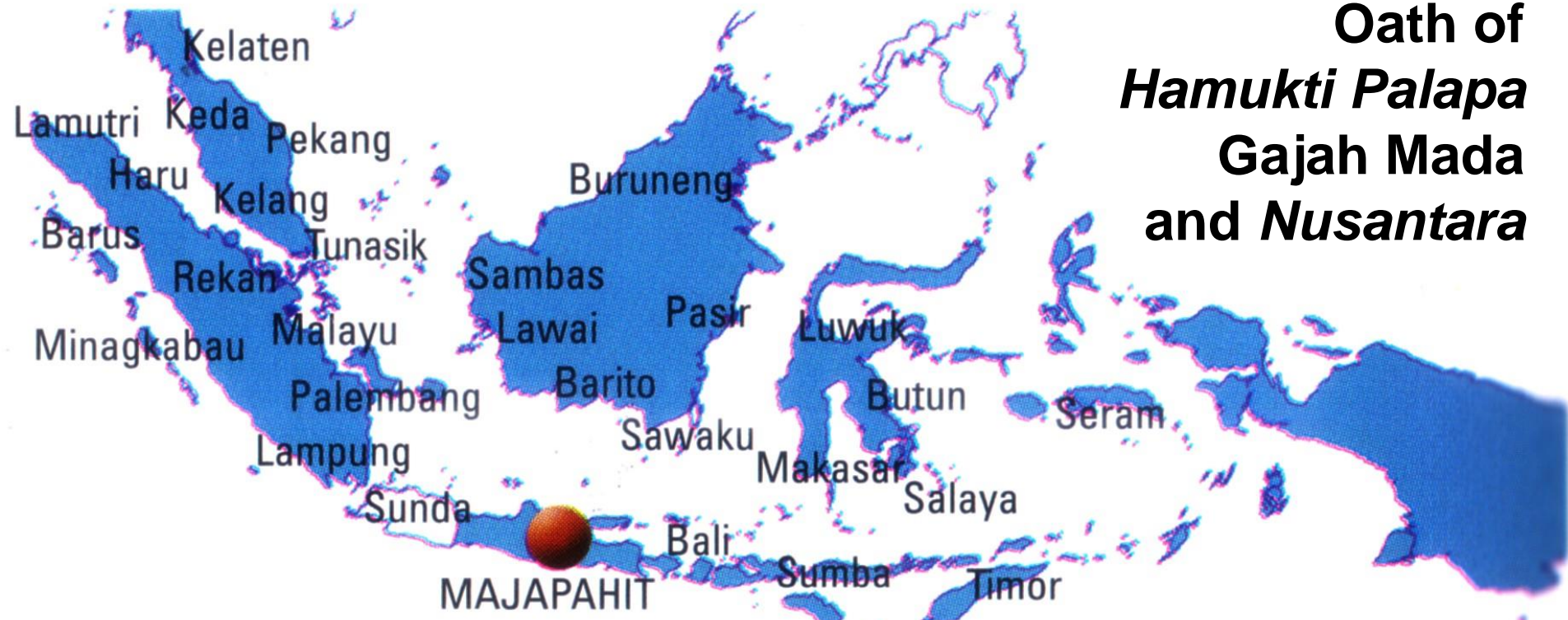
Although the Mongols were expelled in 1293, Majapahit could not claim control of all the former heartland of Singhasari until about 1331. Bali was not reconquered until 1343. Majapahit's further overseas expansion began in about 1347.



Raden Wijaya



# Oath of *Hamukti Palapa* Gajah Mada and *Nusantara*



*van Hove (2005)*

Sira Gajah Mada pepatih  
amungkubumi tan ayun amukita  
palapa, sira Gajah Mada :  
Lamun huwus kalah nusantara  
ingsun amukti palapa, lamun  
kalah ring Gurun, ring Seram,  
Tanjungpura, ring Haru, ring  
Pahang, Domp, ring Bali,  
Sunda, Palembang, Tumasik,  
samana ingsun amukti palapa

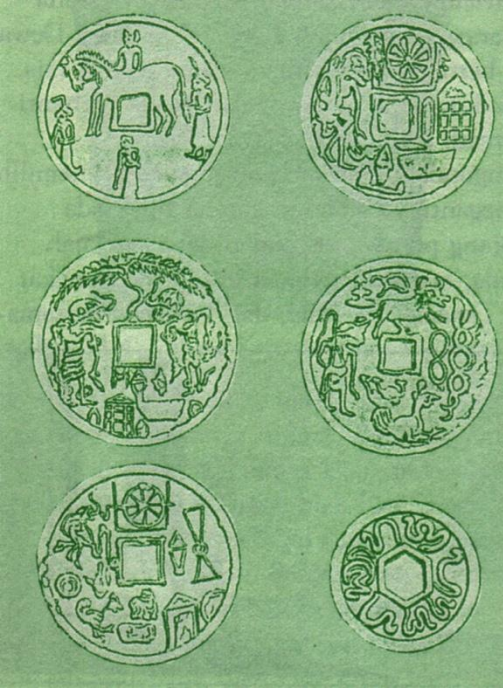


*sr. chief minister Gajah Mada*





# Majapahit Culture



*coin*



*Reliefs of Panataran Temple*



*Panataran Temple*



*Bajangratu Temple*



*Kendi Air*



*Tikus Temple*  
*van Hoes (2004, 2005)*



*Sandhyakala ning Majapahit...  
(Sunset / Fall at Majapahit...)*



*Political Conflict ? Geologic Disaster ?*



## **Fall of Jenggala: Several Possibilities**

- Attack from Kediri Kingdom
- Eruption of volcanoes Arjuno-Penanggungan
- Mud volcano eruption

## **Fall of Majapahit: Several Possibilities**

- Civil war
- Internal conflict
- Attack from Demak Kingdom/Sultanate
- Eruption of volcanoes Anjasmoro-Welirang
- Mud volcano eruption



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# Mud Eruption and Hot Water “Lumpur Sidoarjo” (LUSI) 29 May 2006 - ....?



*CRISP – National University of Malaysia (2007)*



*BPLS (2007)*



*before LUSI eruption (2005)*



© CRISP 2005



*LUSI is erupting (2006)*



© CRISP 2006









*LUSI is erupting (2010)*



© CRISP 2010



(2010)



(2010)



(2010)



(25 May 2011)



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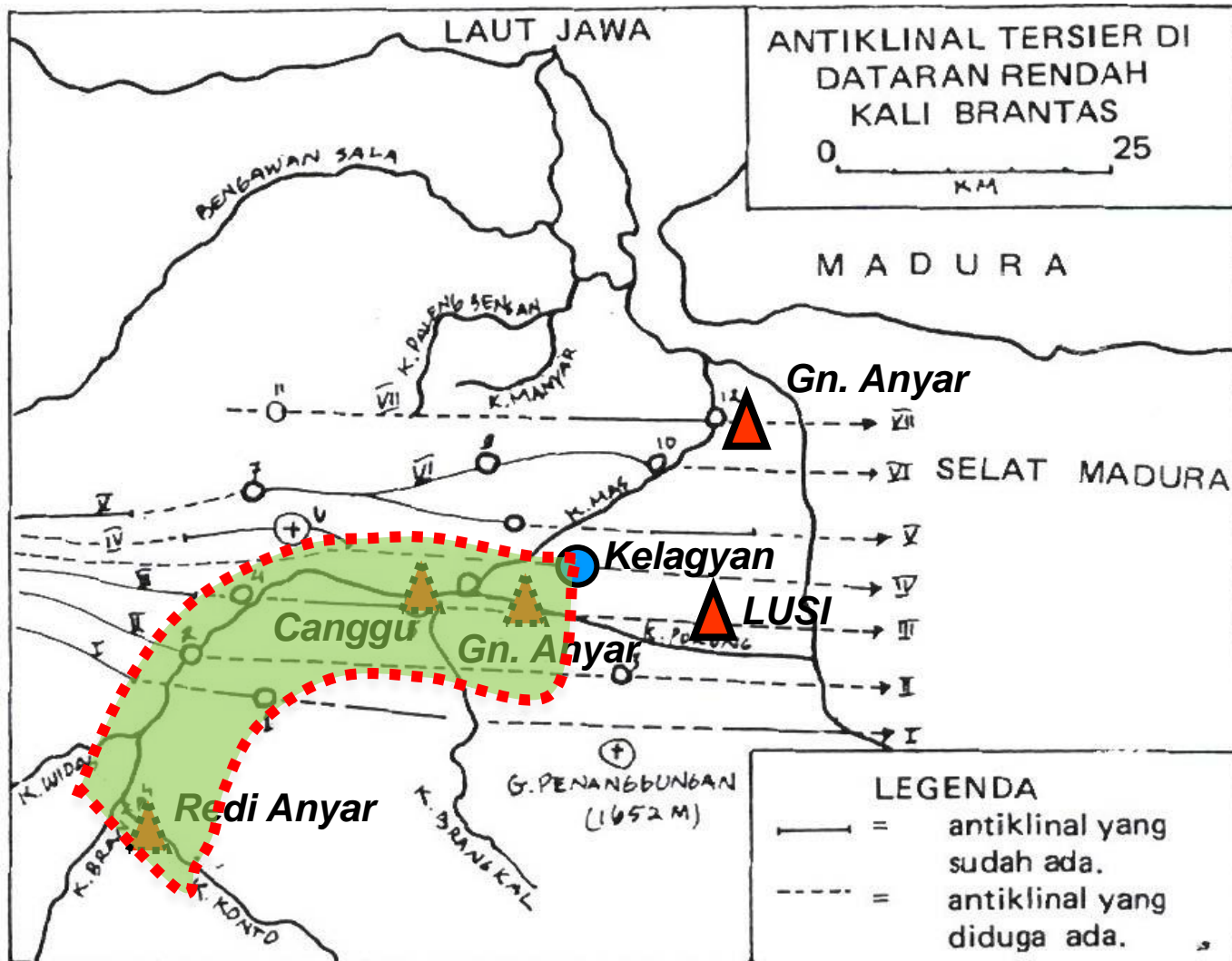
# Presumed Mud Volcanic Eruptions in Jenggala and Majapahit Periods

- *Thesis 1 : Historical Chronicle of “Kitab Pararaton” - disaster “banyu pindah” 1256 Çaka (1334 AD) and disaster “pagunung anyar” 1296 Çaka (1374 AD)*
- *Thesis 2 : Historical Chronicle of “Serat Kanda” and “Babad Tanah Jawi” – suryasengkala (chronowords) “sirna ilang krtaning bhumi” 1400 Çaka (1478 AD)*
- *Thesis 3 : historical chronicle “guntur pawatu gunung” 1403 Çaka (1481 AD)*
- *Thesis 4 : folklore “Timun Mas”*
- *Thesis 5 : geology of Kendeng Depression-Brantas Delta*



**Written 1522-1535 Çaka (completed in 1613 AD), in middle Javanese (Muljana, 1968)**

- **Disaster called “BANYU PINDAH” (1256 Çaka or 1334 AD)**
- **Disaster called ”PAGUNUNG ANYAR” (1296 Çaka or 1374 AD)**
- **Disasters called ”GUNUNG JEBLUG” (1223, 1307, 1317, 1343, 1373, 1384, 1403 Çaka or: 1301, 1385, 1395, 1421, 1451, 1462, 1481 AD)**
- **Disaster of earthquake (1372 Çaka or 1450 AD)**
- **Disaster of famine (1348 Çaka or 1426 AD)**



● *banyu pindah*  
 ▲ *pagunung anyar*

*Presumed mud volcano belt in Majapahit time*


Nash (1931)  
 Daldjoeni (1992)

## Pararaton Disasters and Hydrogeology of Brantas Delta

*Belt of Mud Volcanoes: Tunggorono-Jombatan-Segunung-Canggu-Bangsai (25 kms)*



# “Sirna Ilang Krtaning Bhumi”

- 
- de Graaf (1949) noted the fall of Majapahit in 1400 Çaka or 1478 AD in accordance with the chronicles of Java history. Year of 1400 Çaka was defined by *sengkalan* (chronowords) “Sirna Ilang Krtaning Bhumi” meaning “0041” in chronicles of Serat/Letter Kanda and Babad Tanah Jawi (written in early 18th century).
  - Sengkalan (chronowords) is a string of words or sentence where each word has numerical value, composed sequentially from front to back as units, tens, hundreds, thousands (Dinas Kebudayaan DI Yogyakarta, 2005).
  - Sengkalan (chronowords) was inherited by ancestors to make people of later generations would remember easily historical events occurred at the year of sengkalan tells. Accordingly, sengkalan (chronowords) has two meaning: number of year, and event happening at the year. Each word in sengkalan has both number value and proper meaning.

Oleh:  
Purwadi

# **“Sirna Ilang Krtaning Bhumi”**

- Sengkalan “Sirna Ilang Krtaning Bumi, derived from: “sirna” = hilang (vanish) = number 0, “ilang = hilang” number 0, “krtaning/krta ning” = dibuat (made) = pekerjaan membuat (act of doing) = number 4, “bumi/bhumi” = bumi (Earth) = number 1, sequentially sengkalan “Sirna Ilang Kertaning Bumi” has number values of 0041, read as year of 1400 Çaka or 1478 AD.
- Wojowasito (1980) noted “krta” /kerta was derived from Sanskrit, with various meanings: 1) has been done, completely done, over, good, safe, prosperous, service. 2) dice cube with four eyes; “ning” is linguistic genitive particle (belonging) attached into nomina/substantive (Kridalaksana, 2001)



# “Sirna Ilang Krtaning Bhumi”

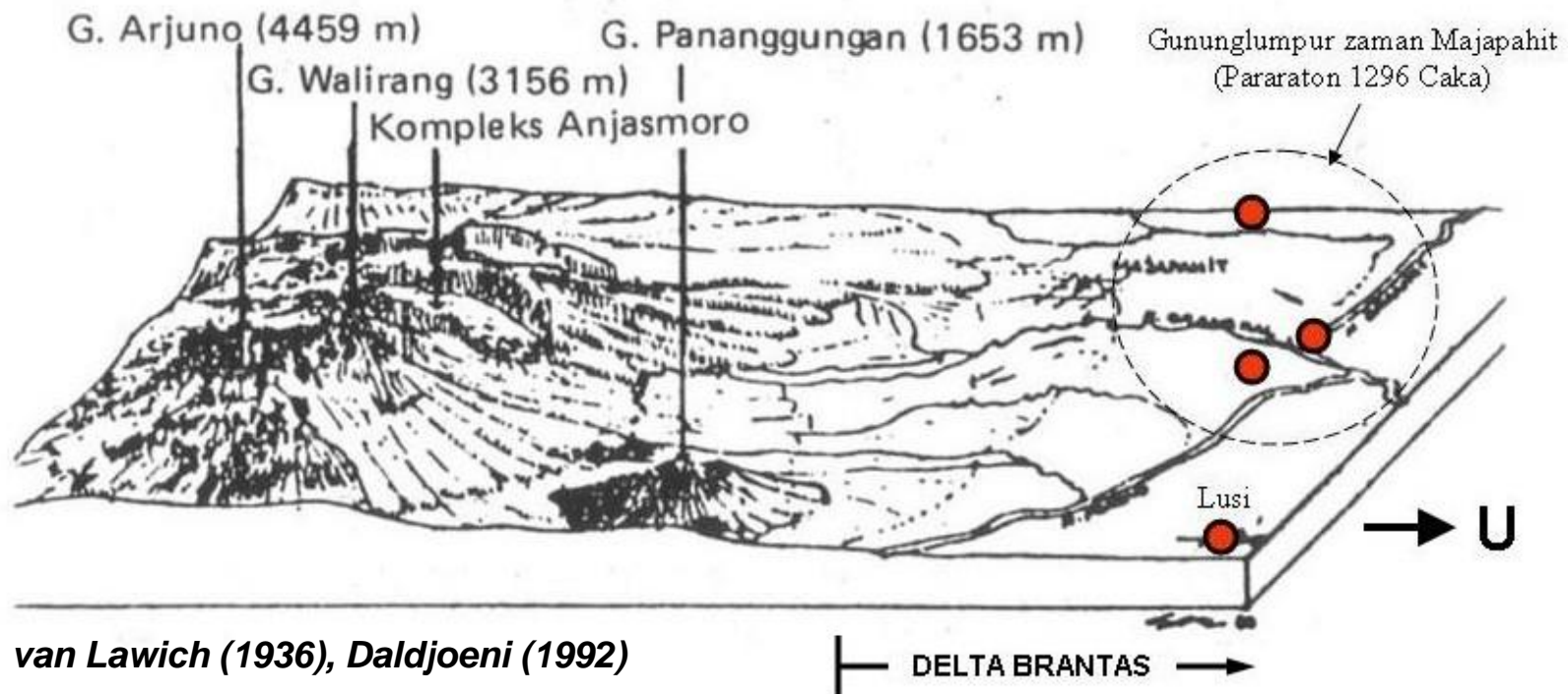
- “sirna ilang krtaning bhumi” can be interpreted as :  
(1) *“musnah hilang sudah selesai pekerjaan bumi”* (*vanish completely due to Earth’s work*) or (2) “musnah hilang kemakmuran bumi/di bumi” (the end of prosperity on Earth). Interpretation 1 has a meaning related to natural disaster. Interpretation 2 could have a meaning that the fall of Majapahit caused the end of prosperity, something related to political conflict or war.

# **“Guntur Pawatugunung”**

- **“Guntur Pawatugunung” was an event according to Ricklefs (1999) occurred in 1403 Çaka (1481 AD). The event was mostly interpreted as volcanic eruption (Berg, 1962; Purwanto, 1983; Daldjoeni, 1992; Ricklefs, 1999).**
- **C.C Berg further interpreted that Guntur Pawatugunung was a natural mark indicating the coming of new kingdom in Java to replace the Majapahit Empire (c.q.: Demak Kingdom/Sultanate).**
- **Year of “sirna ilang krtaning bhumi” (1400 Çaka) and “guntur pawatugunung” (1403 Çaka) was almost coeval – three years differ only – may be a mistake of noting, it could be two events related to each other in the same year.**



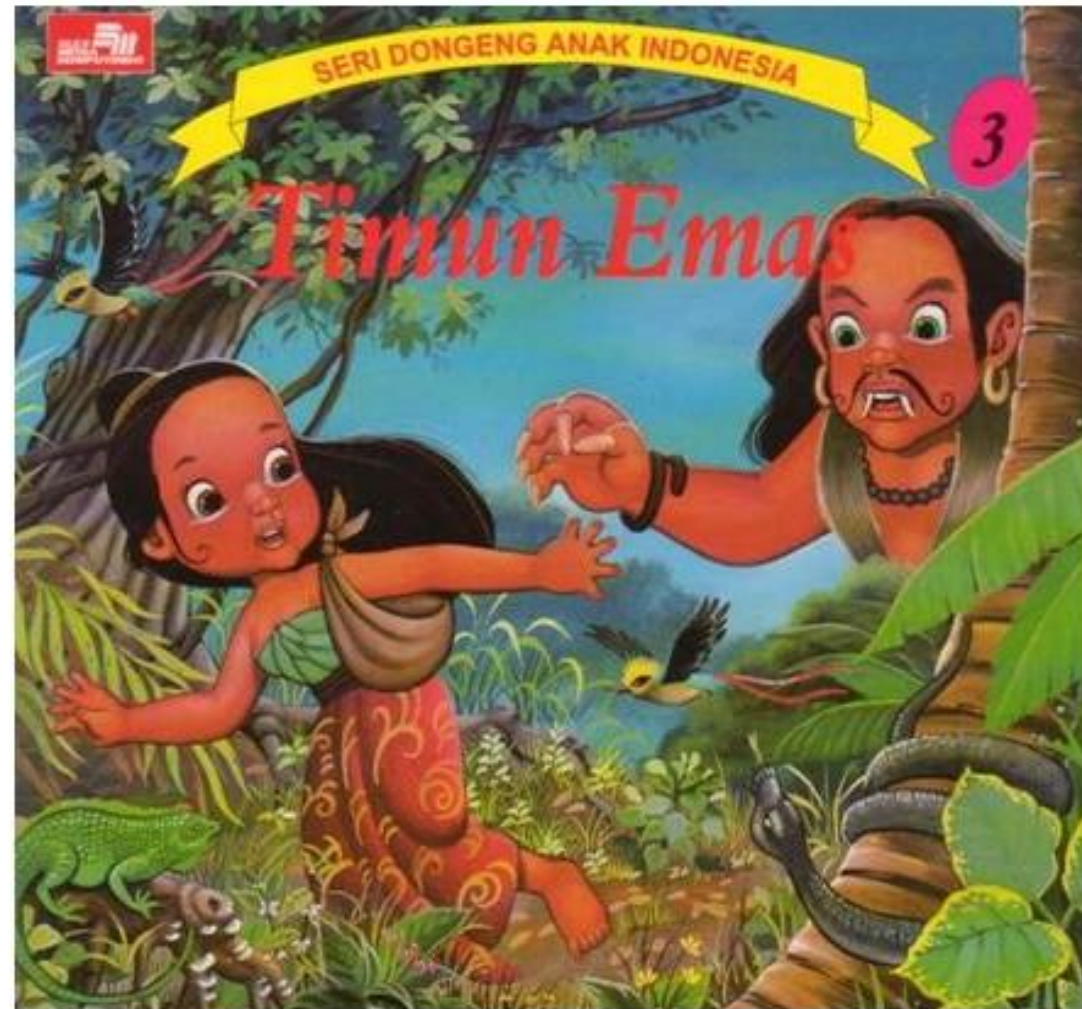
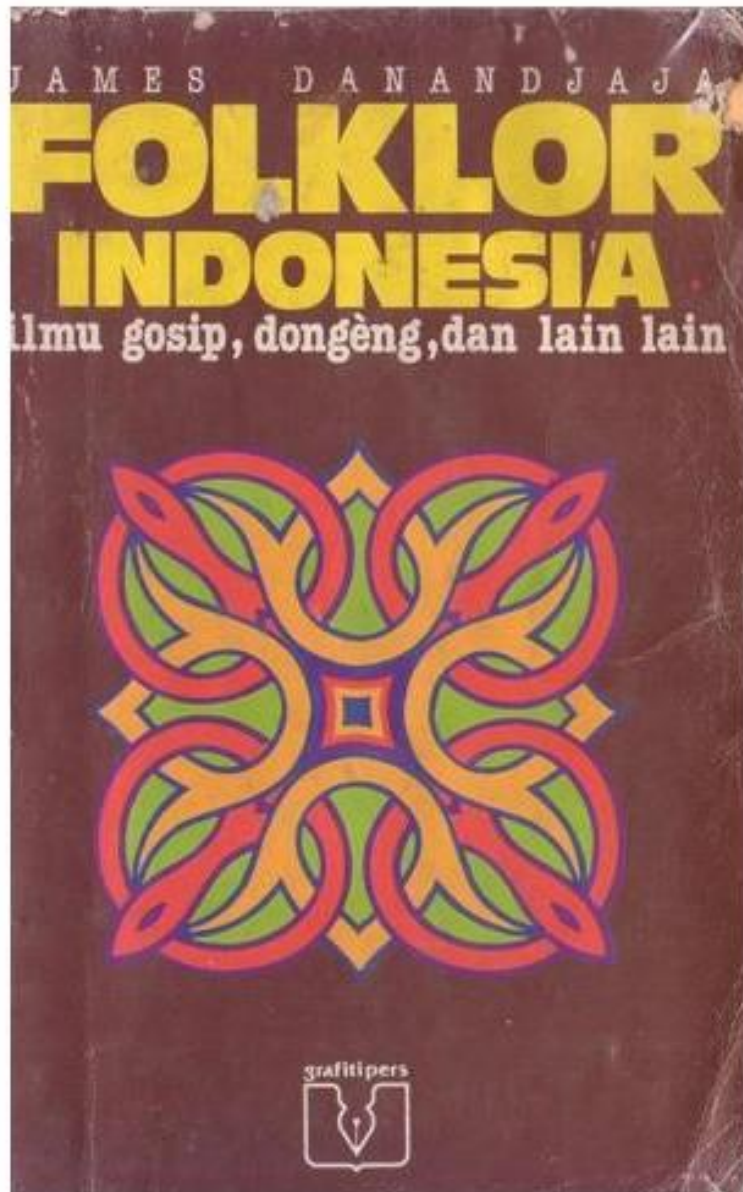
# “Guntur Pawatugunung”



***The event of 'guntur pawatugunung', instead of revealing magmatic volcanic eruption, it can be related to mud volcanic eruption. A mud volcano eruption may look like magmatic volcanic eruption. In area where there are magmatic volcanoes and mud volcanoes, both volcanic eruptions can be associated to each other.***

# Folklore “Timun Mas”

*Timun Mas means ‘golden cucumber’*



*Danandjaja (1984)*

*Ashari (1999)*



# **Folklore “Timun Mas”**

- **Folklore (people story) is a product of culture owned by a collective (group of people/ society) distributed and inherited traditionally from one generation to other generation (Danandjaja, 1984). Folklore brings something considered important to remember by people living at the time of the folklore's event occurred. Prose of people story can be subdivided into three groups: myth, legend and folktale. Folklore of East Java "Timun Mas" can be classified as a legend or folktale.**
- **Folklore "Timun Mas" is considered to develop by the time of the fall of Jenggala Kingdom (1116 AD). This is based on the people belief that "Timun Mas" was actually Dewi Sekar Taji, who later married to Panji Asmara Bangun, the son of Prabu Lembu Amiluhur, King of Jenggala.**

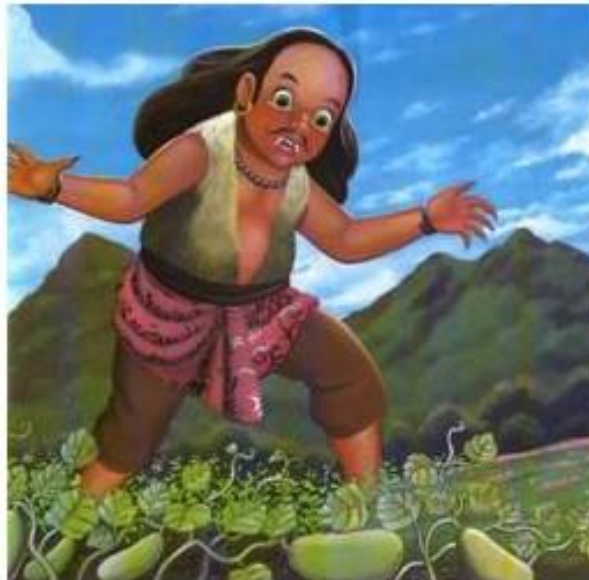
# Folklore “Timun Mas” *Thesis no. 4*



*Ashari (1999)*



*earthquake*



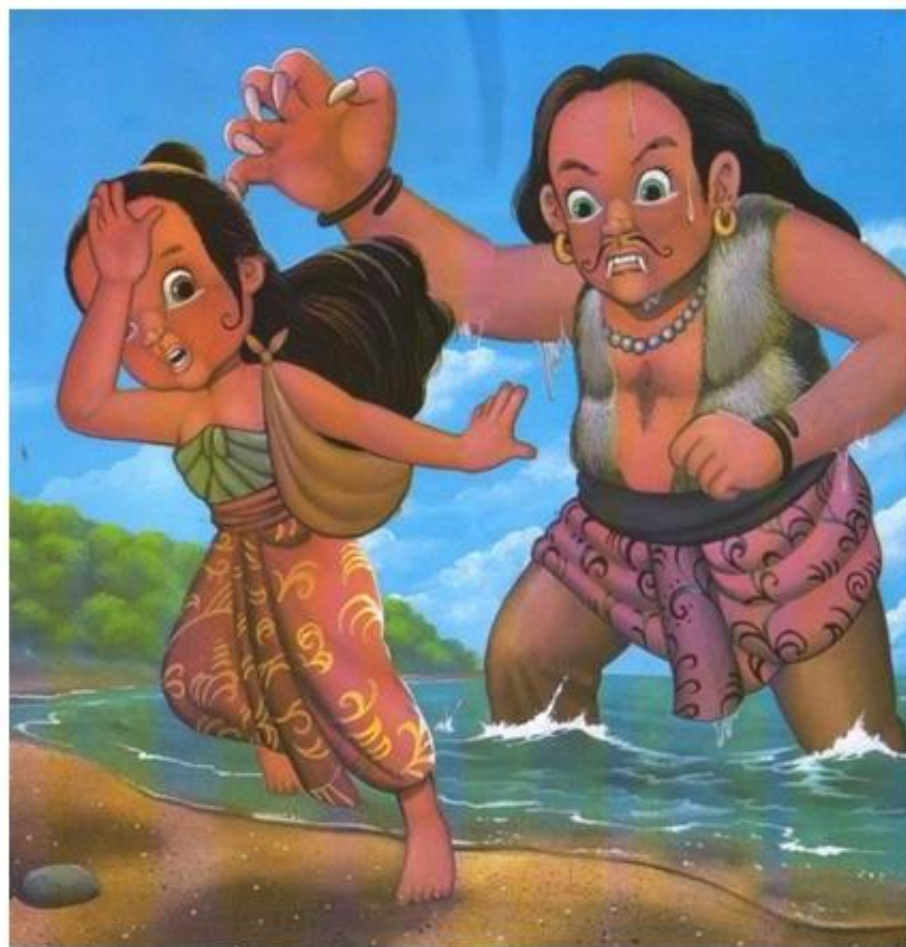
*cucumber field*



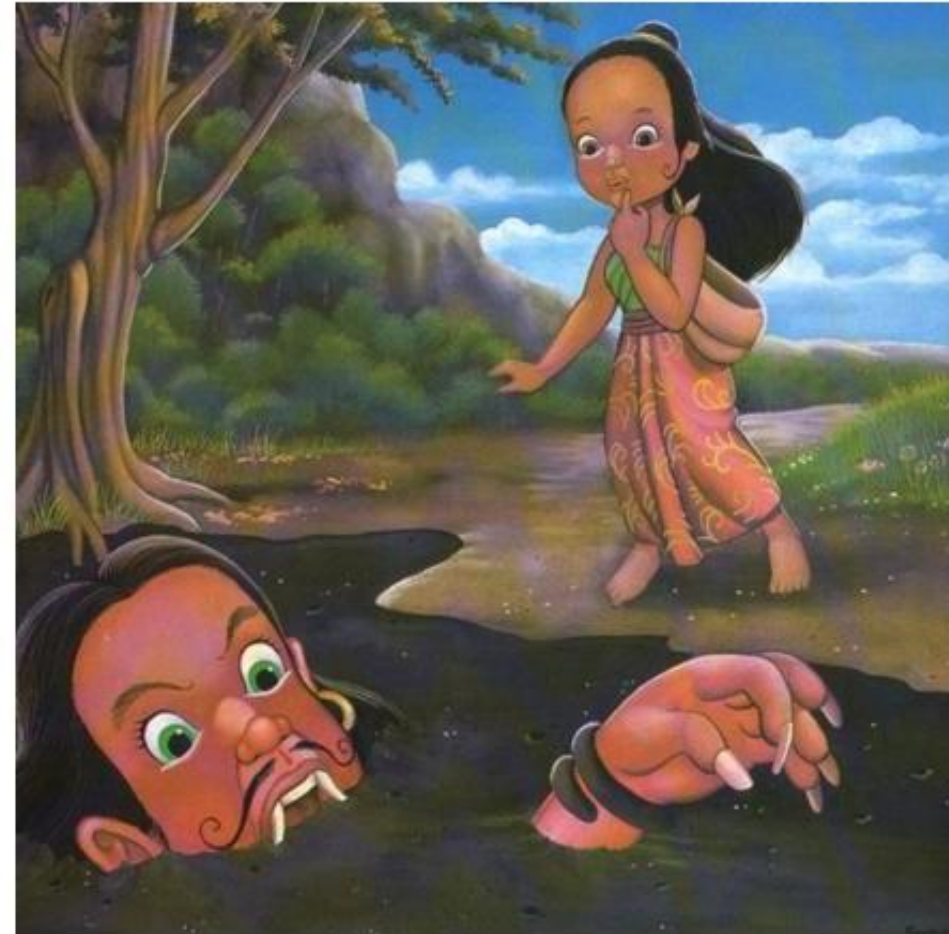
*bamboo forest*



# Folklore “Timun Mas”



*thrown salt to become sea lake*



*thrown ‘terasi’ to become hot mud sea*

*‘terasi’ – a condiment made from pounded and fermented shrimp or small fish*

*Ashari (1999)*

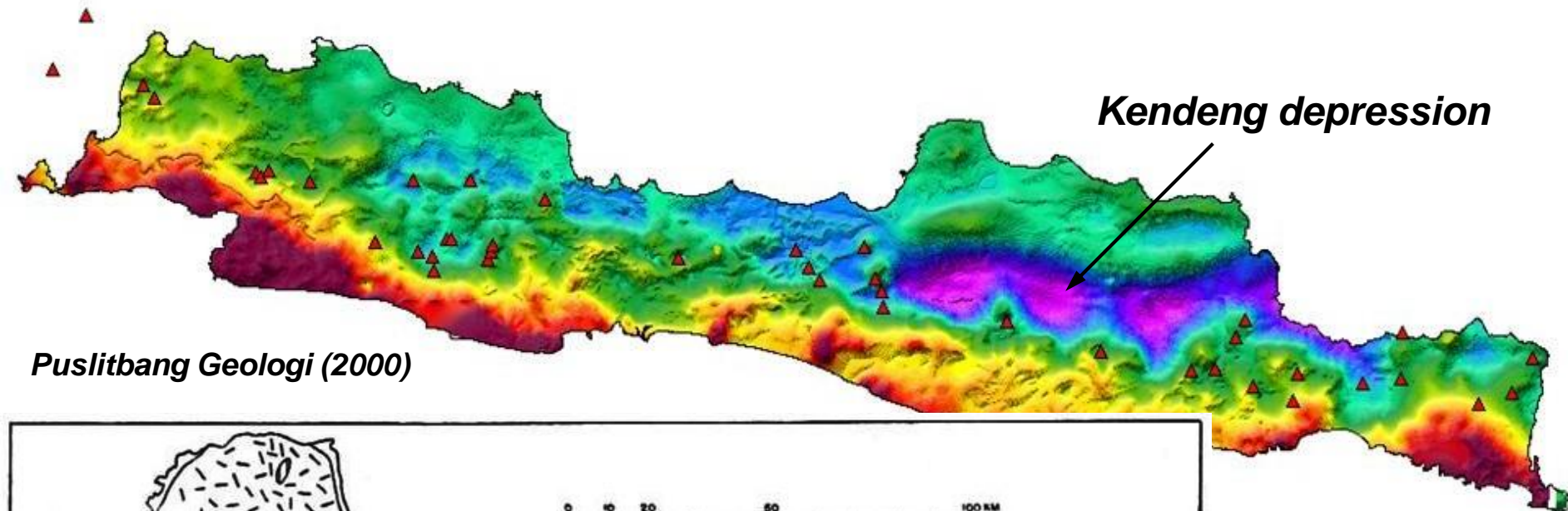
# Folklore “Timun Mas”

- The folklore Timun Mas developed in Jenggala's period (currently Sidoarjo Regency), bears similarity with elements related to present elements of LUSI, namely: earthquake, salted sea lake and hot mud sea. The folklore Timun Mas could tell something related to mud volcano eruption in the period of Jenggala Kingdom (each legend bears a meaning of "*dichtung und wahrheit*" – *fiction and fact*).
- River Porong was not a natural river. It was an artificial river (dig stream) branched from River Brantas made during the 11th or 12th century to reduce flood area of Surabaya and to irrigate paddy fields in Porong, Sidoarjo area (Pramudya Toer, 1999). River Porong was also meant to displace mud flooded Jenggala area from mud volcano eruption (perfectly similar with current condition of displacing LUSI mud to Kali Porong).

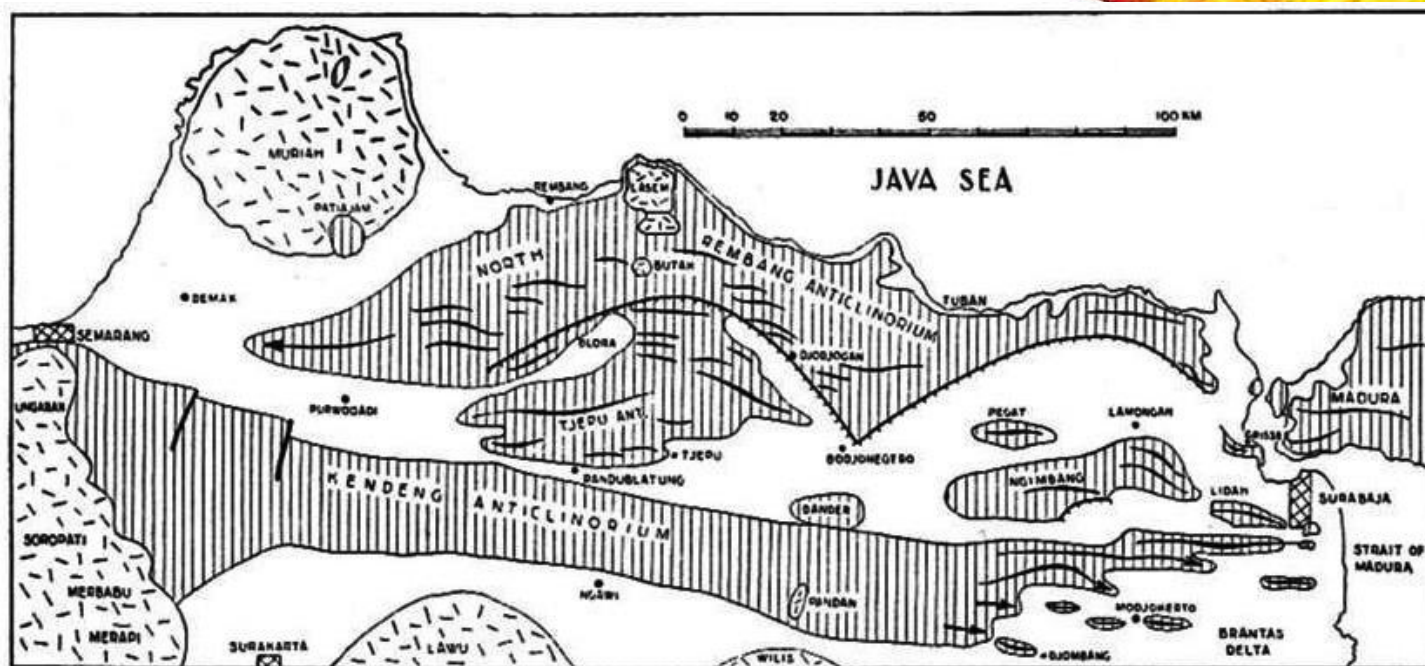


# Geology of Kendeng Depression–Brantas Delta

*the best elisional basin in Indonesia*

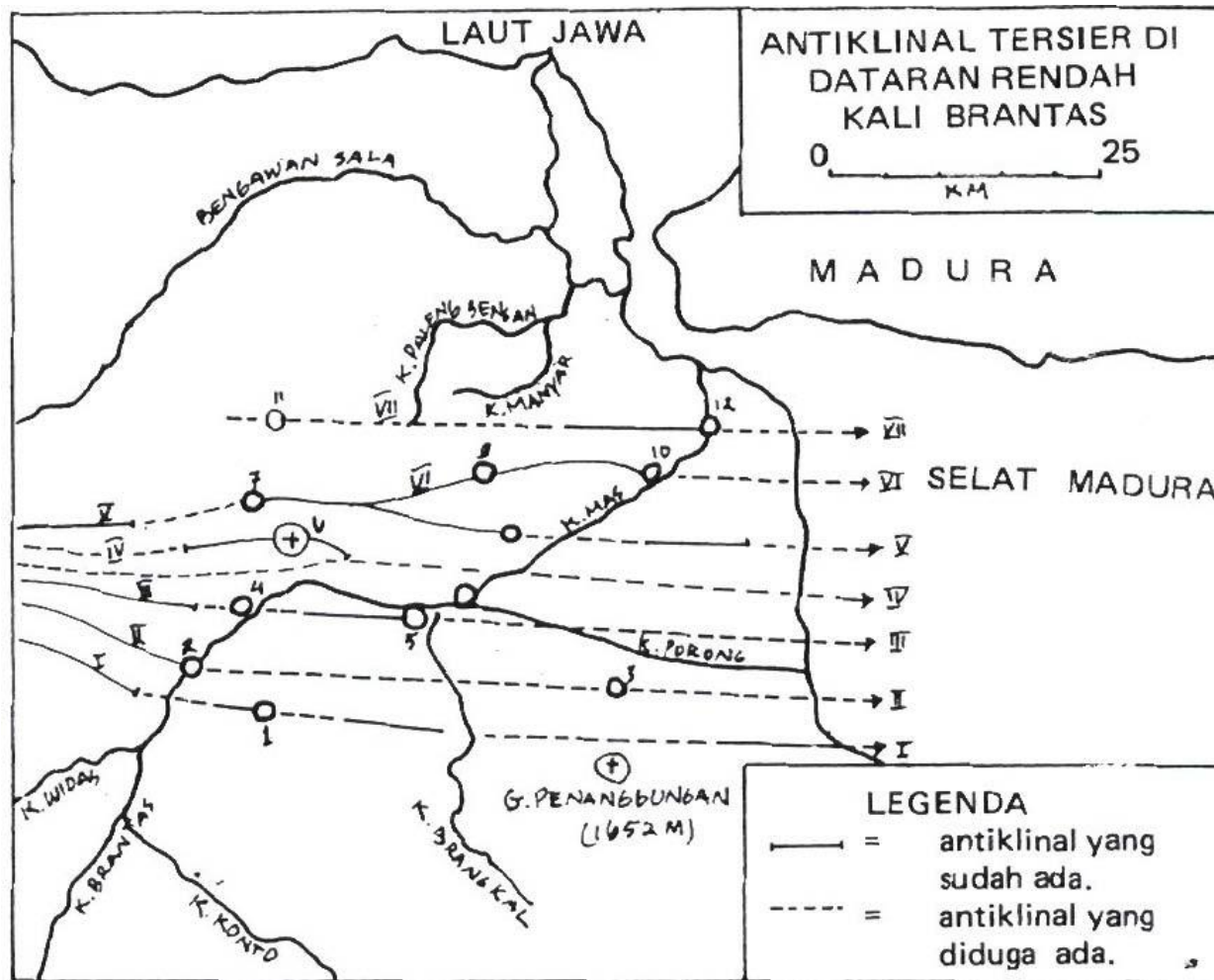


Puslitbang Geologi (2000)



van Bemmelen (1949)

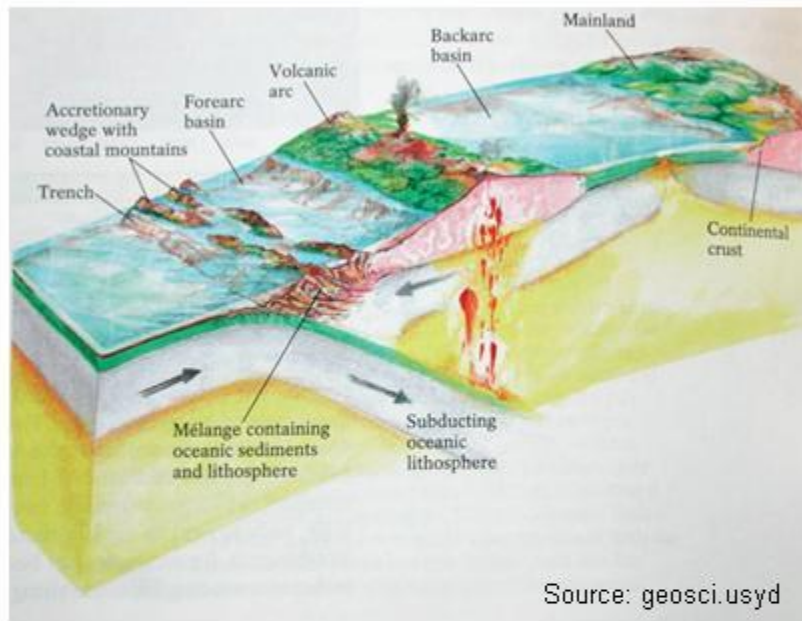
# Active Anticlinorium Belts of Brantas Delta



I. Jombang, II. Nunung Ngoro, III. Ngelom-Watudakon, IV. Pucangan, V. Kambangan-Kedungwaru, VI. Guyangan-Sepanjang, VII. Ngimbang-Wonokromo. 1. Jombang, 2. Munung, 3. Ngoro, 4. Ngelom, 5. Watudakon, 6. Gunung Pucangan, 7. Kambangan, 8. Kedungwaru, 9. Guyangan, 10. Sepanjang, 11. Ngimbang, 12. Wonokromo (Nash, 1931; Daldjoeni, 1992).



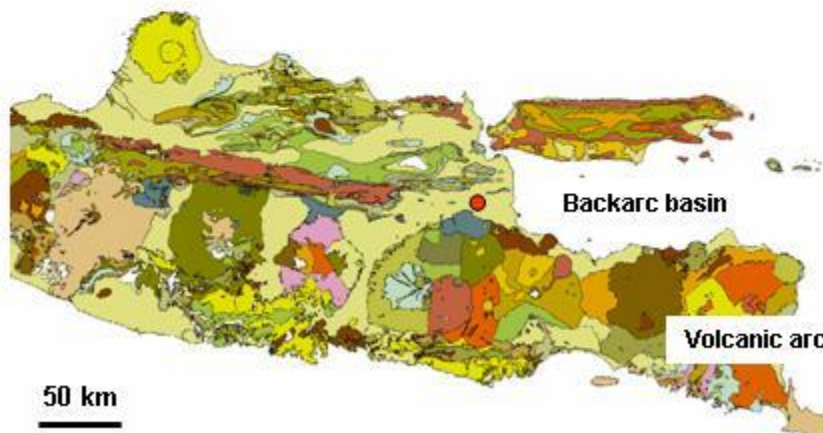
# East Java : Geological Setting



- Convergence of plate boundaries and the subduction of the oceanic plate
- Northern part of Java: backarc basin

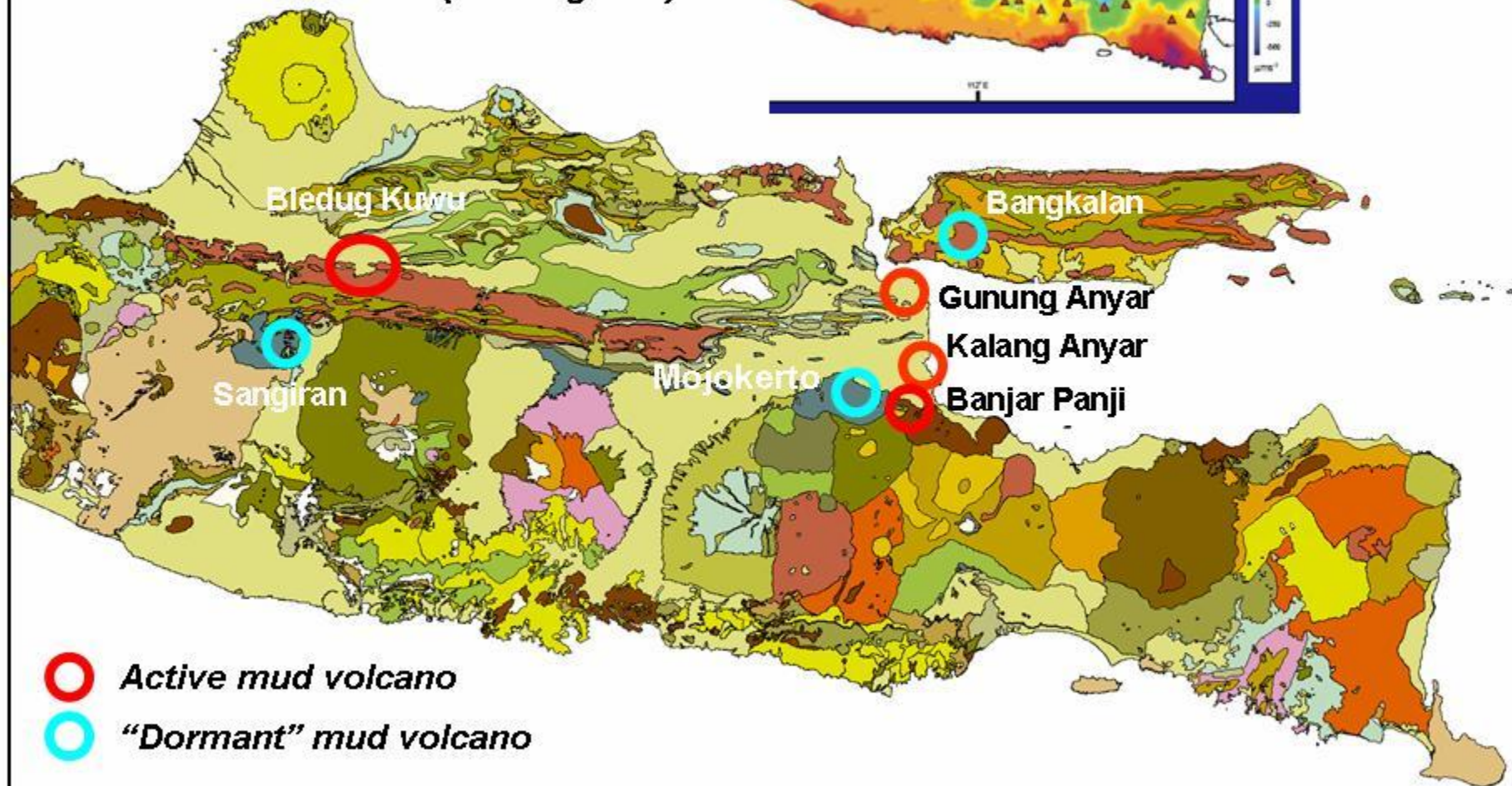
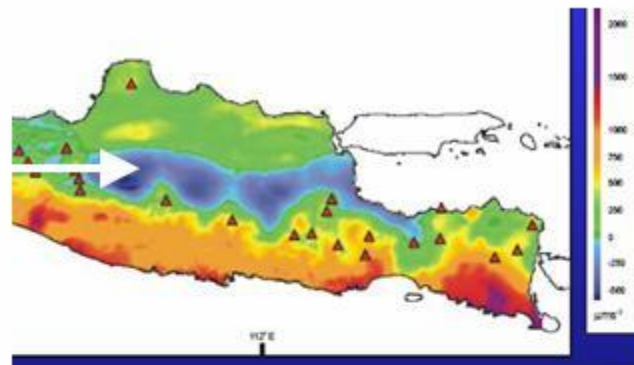
- extensional regime
- high sedimentation rate
- organic-rich sediments
- production of HC



•→ ***ideal setting for mud volcano***



***Mazzini et al. (2007)***

**Rapid Sedimentation Zone  
(Kendeng Zone)**

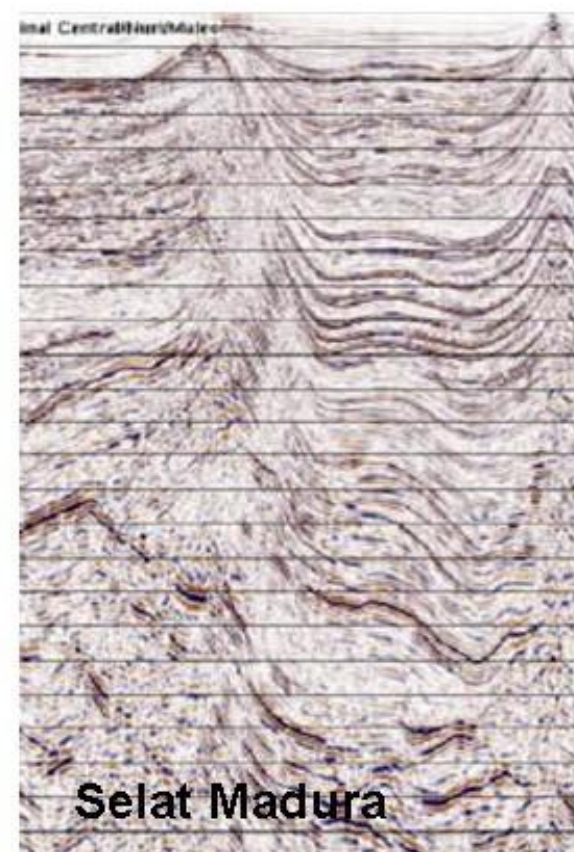


-  **Active mud volcano**
-  **"Dormant" mud volcano**

**Mud Volcanoes of Central - East Java**

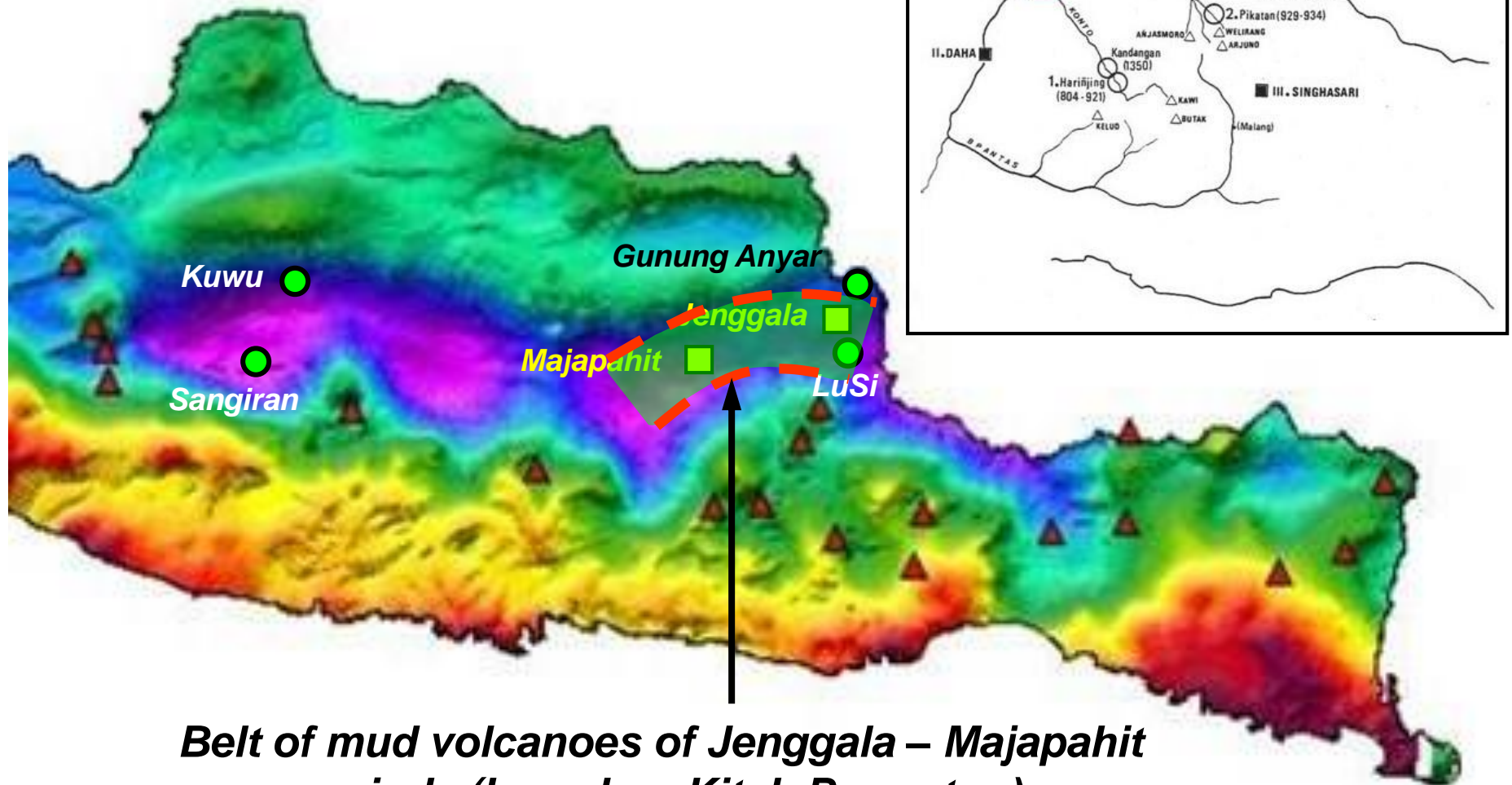


# Geology of Kendeng Depression – Brantas Delta



## Mud Volcanoes of Kendeng Depression

**Capital cities of Jenggala and Majapahit were located among mud volcanoes of Kendeng Depression**



***Belt of mud volcanoes of Jenggala – Majapahit periods (based on Kitab Pararaton)***



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# Conclusions

- Brantas Delta had significant historical roles in rise and fall of kingdoms/empire in East Java in around 950 AD – 1500 AD. Four kingdoms/empire: Medang, Kahuripan, Jenggala and Majapahit were located in Brantas Delta area.
- According to history, the fall of Jenggala in 1116 AD was caused by annexation from Kediri kingdom. The fall of Majapahit in 1478 AD was due to internal conflict and an attack by Demak Kingdom. However, based on some historical chronicles, folklore, and geologic conditions of the areas; it is interpreted that natural disaster such as mud volcanic eruption played significant effects to weaken Jenggala and Majapahit before annexation by other kingdoms.



# Conclusions (cont'd)

- Based on historical sources (Kitab Pararaton, Serat Kanda, Babad Tanah Jawi), folklore, geology of Kendeng Depression and Brantas Delta, and analogy to LUSI event occurring in the area where Jenggala Kingdom and Majapahit Empire located, it is presumed that mud volcanic eruptions had occurred in the Jenggala and Majapahit periods. These disasters are considered to have significant effect to subdue Jenggala and Majapahit.

# Conclusions (cont'd)

- Presumed mud volcano eruptions during the Jenggala and Majapahit periods are constrained by:
  1. Natural disasters in Kitab Pararaton : banyu pindah (1256 Çaka / 1334 AD) and pagunung anyar (1296 Çaka / 1374 AD) and other related disaster including earthquake, volcanic eruption and famine,
  2. Suryasengkala (chronowords) "sirna ilang krtaning bhumi" (1400 Çaka / 1478 AD),
  3. Chronicle "guntur pawatugunung" (1403 Çaka / 1481 AD),
  4. Folklore Jenggala "Timun Mas", and
  5. Geology of the Kendeng Depression –Brantas Delta.

***Analogy to disaster of LUSI (the present is the key to the past)***



# *Thank you for your attention*

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