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OESCHGER CENTRE CLIMATE CHANGE RESEARCH



FNSNF

Fonds national suisse Schweizerischer Nationalfonds Fondo nazionale svizzero Swiss National Science Foundation







**The Towuti Drilling Project** Part 1- Site survey: Seismics, Piston Coring, Sediments, Interpretations

#### Hendrik Vogel $\underline{u}^{\scriptscriptstyle b}$

OWUTI

DRILLING

PROJECT

Geologica

Quaternary Geology and P



### Project Structure PI Team

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- > James M Russell, U Brown, USA, lead (Geochem., Paleoclim.)
- > Hendrik Vogel, U Bern, Switzerland (Sedimentology, Paleoclim.)
- > Satria Bijaksana, IT Bandung, Indonesia (Magnetics)
- > David A. Fowle, U Kansas, USA (Geomicrobiology)
- > **Thomas von Rintelen**, M. f. Naturk. Berlin, Germany (Evol. Biol.)
- > Gordon Douglas Haffner, U Windsor, Canada (Limnology)
- > Janelle Stevenson, ANU, Australia (Terr. Botany)
- > Ian Watkinson, Royal Holloway, UK (Struct. Geology)
- > Martin Melles, U Köln, Germany (Sedimentology)
- > Ristiyanti Marwoto, LIPI, Indonesia (Evol. Biology)
- > John William King, U Rhode Island, USA (Paleomagnetics)
- > Sean Crowe, UBC, Canada (Geomicrobiology)
- > Nigel Wattrus, LLO Minnesota, USA (Seismics)





### **Project Structure** Science Team (> 40 scientists)



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### **Rationale** (Hydro-)Climate History

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Peixoto & Oort, 1992, Physics of Climate



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## Precipitable Water in the Earth's Atmosphere (kg/m<sup>2</sup>)



## **Rationale** (Hydro-)Climate History

**1.** Latitudinal migration of the tropical rain belt (ITCZ) forced by precession (21 kyr), high-latitude temperature changes

Precipitation Rate, mm/day NCEP Reanalysis Electronic Atlas



2. Rainfall is positively correlated to regional SSTs. Variations due to ENSO, Indonesian throughflow, greenhouse gases...

## **3.** Reduced sea level during glacials exposes the Sunda Shelf





## **Rationale** Evolution/Endemism

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T. prognatha

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### **Rationale** Evolution/Endemism

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ICDP Training Course, Sept 15, 2015, Ohrid, Macedonia

Rintelen et al. 2010



## **Battiongale** Geomicrobiology, Structural Geology



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- Central Indonesia (2.7° S, 121.5° E)

- Downstream end of Malili Lake System, extensional basins along Matano-Palu Fault

- 561 km<sup>2</sup>, 200 m deep
- Hosted in ophiolite
- 150  $\mu$ S/cm, pH ~ 8.2, anoxic, ferruginous, oligotrophic

- Annual rainfall ~3100 mm/yr, austral summer maximum





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## **Site Survey** Seismic Survey 2007-2013



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# Seismic Survey 2007-2013



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## Site Survey Piston Coring 2010

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## **Site Survey** Piston cores/sediments

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## **Site Survey** Piston cores/Sediments/Chronology

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## **Site Survey** Sediments- Piston core TOW9

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## **Site Survey** 60 kyr Hydroclimate- leaf wax isotopes, Ti

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## **Site Survey** 60 kyr Hydroclimate – Towuti Record

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## **Site Survey** 60 kyr Hydroclimate – Towuti Record



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## **Site Survey** 60 kyr Hydroclimate – Lake Mixis

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## **Site Survey** 60 kyr Hydroclimate – MIS 2 low stand

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Vogel et al. (in press)



**The Towuti Drilling Project** 

Part 2: Deep Drilling Operations

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#### Hendrik Vogel u<sup>b</sup>



Quaternary Geology and Paleoclimatology



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St ht 🛛	St hh	St hS2	St hf 🛛	St h12	St hL 🛛
?????? <mark>?????</mark> ?????????????????????????			<mark> </mark>	<u> </u>	
↑ Site Surve Piston Cori Airgun Seisn	2 <b>y</b> ng nics -2°40' -2°45' -2°50' -2°55' 121	S 20' E 121°30' E -Line185- 3000 4000 5000 6000 700 8000	N 100 100 100 100 100 100 100 10		
	West 0.1 0.1 0.1 0.2 0.4 0.4 0.4 0.4	Site 1 220 m core	East Site 2 130 m core		



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& Geomicrobiology **Structural Geology** 







Figure 2. Examples of the endemic snails, shrimp, and fishes of the Malili Lakes. From Rintelen et al. (in press).





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#### $\rightarrow$ 2.25 M USD needed





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## **Road to Deep Drilling** Housing for >30 people



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Hotel Mulia

- Barge Crews (7 Drillers, 6 Scientists, 2 Loggers)
- Visitors, Coordinators
- -> need dinner (7AM/PM) & breakfast (4AM/PM)
- -> daily laundry service, drivers...

Research Houses

- Lab Personell (4 Core Processing, 8-10 BugLab)
- visitors





## Road to Deep Drilling Lab Space



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#### Smear-slides, Sieving



#### Whole-core MSCL





## Road to Deep Drilling Lab Space



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#### **Bug Lab**





### Road to Deep Drilling Boats

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#### Tow



#### **Crew Transfer**



#### Supply



#### Emergency





### Road to Deep Drilling Crane, Fork Lift, Dock



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#### 250t Crane



#### **Telescopic Forklift & Dock**





### Road to Deep Drilling Participants Guide, Safety Docs



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### Road to Deep Drilling Personnel Schedule

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#### 'Planned' Personnel Schedule

Personnel Arrival/Departure Schedule				
Date	Location	Event		
02-May	Sorowako	Tia Arrives		
03-May	Makassar	Jim Arrives		
04-May	Makassar	Jim, permit		
05-May	Sorowako	Jim Arrives		
05-May	Jakarta	Hendrik, Ryan, Ascelina, Sarah, Chris, Marina, Io arrive		
06-May	Jakarta	Hendrik, Ryan, Ascelina, Sarah, Chris, Marina Jakarta permits		
06-May	Makassar	Gerald Arrives		
06-May	Makassar	Hendrik, Ryan, Ascelina, Sarah, Chris, Marina, Io arrive late		
7-8 May	Makassar	Hendrik, Ryan, Ascelina, Sarah, Chris, Marina KITAS		
09-May	Sorowako	Hendrik, Ryan, Ascelina, Sarah, Chris, Marina arrive late		
10-May	Jakarta	DES team arrives		
11-May	Jakarta	DES team permits		
11-May	Makassar	DES team and Io arrive late		
12-13 May	Makassar	DES team KITAS		
14-May	Sorowako	DES team, Gerald, and Io Arrive (backup arrival 15 May)		
15-May	Sorowako	Imran Arrives		
19-May	Sorowako	Tika and Sylvie arrive		
18-May	Jakarta	LIAG group arrives		
19-May	Jakarta	LIAG group permits		
19-May	Makassar	LIAG group arrives late		
20-21 May	Makassar	LIAG group KITAS		
23-May	Sorowako	LIAG group and Hafidz arrives		
29-May	Sorowako	Udin Arrives		
31-May	Sorowako	Imran Departs		
06-Jun	Sorowako	Udin, Hafidz depart		
09-Jun	Sorowako	Risti Arrives		
18-Jun	Sorowako	Risti and LIAG group departs		
28-Jun	Sorowako	Most depart		
30-Jun	Sorowako	Final team (DES manager, Ryan) depart		
02-Jul	Sorowako	Jim, Tia depart		



## **Deep Drilling Operations** Additional Sampling



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### Surface Sediment sampling locations (2-3 km spacing)







## **Deep Drilling Operations** Planned Drilling Schedule

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#### Project & Personnel Schedule





## **Deep Drilling Operations** Setting an Anchor



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## **For Videos Check:**

https://www.facebook.com/towutidrilling

SwissDrillingDay, September 9th 2015, Bern



## **Deep Drilling Operations** Drilling/Coring



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## **Deep Drilling Operations** Planned Drilling Schedule

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#### Project & Personnel Schedule





## **Deep Drilling Operations**

Planned Drilling Schedule- Reality Check

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### **Deep Drilling Operations Drilled Sites**



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## **Deep Drilling Sites** Drilled Sites- Core Recovery

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## Outlook

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