



BSP Exit Report Presentation

Growth, collapse, and re-growth: a story of volcanoes and Earth science teaching



Scan me!

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Earth Science
hosted by: Caraga State University
April-October 2020

OUTLINE

① ABOUT ME

- Bio
- Research
- Modes of Teaching & Understanding DEI
- During Covid-19/during BSP

② EARTH SCIENCE IN BLENDED MODE

- During Covid-19 at CSU

③ EVOLUTION AND COLLAPSE OF VOLCANOES

- Philippine Volcanoes
- Factors that cause volcanoes to collapse
- Transport regimes and emplacement of volcanic avalanches

④ EQUALLY SIGNIFICANT CONTRIBUTIONS

- Delivered Online Webinars
- Proposals
- People Trained

BSc. Statistics
University of
the Philippines
2000-2004

Ph.D. Earth Science
Université
Blaise Pascal
2010-2012
**dynamics and
mechanism of
volcanic debris
avalanches**

Postdoctoral
Researcher
Vrije Univer-
siteit Brussel
2015-2017
**(1)morphometry of
Philippine volcanoes**
(2)climate-
tectonics-volcanism

Balik Scientist,
Associate Professor
Caraga State
University
2020-2021

MSc. Geology
University of
the Philippines
2005-2009

2006 lahars at Mayon

Postdoctoral Associate
University at Buffalo
2013-2015

**(1)volcano-tectonics
of Hat Creek
Graben, California**
(2) Canyonlands
NP in Utah as
a big landslide

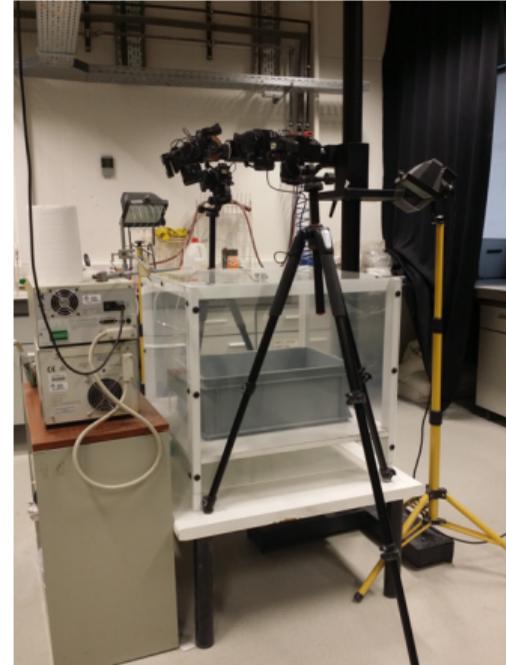
Lecturer
University of the
South Pacific
2018-2019



INVESTIGATING THE EARTH'S INTERIOR



VOLCANISM–TECTONICS–CLIMATE INTERACTION



DIVERSITY



WORK FROM HOME: ADVANTAGES AND CHALLENGES



Traditional dress from Vanuatu

Advantages

- Writing papers
- Curriculum review
- Instructional materials
- Online meetings and seminars
- Delivered and attended international webinars and conferences
- Undergraduate thesis advising

Challenges

- COVID: my deliverables now has to be covid proof and deliverable online, but unlike where I was previously, the education system was not ready for online-only learning
- Less interactions with colleagues
- Anxiety and depression from isolation and uncertainty

SOME GEOLOGY CORE COURSES

- Moodle platform
- Synchronous classes
- Online quizzes for the concepts
- The application of geology
- Chapter exercises & thought questions
- Cooperative exercises
- Google Earth exploration of key geologic locations
- Online petrologic microscope
- Online 3D rock and mineral samples

GEOLOGY FIELD COURSES

- Field Handbook
- Creation of field trip protocols (SOP, safety policy, hazard identification and risk assessment, other field and staff health and safety forms)
- General information including logistics, travel safety and security, safety preparations, emergency preparedness, and the basic field skills
- Local face-to-face field experience
- International virtual field experience

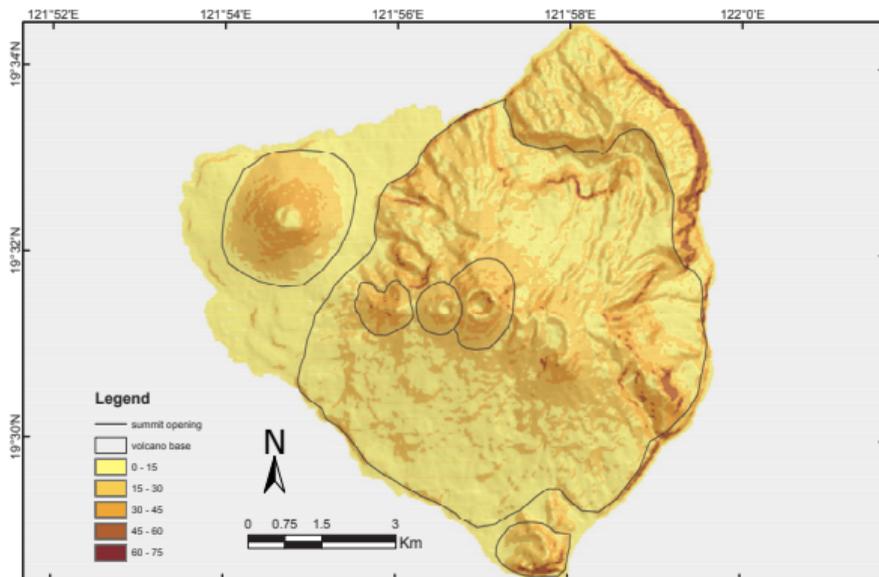
ADVANCING A CULTURE OF DIVERSITY, EQUITY AND INCLUSION

- Opportunity to students that are less privileged but no less deserving
- Considers student circumstances and allocate the appropriate resources so they can achieve equal outcome
- Extra consultation hours
- Disabilities: geology courses were developed considering some student disabilities that can be easily accommodated
- Taking into account students' mental health: virtual face-to-face meeting, avenues cooperative discussions, no last minute schedules

QUESTIONS ABOUT VOLCANOES AND THEIR COLLAPSES:

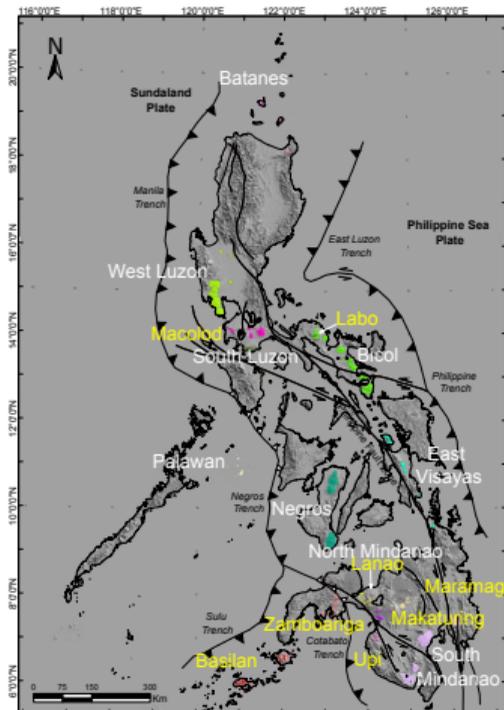
1. How does the morphology of volcanoes change through time?
2. What quantitative information can we extract from describing the morphology of edifices?
3. Why do volcanoes collapse? If they do, how do they emplace debris avalanche deposits?

DELINEATION OF EDIFICE BASE & SUMMIT



- 30 m SRTM DEM
- Interpret **conical topographic features**: base, summit
- considered **individual edifices**: parasitic cones and overlapping edifices

DISTRIBUTION OF VOLCANOES

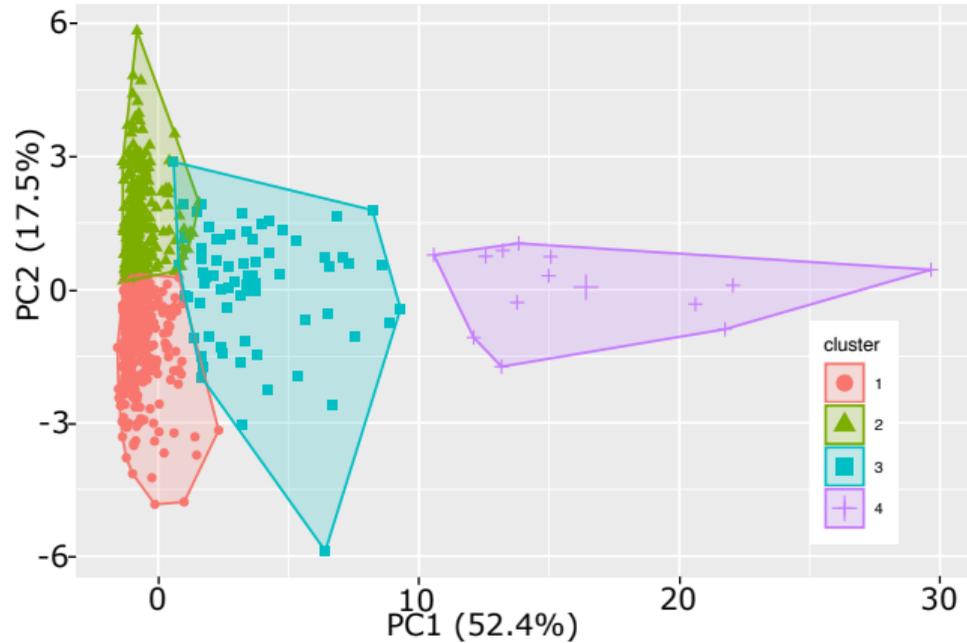


- 731 edifices
- 9 volcanic regions
- 8 volcanic fields

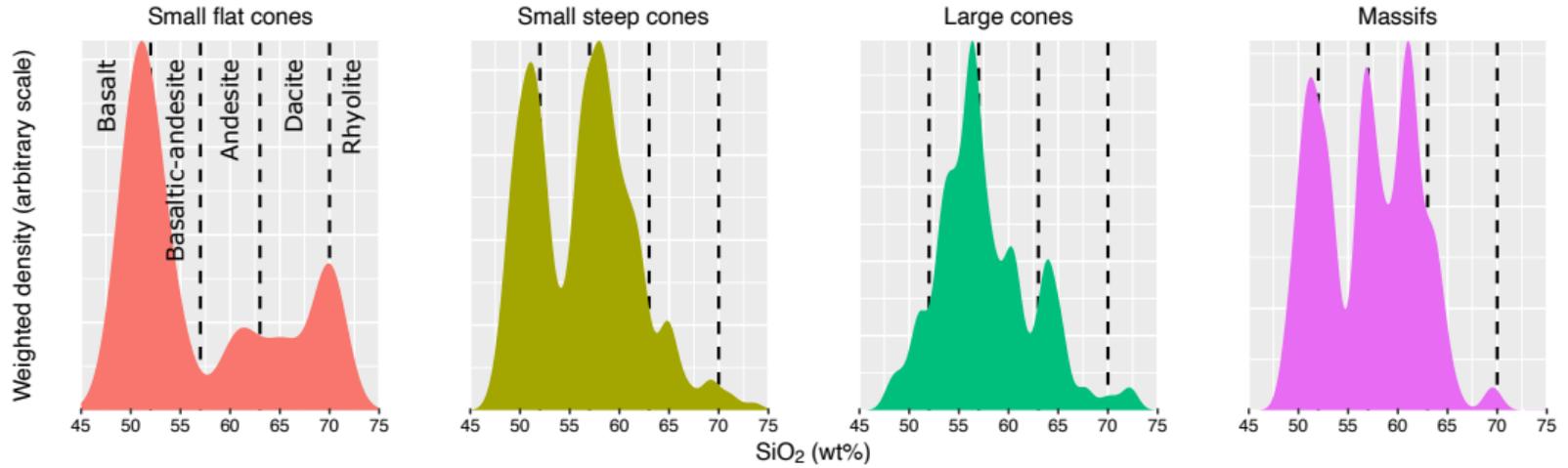
HIERARCHICAL CLASSIFICATION BY PRINCIPAL COMPONENT

		PC1	PC2	PC3	PC4	
		52.4%	17.5%	9.1%	7.8%	
		Morphometric Parameters				
Size	Base	Area	0.91	0.03	-0.24	0.24
		Average width	0.96	0.04	-0.22	0.03
		Maximum axis	0.95	0.04	-0.24	0.05
	Summit	Area	0.82	-0.07	0.38	0.08
		Average Width	0.88	-0.13	0.39	0.01
		Maximum axis	0.74	-0.13	0.55	-0.20
	Overall	Edifice height	0.82	0.29	-0.16	-0.05
		Edifice volume	0.89	0.04	-0.14	0.26
	Plan Shape	Irregularity	Number of secondary peak	0.87	0.03	-0.25
Average irregularity index of main elevation curves			0.80	-0.13	0.33	-0.25
Elongation		Average ellipticity index of main elevation curves	0.29	0.05	-0.05	-0.79
Truncation		Summit width/basal width ratio	-0.21	-0.44	0.52	0.44
Profile Shape	Slope	Height/basal width ratio	-0.35	0.84	0.22	0.22
		Mean slope of whole edifice	-0.10	0.92	0.24	0.03
		Standard deviation of slope of whole edifice	0.28	0.86	0.12	-0.04

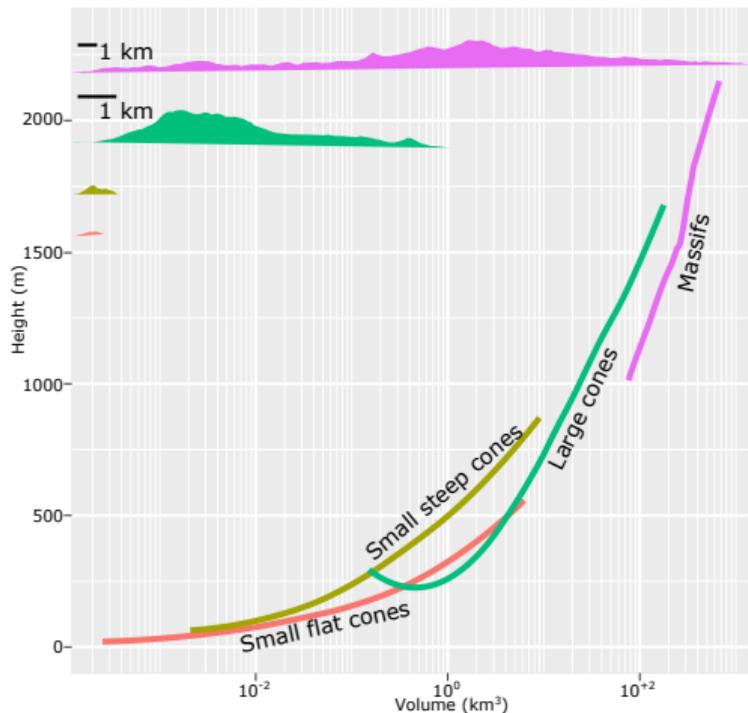
PRINCIPAL COMPONENTS PLOTS



GEOCHEMISTRY

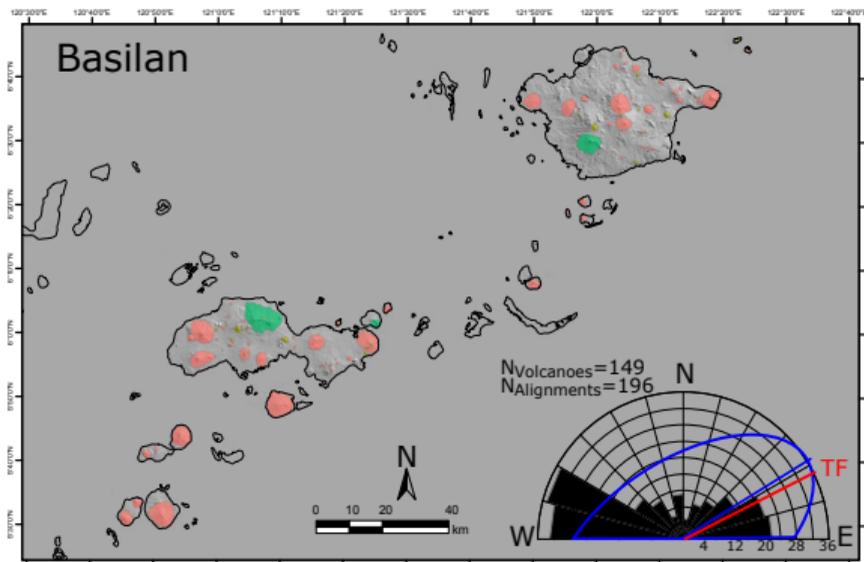
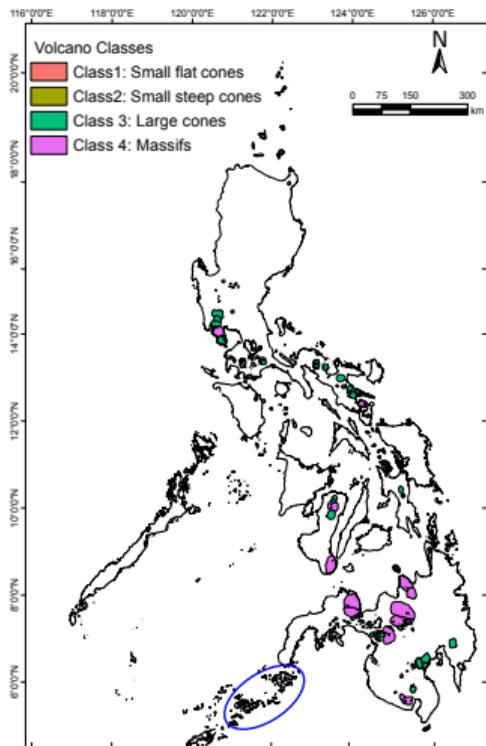


EVOLUTION OF PHILIPPINE VOLCANOES



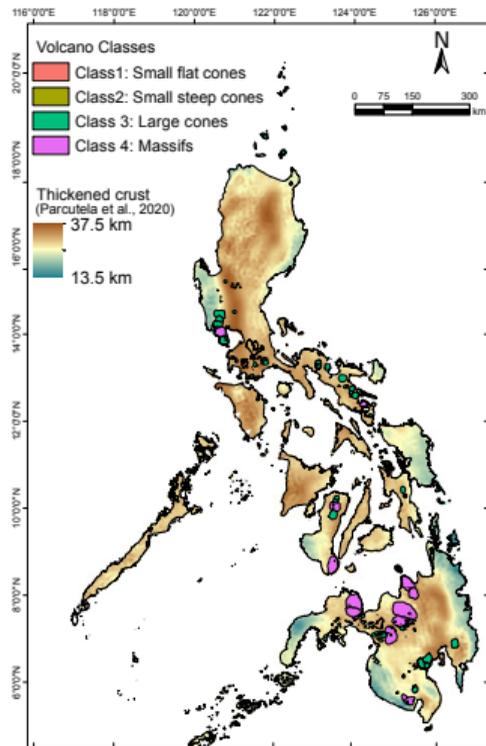
- at mature thresholds, volcanoes grow laterally than vertically
- to keep volcano stable, lateral growth dominates with increasing volume
- Massifs do not have single restricted summit but an extensive plateau with multiple vents

DISTRIBUTION OF SMALL VOLCANOES



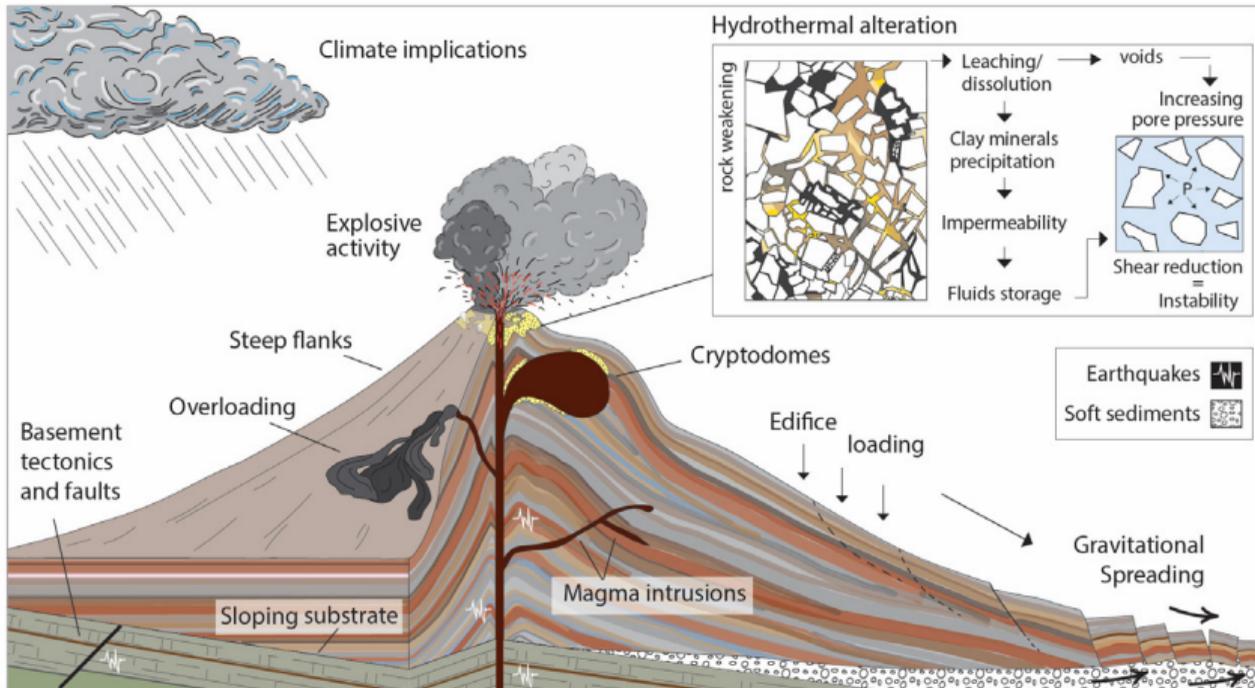
- most alignments are aligned roughly E-W
- shape of the volcanic field is parallel to Sulu trench
- Alignments are attributed to magma ascent along pre-existing crustal structures and reactivated faults

DISTRIBUTION OF LARGE VOLCANOES



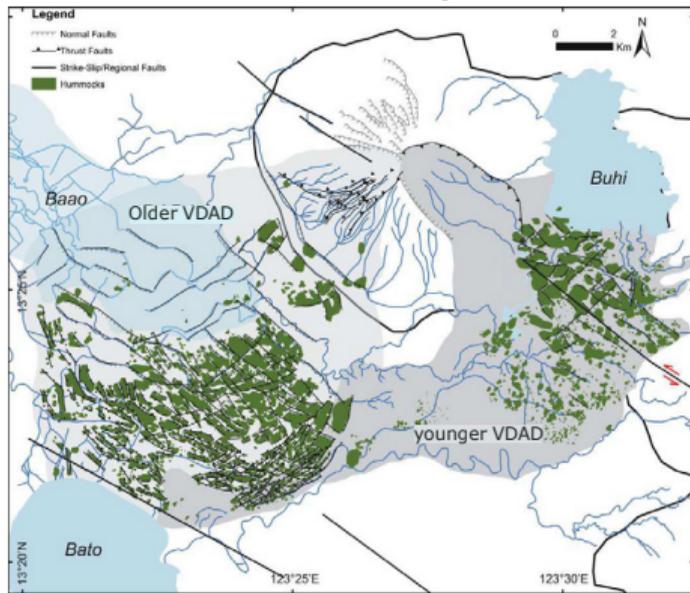
Large volcanoes are on the thickened crust

DURING A VOLCANO'S LIFETIME:



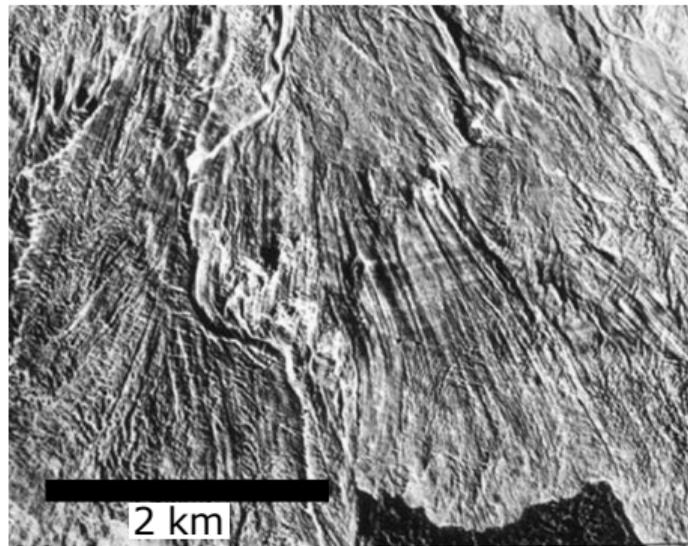
SURFACE MORPHOLOGICAL FEATURES

Hummocky



Iriga, Philippines (Paguican et al. 2014)

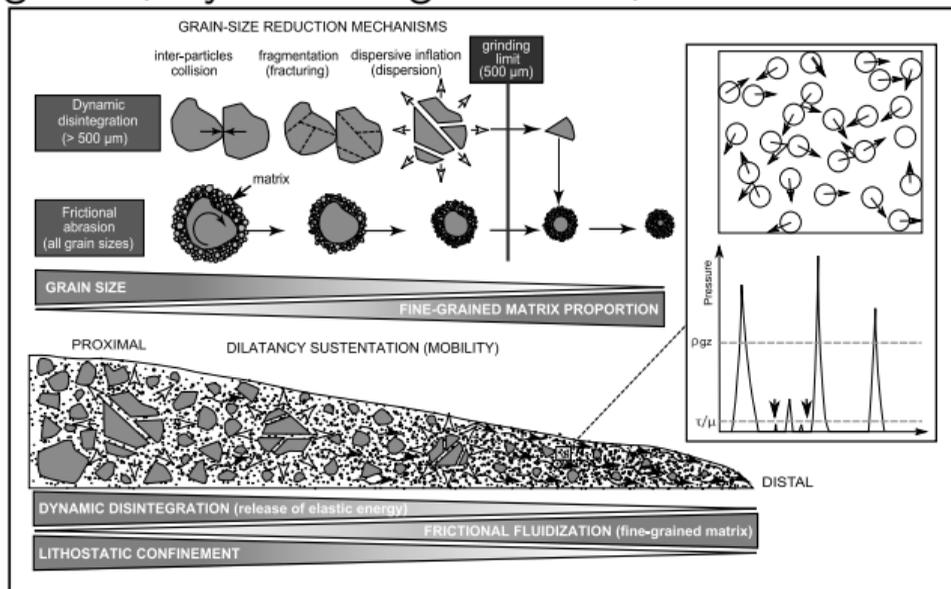
Elongated ridges



Shiveluch, Russia (Belousov et al. 1999)

INTERNAL STRUCTURES: PROCESSES DURING EMPLACEMENT

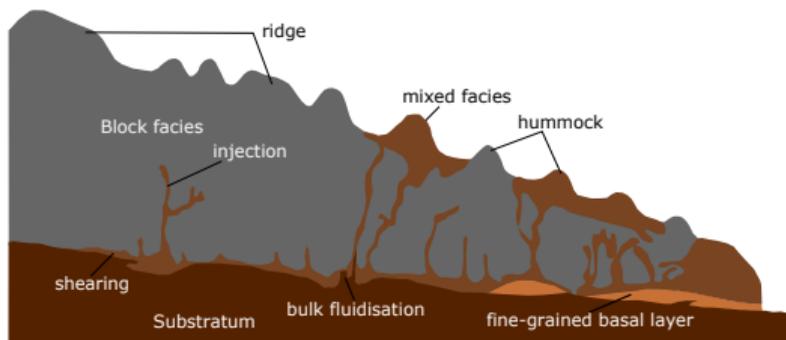
Disintegration, Dynamic fragmentation, mechanical fluidization



Perinoto et al. 2015

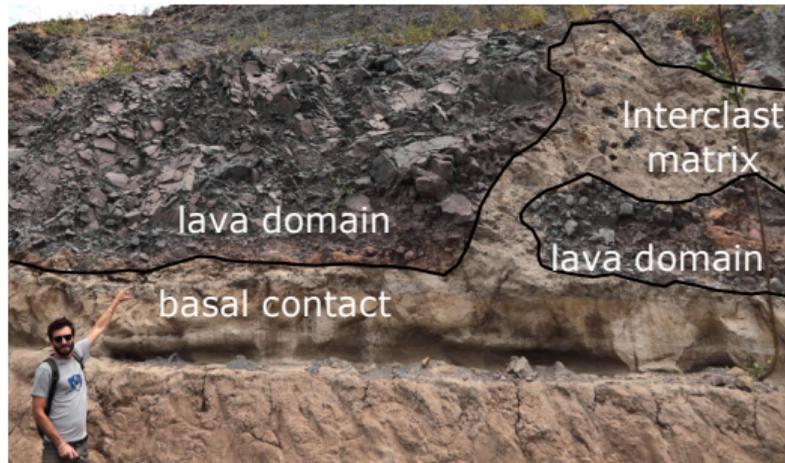
INTERNAL STRUCTURES: PROCESSES DURING EMPLACEMENT

Substrate entrainment and deformation



after Bernard et al. 2008

Substrate entrainment and deformation

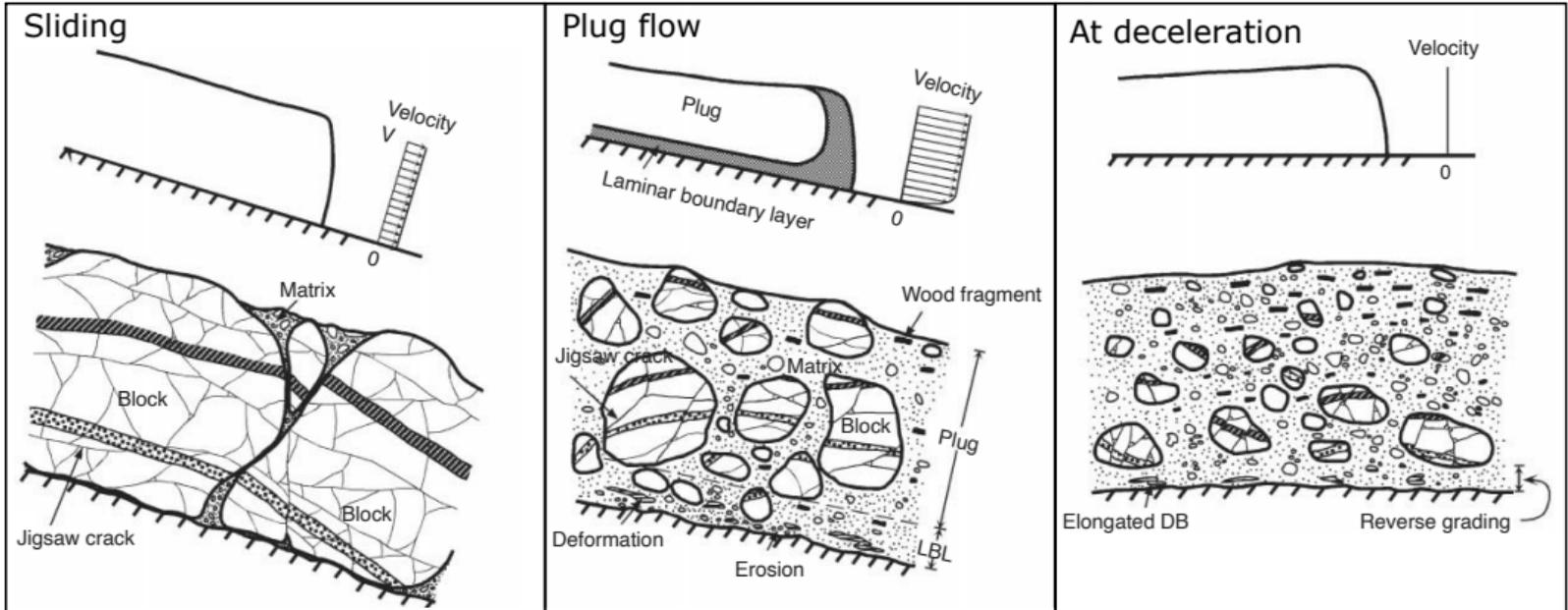


northern Andes, Ecuador

Roverato et al. 2018

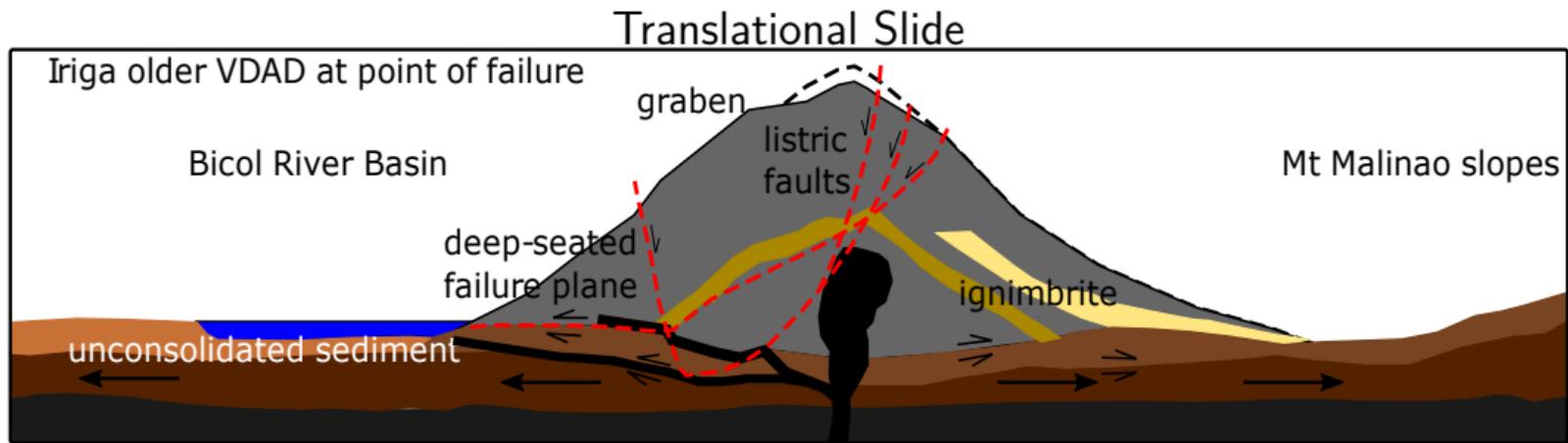
INTERNAL STRUCTURES: TRANSPORT REGIME

Plug flow: Valley-confined settings



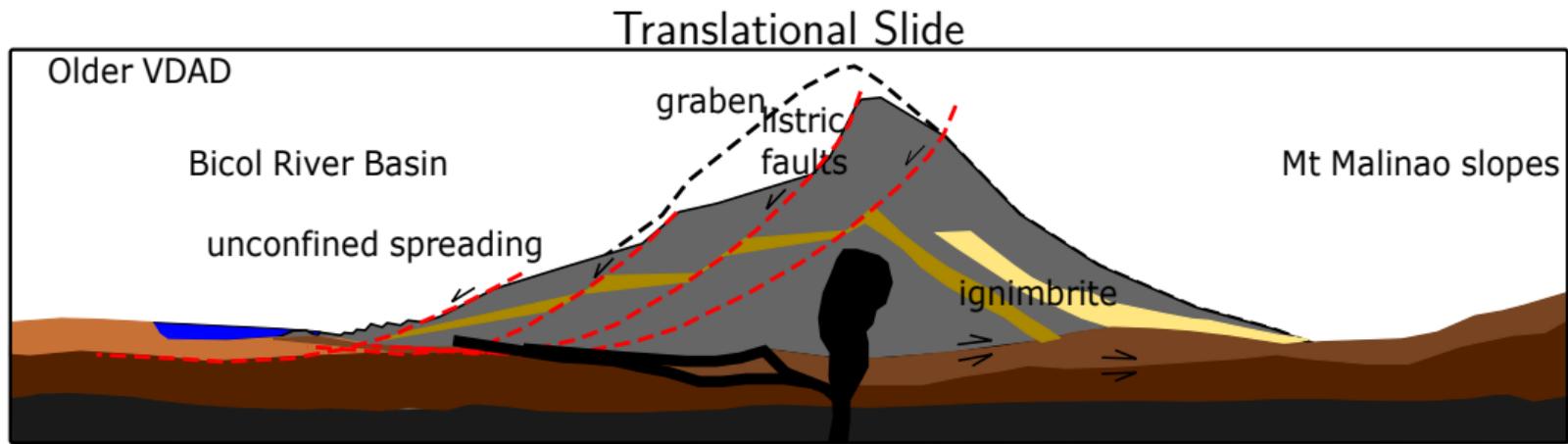
Takarada et al. 1999

INTERNAL STRUCTURES: TRANSPORT REGIME



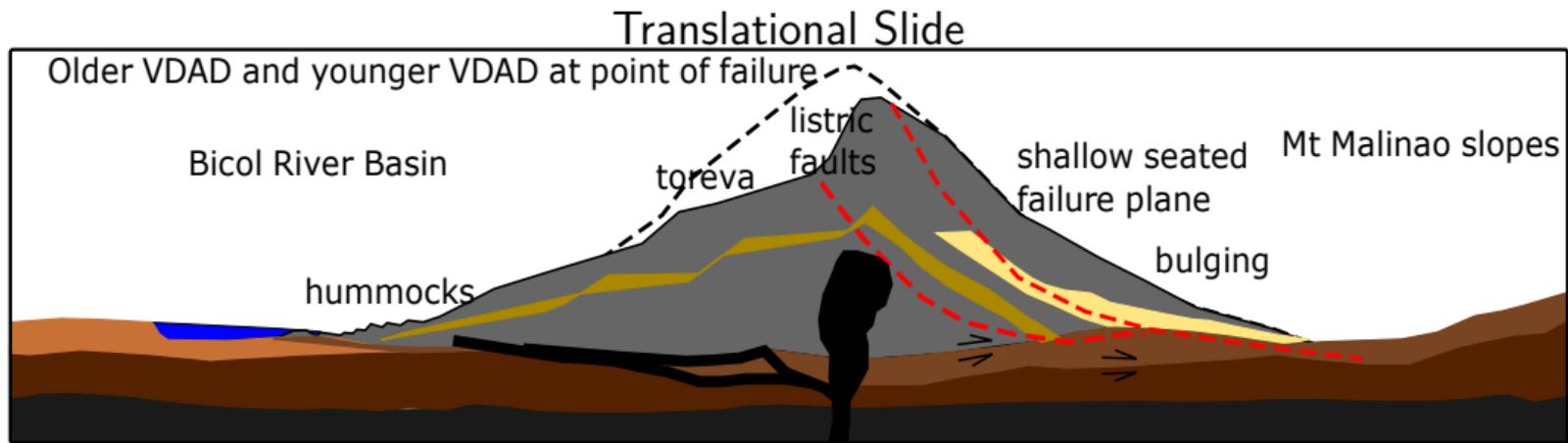
Paguican et al. 2012

INTERNAL STRUCTURES: TRANSPORT REGIME



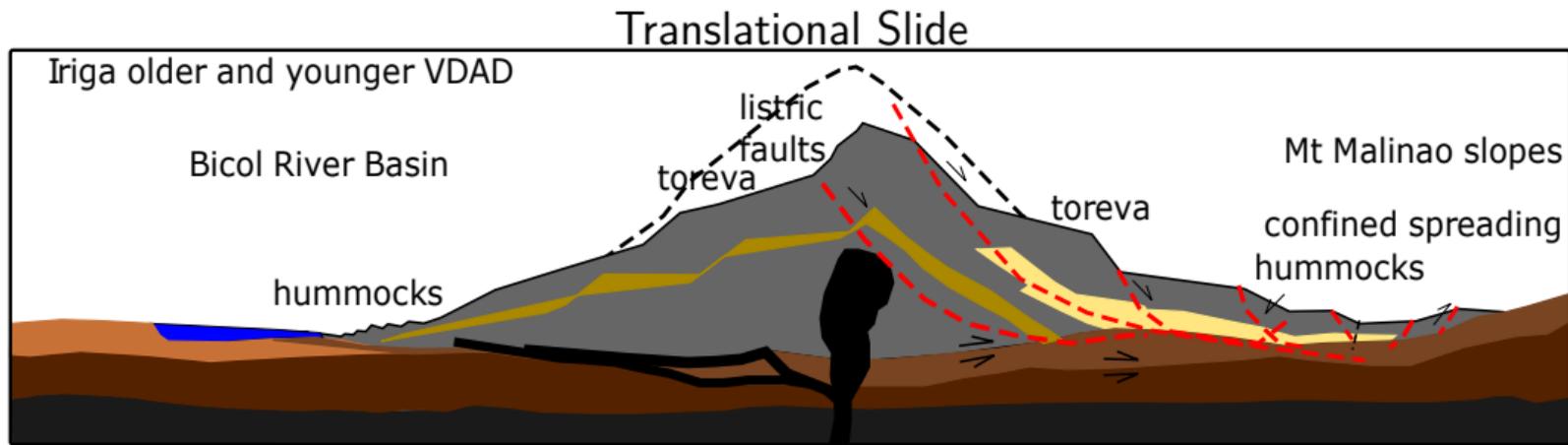
Paguican et al. 2012

INTERNAL STRUCTURES: TRANSPORT REGIME



Paguican et al. 2012

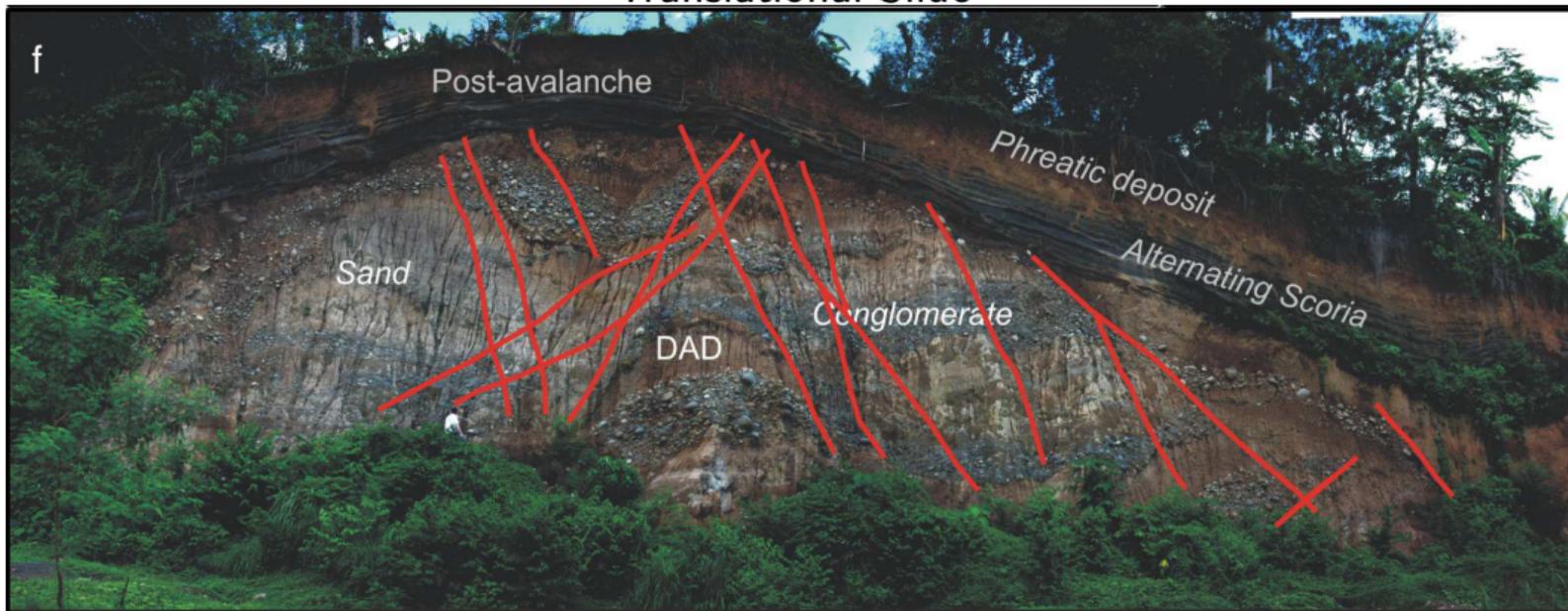
INTERNAL STRUCTURES: TRANSPORT REGIME



Paguican et al. 2012

INTERNAL STRUCTURES: TRANSPORT REGIME

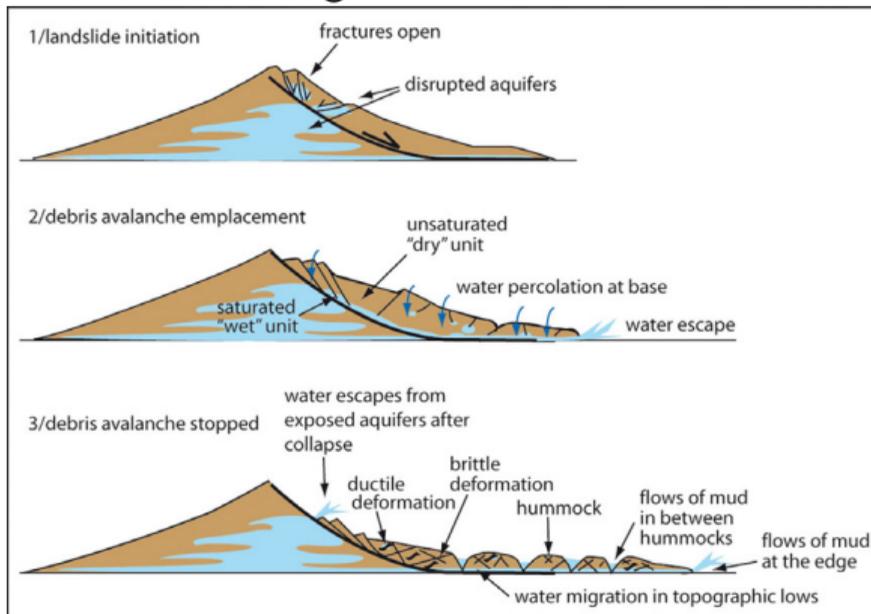
Translational Slide



Paguican et al. 2012

AVALANCHE TRANSFORMATION

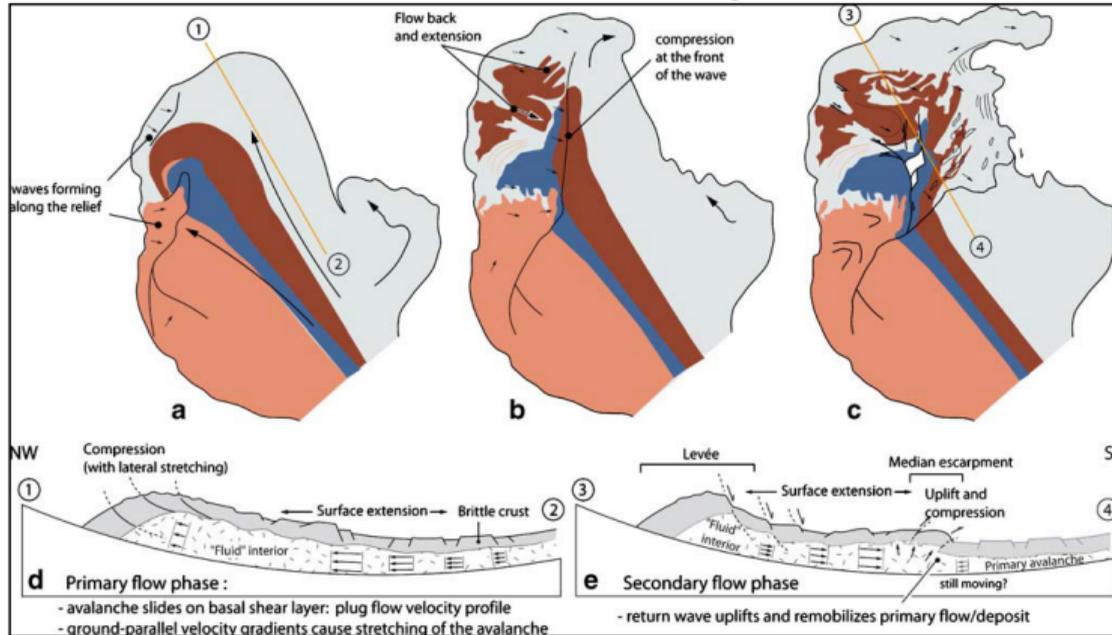
Dewatering: transition into lahar



Delcamp et al. 2016a, b

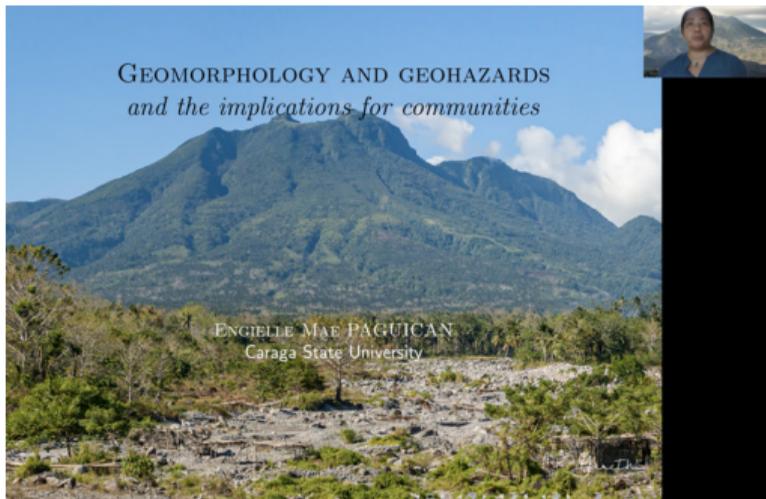
AVALANCHE TRANSFORMATION

Secondary slides



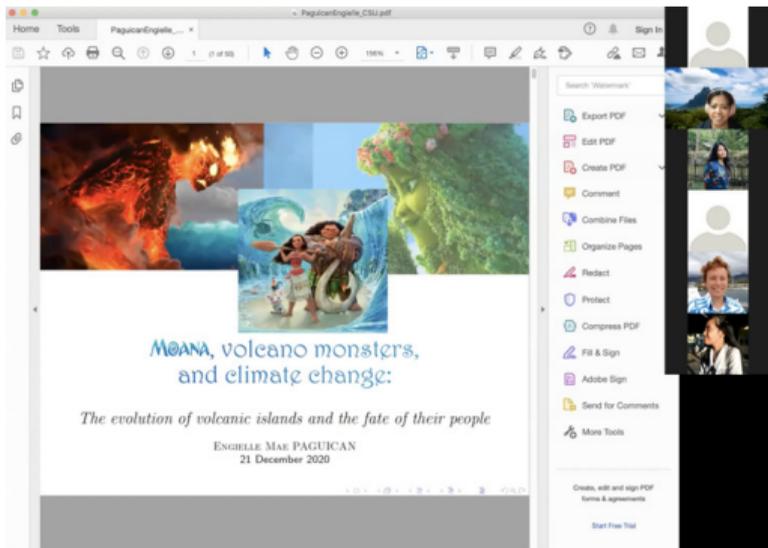
Kelfoun et al. 2008

MABAHANG USAPAN 2.0 BY CCGEO



- December 2020
- 4 Sessions
- *How the Earth works, geomorphology, geohazards and impacts, and thoughts on geohazards*
- Regions 9–12, Caraga, Basilan, Sulu, Tawi-Tawi, BARMM incl. Lanao del Sur and Maguindanao

MOANA, VOLCANO MONSTERS, AND CLIMATE CHANGE:



- December 2020
- end-of-semester talk
- CSU-CEGS students and interested faculty
- *Volcanoes, destroying a volcano, eroding volcanoes and rising reefs, rising seas and drowning atolls*

DOST-NERC PROJECT PARTNERSHIP DEVELOPMENT GRANT

- MINEMAP: Framework for an integrated network for environmental management of mining areas in the Philippines (Edinburgh University, UP)
- SusNi: Developing a sustainable pathway for the Philippine Nickel sector (CSU, MGB, British Geological Survey)

GEODETIC ENGINEERING THESIS ADVISING

- Identifying the relationship between deep well groundwater exploitation and Surigao City's terrain deformation using Sentinel-1 InSAR data, *Finalist, Best Engineering Thesis Award 2021* by Ronnie Quiño
- Multi-hazard assessment of evacuation areas during earthquakes in Surigao City using GIS techniques, *Finalist, Best Engineering Thesis Award 2021* by Adriel Arlan & Johnserg Sombilon
- 3D modelling of riverbank changes and erosion on the Agusan river using UAV-based imagery
- Comparison of machine learning algorithm in the derivation of land surface temperatures in Claver, Surigao del Norte
- Assessment of surface water quality in open pit areas in Claver, Surigao del Norte

SUMMARY

Activities	Deliverables	% accomplished
Technical expertise	1. Suggestions/comments on the BS Geology curriculum 2. Thesis students	100%
Development of course syllabi	1.* Geology field trip protocols (SOP, Safety Policy, Hazard Identification and Risk Assessment, other field and staff forms) 2. Geol 194: Field Geology 1 (Syllabus, Handbook, Virtual and Face-to-face LM, IM) 3.* Geol 100: Principles of Geology 1 (IM, Syllabus) 4. Geol 100.1 (Principles of Geology Lab (LM, Syllabus) 5. Geol 105: Geomorphology (IM, LM, Syllabus) 6.* Geol 117: Principles of Geology 2 (IM, Syllabus) 7.* Geol 103: Structural Geology (IM, LM, Syllabus) 8.* Geol 102: Sedimentary and Stratigraphy (IM, Syllabus)	267%
Establish collaborations	8 of 4* Commitment letters for the 2 projects below	200%
Publications & Proposals	2 book chapters, 1 journal article, 4 of 1 proposal	200%
Lectures, training, & workshops	1. 4 sessions of Mabahang Usapan 2.0 2. Moana, volcano monsters and climate change	>100%
* in addition to TOR		

RECOMMENDATIONS

The BSP is attractive (in terms of compensation and less paperwork) and has been a platform for us to come home and serve the country.

- Fully online application
- What held me back is the limited opportunities available for my other half
- Flexibility in deliverables, should adopt to changing situations and should reflect truthful and long lasting results

THANKS!!!

- **Pablo Grosse:** Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Argentina; Fundación Miguel Lillo, San Miguel de Tucuman, Argentina
- **Gareth Fabbro:** Earth Observatory of Singapore, Nanyang Technological University, Singapore; Caraga State University, Philippines
- **Matthieu Kervyn:** Department of Geography, Vrije Universiteit Brussel, Belgium
- **Matteo Roverato:** Department of Earth Sciences, University of Geneva, Geneva, Switzerland; School of Earth Science, Energy and Environment, Yachay Tech University, Urcuqui, Ecuador
- **Hidetsugu Yoshida:** School of Arts and Letters, Meiji University, Tokyo, Japan
- **Anja Dufresne:** Engineering Geology and Hydrogeology, RWTH-Aachen University, Aachen, Germany
- **Frederico di Traglia:** Dipartimento di Scienze della Terra, Università degli Studi di Firenze, Firenze, Italy
- **Jonathan Procter:** School of Agriculture and Environment, Massey University, Private Bag 11 222, Palmerston North, New Zealand
- **Proposal co-Investigators:** CSU Faculty (Dr Varela, Dr Seronay, Dr Jumawan, Dr Paz, Ms Varela), British Geological Survey (SusNi), University of Edinburgh (Justine Domingo and Dr Mikael Attal), MGB

THANKS!!!

- Dr Deborah Tangunan, Dr Lea Soria, Ms Nancy Aguda, Mam Ghing Laudencia, Ms Joan Salise
- **The Balik Scientist Program Secretariat:** Ms Julie, Ms Roxanne, Ms Joy, and everyone
- **Dr Eric Paringit:** DOST-PCIEERD Director
- Friends and family

THANKS!!!

- **Ms. Riva Karyl P. Varela:** Head, Department of Geology
- **Engr. Meriam M. Santillan:** Dean, College of Engineering and Geosciences
- **Dr. Rowena P. Varela:** Vice-President for Research and Development
- **Dr. Anthony Penaso:** President
- **Dr. Gareth Fabbro:** Faculty, Department of Geology
- **Colleagues at CEGS** and of course, the **CEGS staff!!**
- **Students**

TAKE HOME MESSAGE

- The Philippines has lots of volcanoes and these features will continue to evolve.
- Some volcanoes destroy themselves through big eruptions, some by collapse.
- We need more Filipinos who study these hazards, and geohazards in general.
- Teaching Earth Science has to evolve with the changing times, and must consider diversity, equity and inclusivity.
- It has been a great honor to come home and serve the country in the way that I know how, giving purpose to all the years that I've spent nurturing my expertise. It was a privilege to share it here in the Philippines.