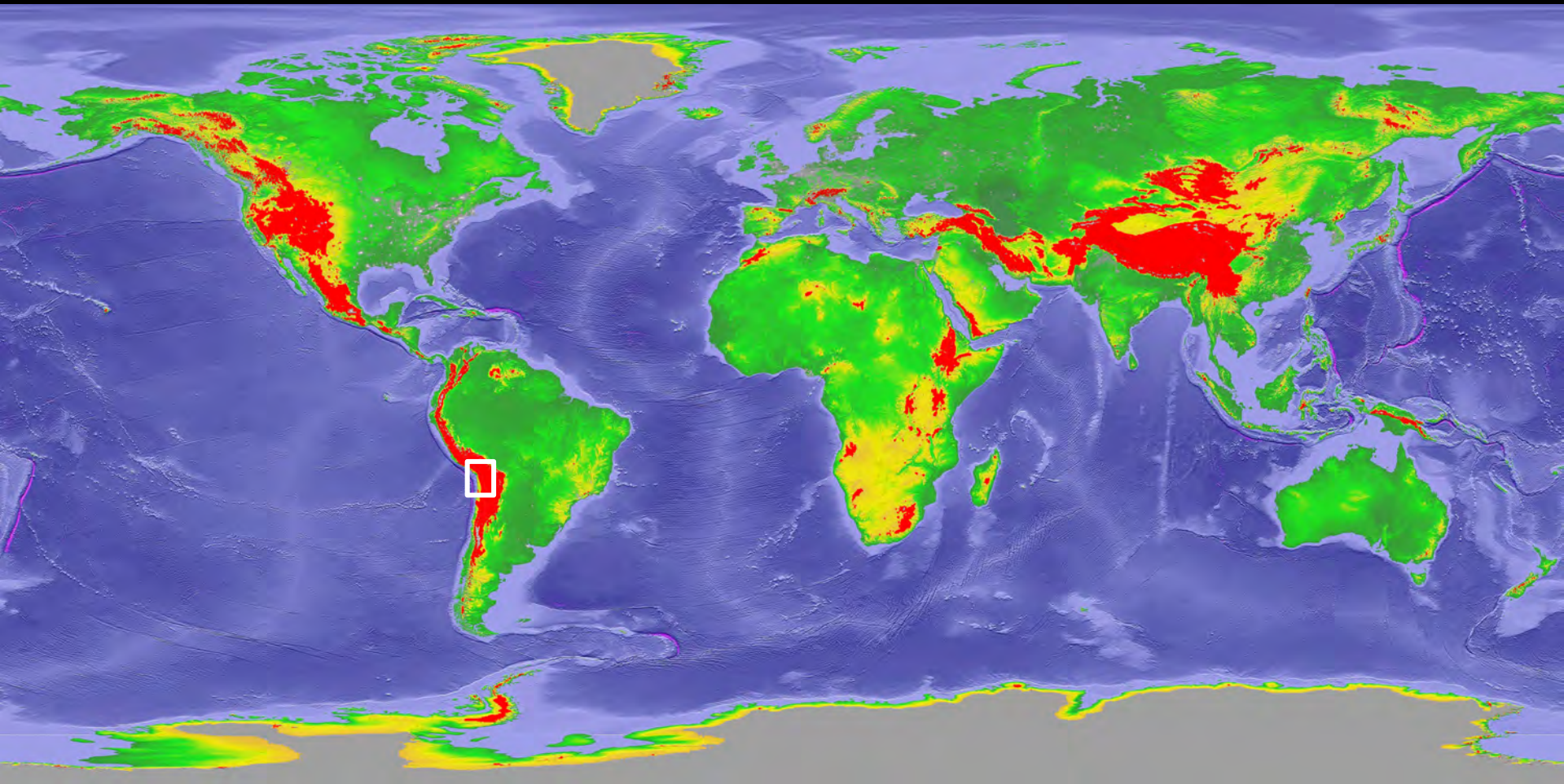


# Ignimbrite flare-ups in the Central Andes: Crustal sources and processes of magma generation

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Axel Schmitt, Axel Gerdes, Shan deSilva



# Layout:

1. Geological setting (review, maybe skipped)
2. Ignimbrite compositions: AIDA data base: (review, maybe skipped)  
Ages, volume and composition through time and space
3. Evidence for large crustal contributions (review, maybe skipped)
4. Zircon U/Pb dating combined with O-isotope and Hf-isotope analyses (new data)

## □ Results (in a nutshell)

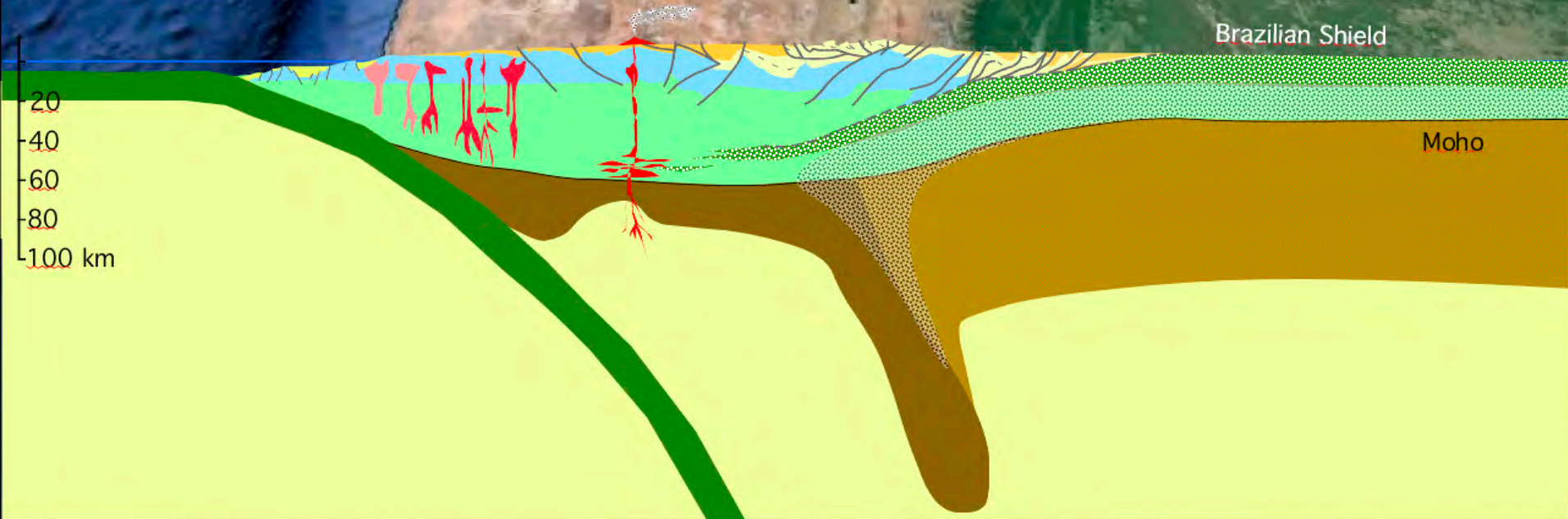
- > Contributions of large volume ignimbrite magmas increase from 20 to 70% with thermal maturation of increasingly thickened Andean crust
- > Individual ignimbrite units are isotopically heterogeneous and are amalgamations of crustal melts from distinct Proterozoic sources w/r to age and composition

# Ignimbrites:



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message from thickening crust at  
Andean-type active continental margins



## 1. Geological setting

Large-volume, plateau-forming ignimbrites on the western margin of the Central Andean orogen...

over 30 Ma and 1500 km N-S extension

900 m

Valle de Azapa 18°S

# 1. Geological setting

## Cuno Cuno Section

with > 24 Ma old marine sediments at 1900 m (S. Peru)

22 Ma Ignimbrites



Uplift, erosion and sedimentation prior to „ignimbrite flares“

Jurassic Sediments



# 1. Geological setting

1700 m



1. Geological setting

1700 m

What is the source of these voluminous ignimbrites ?

Our tools:

GIS-Data base mapping

Ages

Volumes

Sr-O-isotopes

O-Hf-U/Pb analyses in zircons



1. Geological setting

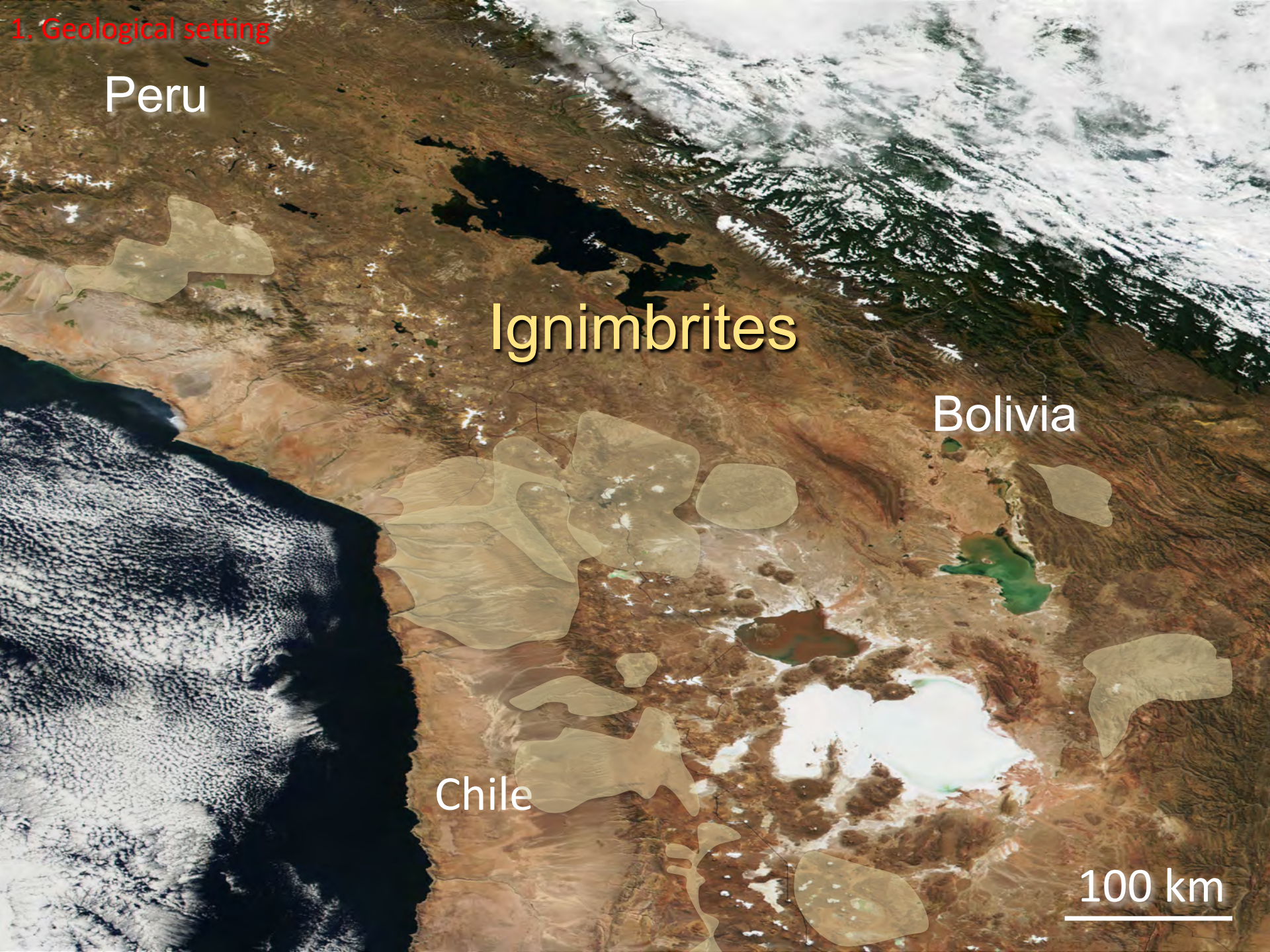
Peru

Ignimbrites

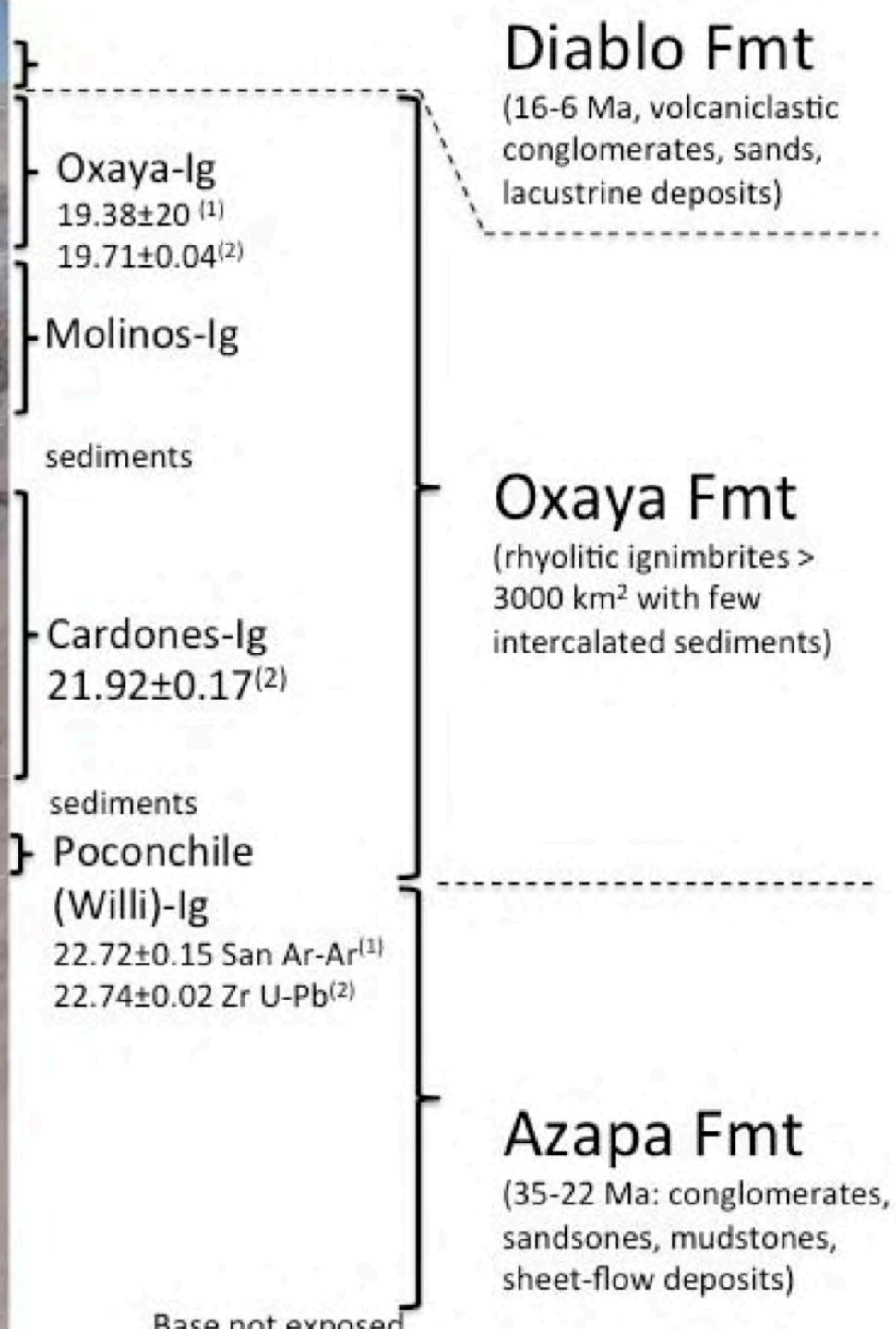
Bolivia

Chile

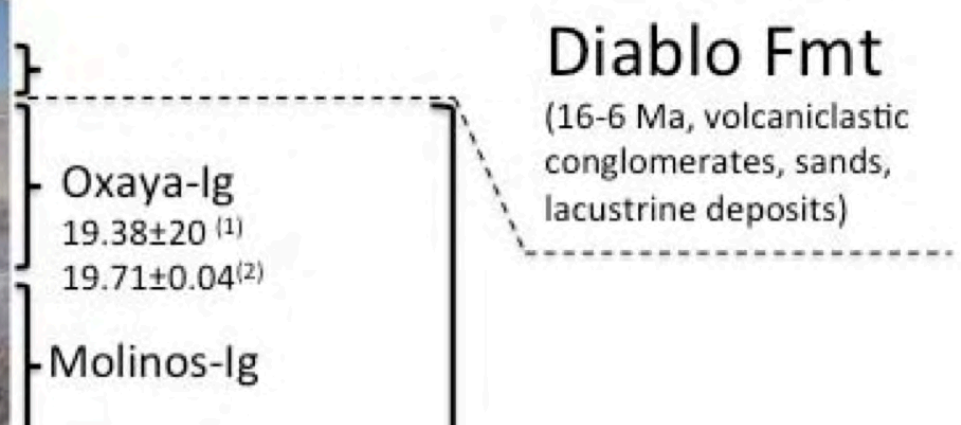
100 km



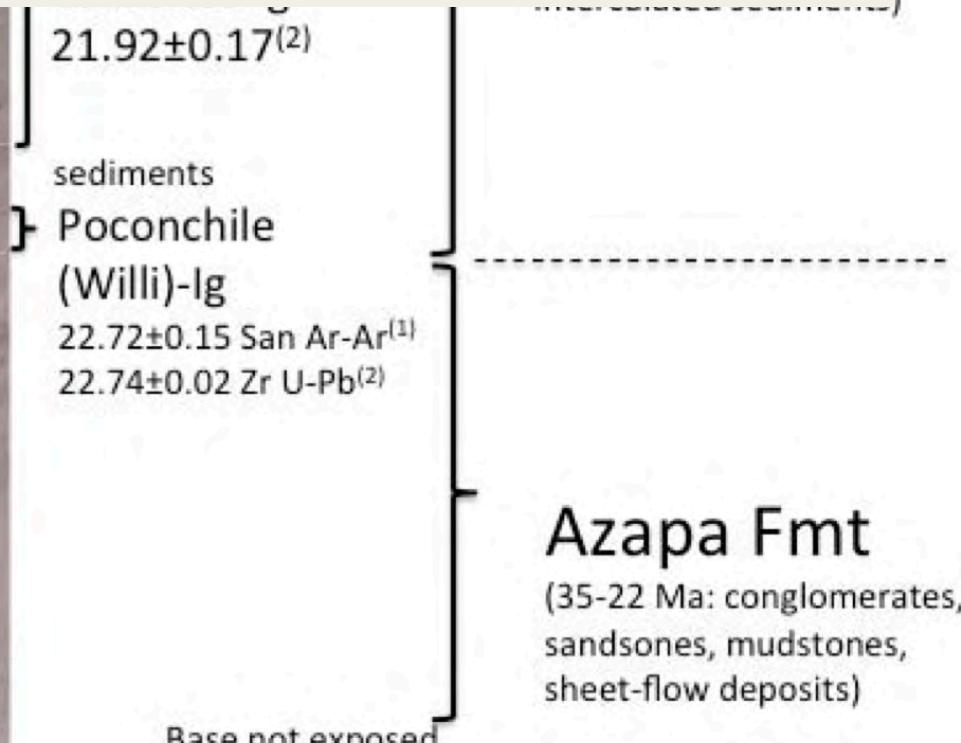
# 1. Geological setting



# 1. Geological setting



U-Pb zircon ages and Ar-Ar sanidine ages perfectly overlap !!



# Temporal and compositional evolution of „ignimbrite flares“

Based on our Andes Ignimbrite Database  
(AIDA)

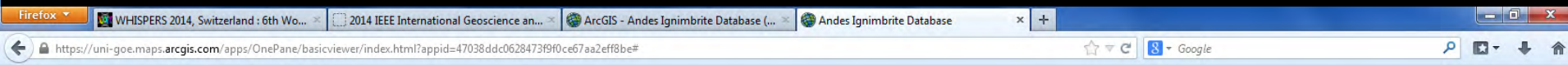
More than 200 ignimbrite sheets  
GIS-mapped,

more than 1600 samples  
with geochemical, isotopic,  
and many with age data

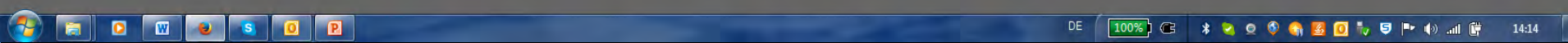
APVC, 3-10 Ma, 23°S

# 2. Ignimbrite compositions

...La Pacana caldera...as an AIDA - example



## Andes Ignimbrite Database



# 2. Ignimbrite compositions

# ...La Pacana caldera...as an AIDA - example

The screenshot displays the Andes Ignimbrite Database web application. The browser address bar shows the URL: <https://uni-goe.maps.arcgis.com/apps/OnePane/basicviewer/index.html?appid=47038ddc0628473f9f0c67aa2eff8be#>. The application interface includes a top navigation bar with 'Editor', 'Details', and 'Legend' tabs. A search bar on the right contains the text 'Adresse oder Ort suchen'. On the left, there are two legend panels: 'Structures' and 'Samples'. The 'Samples' legend lists age ranges from 0,0 - 2,0 Ma to 23,1 - 24,0 Ma, plus 'No age data'. The 'Ignimbrite mapping' legend shows color-coded age ranges from 0,20 - 2,00 to 19,01 - 24,00, plus 'Undated ignimbrite'. The main map area shows a satellite view of the Andes region with colored overlays representing ignimbrite deposits. A popup window titled 'La Pacana Caldera - Atana Ignimbrite' is open, displaying the following information:

NAME	La Pacana Caldera- Atana Ignimbrite
Description	
Age (Ma)	3.8-4.2
Comment	
Reference	in: Kay et al. (2010)
Caldera	La Pacana Caldera
Further references	De Silva and Francis (1988), Ramirez and Gardeweg (1982, 1985, 1987), Lindsay et al. (2001a,b), Schmitt et al. (2001), Barqero-Molino (2003)
Thickness	
	<a href="#">Zoomen auf</a>

The bottom of the screenshot shows the Windows taskbar with various application icons and the system tray displaying 'DE', '100%', and '14:16'.

# 2. Ignimbrite compositions

# ...La Pacana caldera...as an AIDA - example

The screenshot displays the Andes Ignimbrite Database web interface. The browser address bar shows the URL: <https://uni-goe.maps.arcgis.com/apps/OnePane/basicviewer/index.html?appid=47038ddc0628473f9f0c67aa2eff8be#>. The application title is "Andes Ignimbrite Database".

On the left side, there are two legend panels:

- Samples:** A vertical list of colored circles representing different age ranges in millions of years (Ma):
  - 0,0 - 2,0 Ma (dark green)
  - 2,1 - 4,0 Ma (medium green)
  - 4,1 - 7,0 Ma (light green)
  - 7,1 - 11,0 Ma (yellow-green)
  - 11,1 - 16,0 Ma (yellow)
  - 16,1 - 18,0 Ma (orange)
  - 18,1 - 23,0 Ma (red-orange)
  - 23,1 - 24,0 Ma (red)
  - No age data (blue)
- Ignimbrite mapping:** A vertical list of colored squares representing different age ranges in millions of years (Ma):
  - 0,20 - 2,00 (dark green)
  - 2,01 - 4,00 (medium green)
  - 4,01 - 7,00 (light green)
  - 7,01 - 12,00 (yellow-green)
  - 12,01 - 15,00 (yellow)
  - 15,01 - 17,00 (orange)
  - 17,01 - 19,00 (red-orange)
  - 19,01 - 24,00 (red)
  - Undated ignimbrite (blue)

The main map area shows a satellite view of the La Pacana Caldera region, with ignimbrite deposits overlaid in various colors corresponding to the legends. A light blue outline highlights a specific area. A popup window titled "Atana Ignimbrite" is open over this area, displaying the following information:

Atana Ignimbrite	
NAME	Atana Ignimbrite
Description	Plag-qtz-bt-hbl dacitic ignimbrite, crystal-rich homogeneous
Age (Ma)	3.8-4.2
Comment	
Reference	in: Kay et al. (2010)
Caldera	La Pacana Caldera
Further references	De Silva and Francis (1988), Ramirez and Gardeweg (1982), Lindsay et al. (2001a, b), Schmitt et al. (2001), Barqero-Molino (2003)
Thickness	
<a href="#">Zoomen auf</a>	

At the bottom of the browser window, the Windows taskbar is visible, showing the system tray with the time 14:18 and various icons. The bottom right corner of the slide contains the text "Brandmeier and Wörner AIDA Website".

# 2. Ignimbrite compositions

...La Pacana caldera...as an AIDA - example

The screenshot displays the Andes Ignimbrite Database web application. The main map shows the Purico Ignimbrite complex in green, with various age ranges indicated by different colors. A popup window provides detailed information for the Purico Ignimbrite:

Purico Ignimbrite	
NAME	Purico Ignimbrite
Description	monotonous, intermediate dacite, crystal-rich
Age (Ma)	0.87-1.38
Comment	upper and smaller lower unit
Reference	in: Kay et al. (2010)
Caldera	Purico Ignimbrite Complex
Further references	De Silva and Francis (1988), Schmitt et al., de Silva (1989a,b)
Thickness	
Area (km <sup>2</sup> )	1.067,14
Calculated volume (km <sup>3</sup> )	100,00
Reference for volume calculations	Schmitt et al. (2001)

Additional interface elements include a search bar, navigation tools, and a legend for ignimbrite mapping and samples. The legend for ignimbrite mapping shows age ranges from 0,20 - 2,00 Ma to 19,01 - 24,00 Ma, plus undated ignimbrite. The sample legend shows age ranges from 0,0 - 2,0 Ma to 23,1 - 24,0 Ma, plus no age data. The application is powered by i-cubed and esri.

## 2. Ignimbrite compositions

Example Lauca and Oxaya ignimbrites :  
Edit and update the database by authorized users

Firefox

WHISPERS 2014, Switzerland : 6th Wo... | 2014 IEEE International Geoscience an... | ArcGIS - Andes Ignimbrite Database (... | Andes Ignimbrite Database

https://uni-goe.maps.arcgis.com/apps/OnePane/basicviewer/index.html?appid=47038ddc0628473f9f0ce67aa2eff8be#

### Andes Ignimbrite Database

Editor | Details | Layers

Drucken | Layer | Grundkarte | Messen | Lesezeichen | Freigeben | Adresse oder Ort suchen

#### Structures

#### Samples

- 0,0 - 2,0 Ma
- 2,1 - 4,0 Ma
- 4,1 - 7,0 Ma
- 7,1 - 11,0 Ma
- 11,1 - 16,0 Ma
- 16,1 - 18,0 Ma
- 18,1 - 23,0 Ma
- 23,1 - 24,0 Ma
- No age data

#### Ignimbrite mapping

- 0,20 - 2,00
- 2,01 - 4,00
- 4,01 - 7,00
- 7,01 - 12,00
- 12,01 - 15,00
- 15,01 - 17,00
- 17,01 - 19,00
- 19,01 - 24,00
- Undated ignimbrite

#### Lauca-Perez Ignimbrite

NAME	Lauca-Perez Ignimbrite
Description	
Age (Ma)	2,73
Comment	
Reference	from SERNAGEOMIN, 2003. Mapa Geológico de Chile
Caldera	
Further references	Wörner et al. (2000)
Thickness	
Area (km2)	2.405,09
Calculated volume (km3)	90,19
Reference for volume calculations	own source

[Zoomen auf](#)

POWERED BY  
i-cubed esri

DE | 100% | 14:56