Big bad mt. Vesuvius

Austin Dusek

5/1/2012

Petrology 422

OUTLINE

- History/background
- Age of eruption that produced my sample
  - Methods of Analysis
    - XRF
    - XRD
- Hand specimens (crystals)
- Results
- Conclusion

Location: Gulf of Naples, Italy

Formation: Convergence of African and Eurasia plates ~300 ka

http://www.civilization.ca/cmc/exhibitions/cmc/pompeii/pompei6e.shtml

http://www.longislandpress.com/2011/08/24/vesuvius-day-mount-vesuvius-eruption-anniversary/

Famous Eruptions:

-August 24, 79 A.D. (Pompeii)

-December 10, 1631

-March 18, 1944

http://www.viator.com/photos/Rome-tours/Naples-and-Pompeii-Day-Trip-from-Rome/994894

http://www.creative-journeys.com/?p=2774

http://www.stormchaser.ca/Volcanoes/Vesuvius_%26_Pompeii/Vesuvius_%26_Pompeii.html

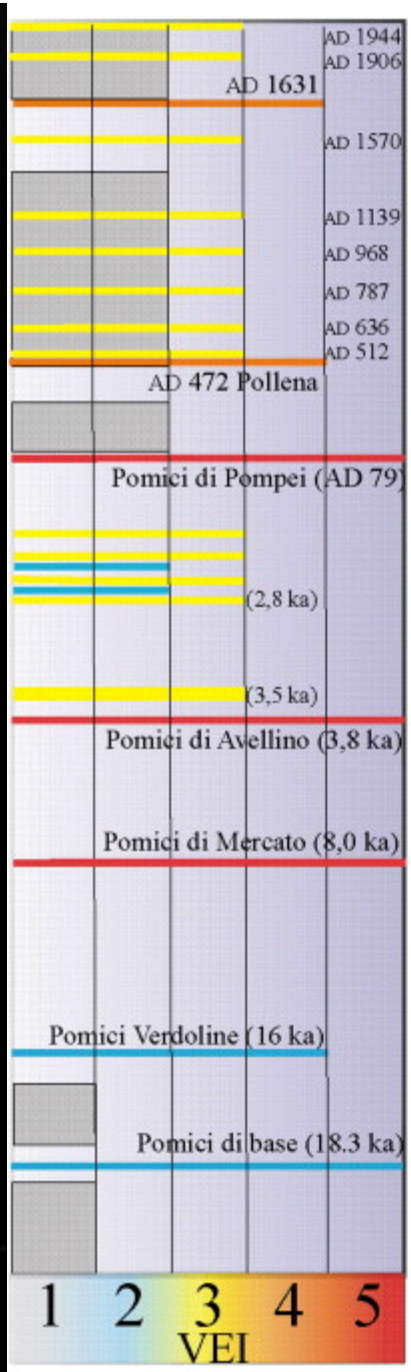
Which Eruption ejected my sample?

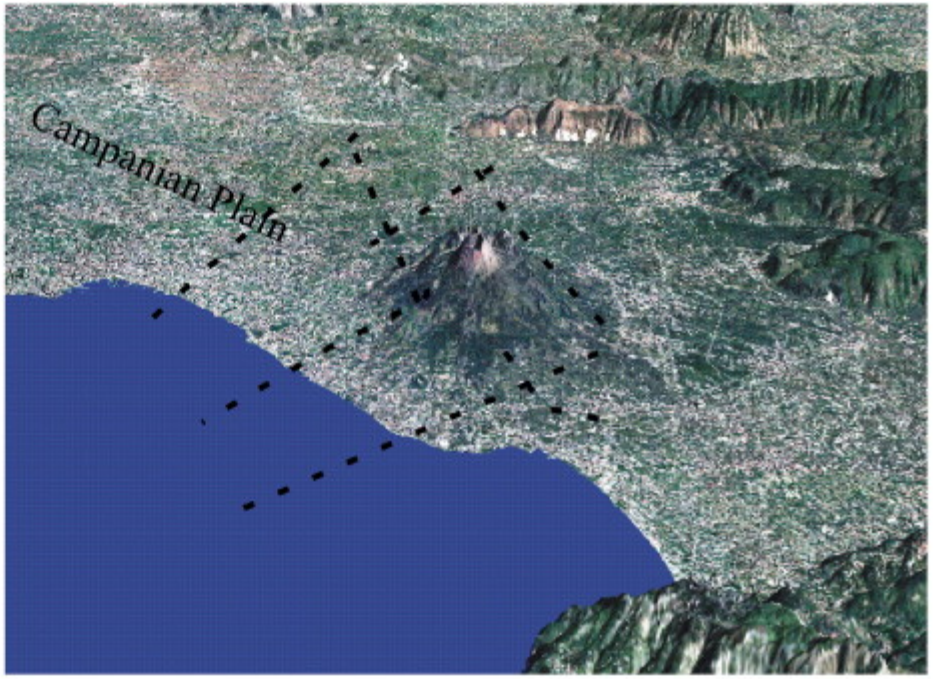
-Pompeii of 79 A.D.

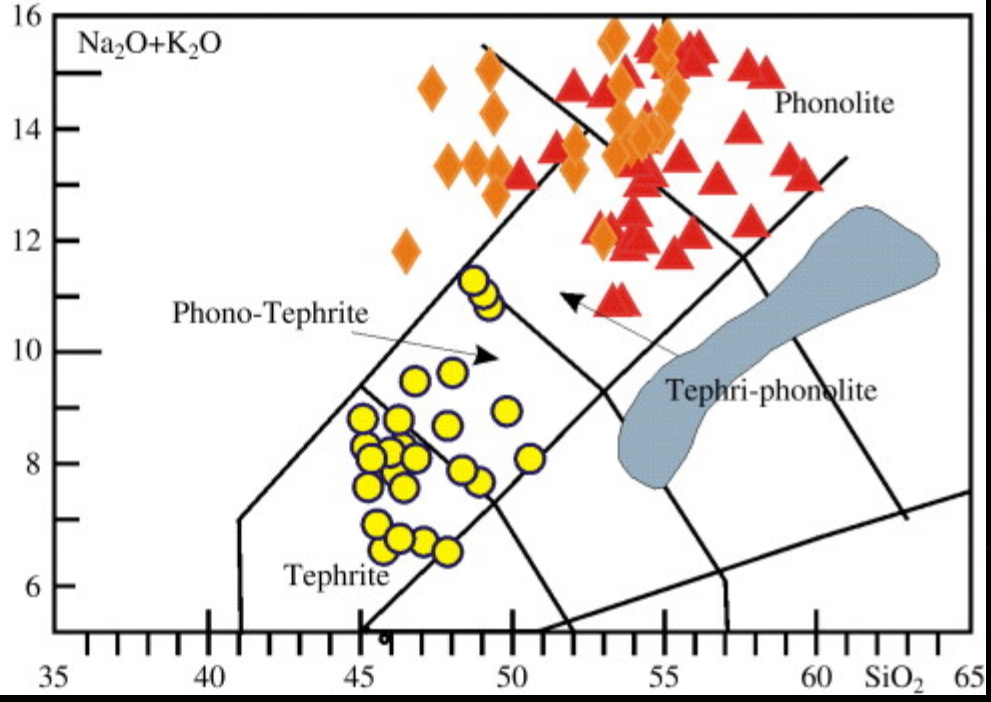
-Pollena of 472 A.D.

-Eruption of 1631

-Eruptions of 1906/1944

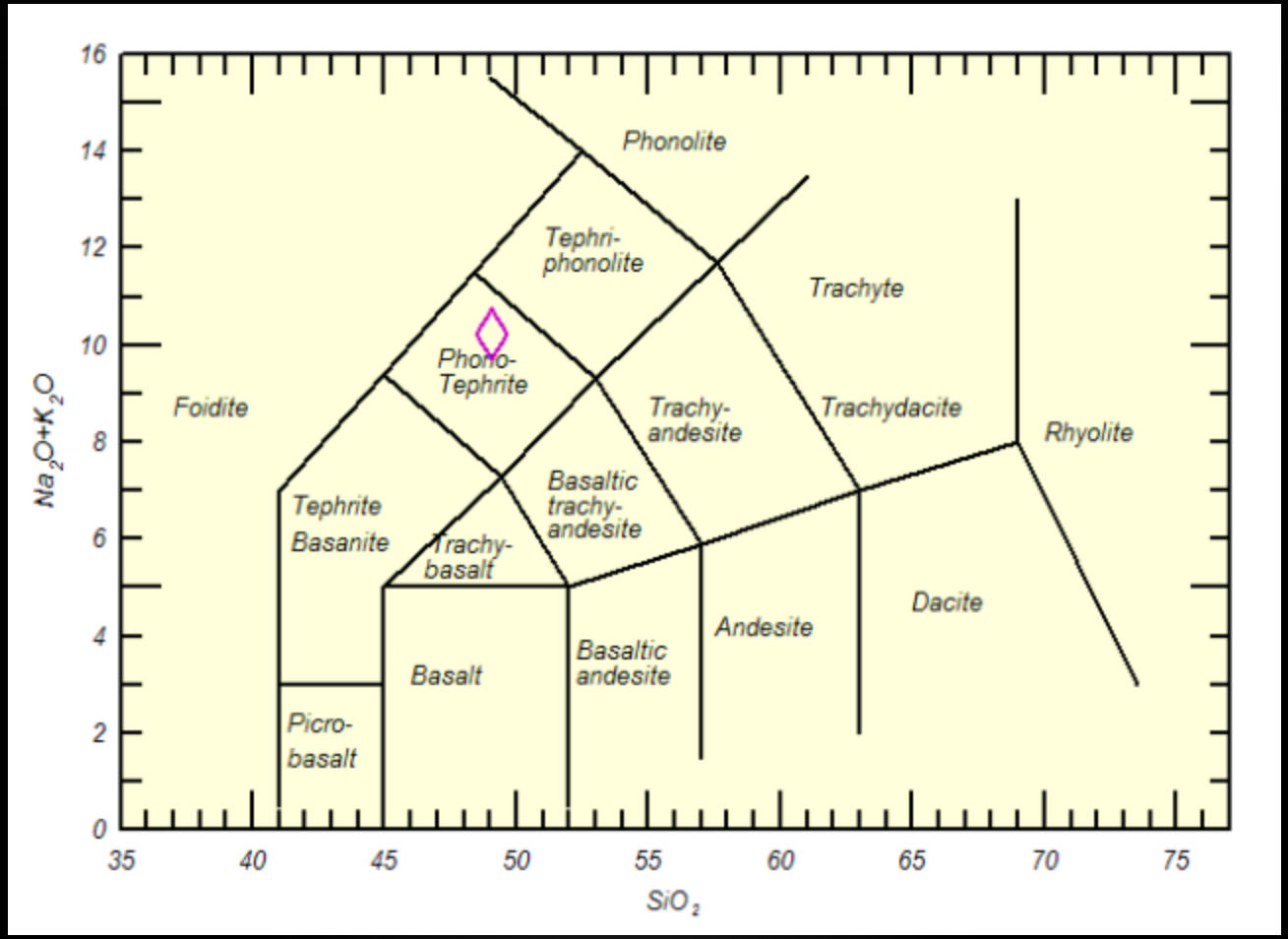






http://www.sciencedirect.com/science/article/pii/S0012821X10003286

TAS diagram from Igpet XRF data



Two types of eruptions

Dependent on chemical composition of magma

- Phonolitic – more explosive
- Ex. Eruptions of Pompeii, Mercato, and Avellino

- Tephritic – less explosive
- Ex. “Medieval” time between 472 A.D. and 1631

Pappalardo et al, 2010

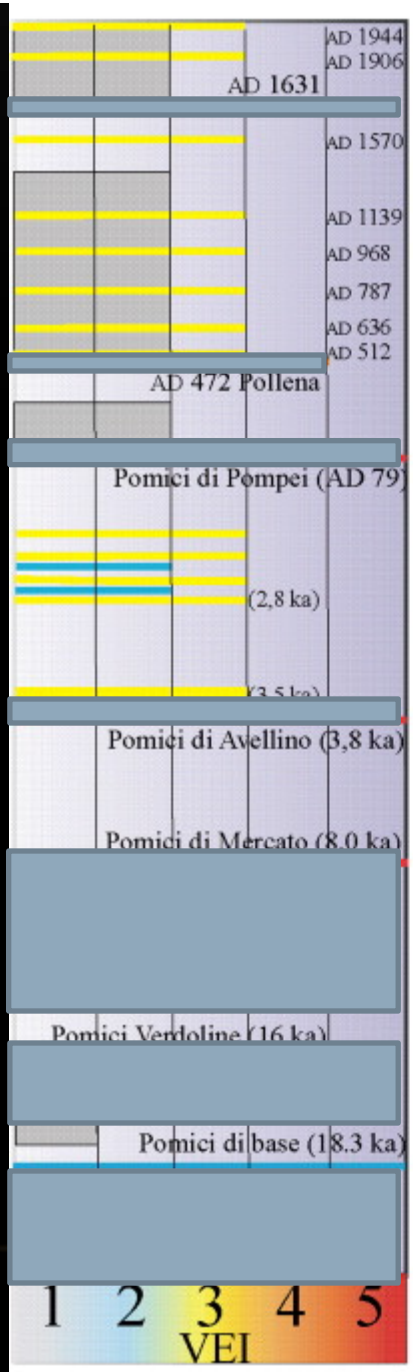
Rocks older than 11.5 ka are of shoshonite and trachy-phonolite

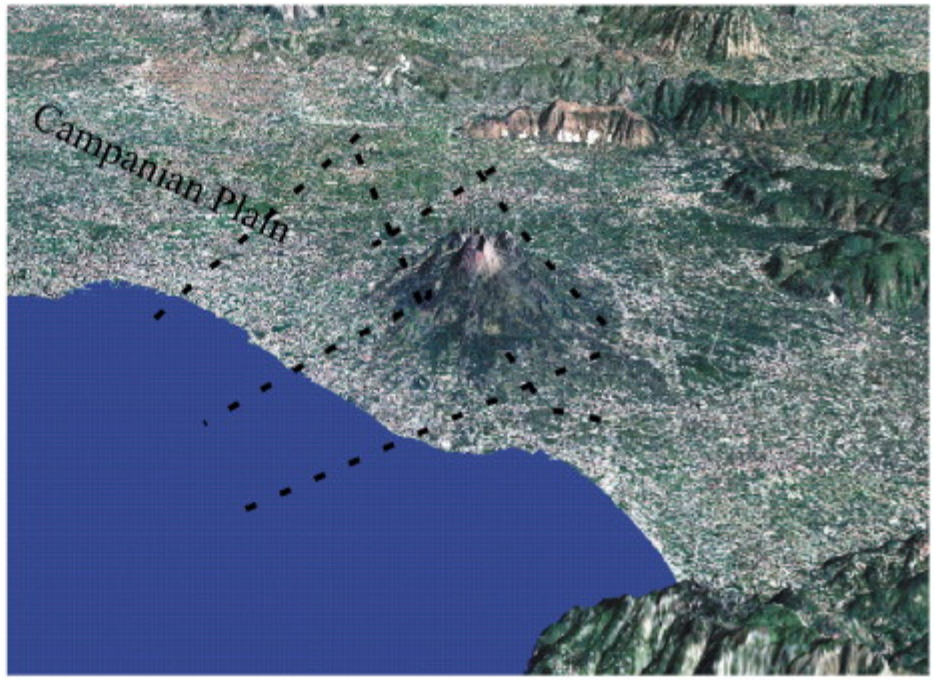
-Major and trace elements and isotope trends show that these older magmas originated from the mantle

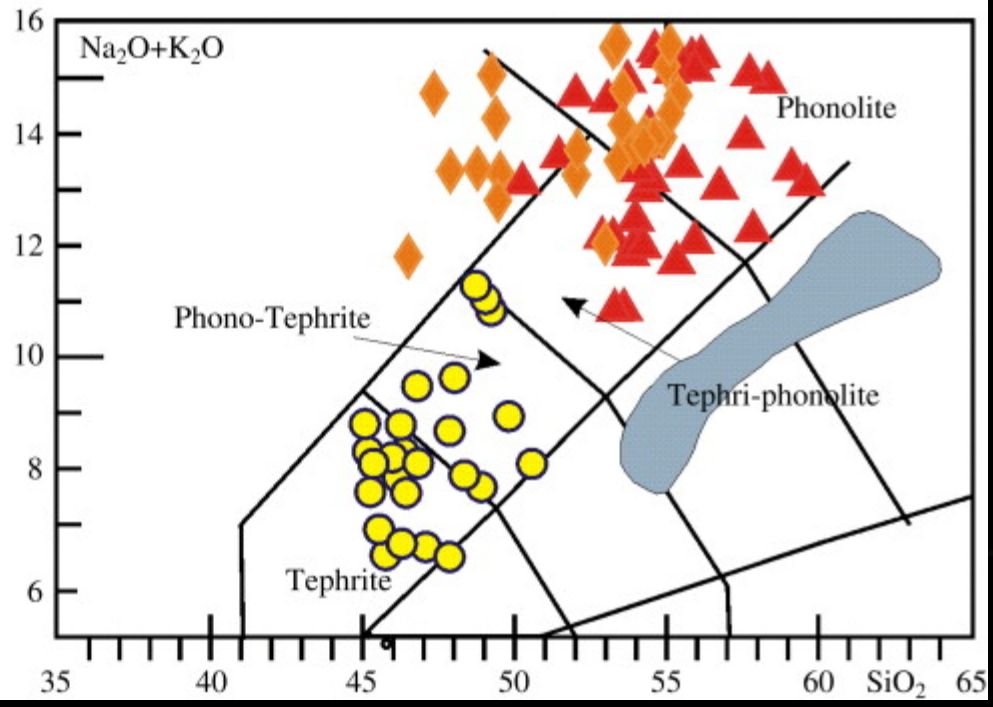
Rocks younger than 11.5 ka are in a series consisting of alkali-basalt to phonolite and tephrite

-These younger magmas can be contaminated by crustal rocks

Pappalardo et al, 2010



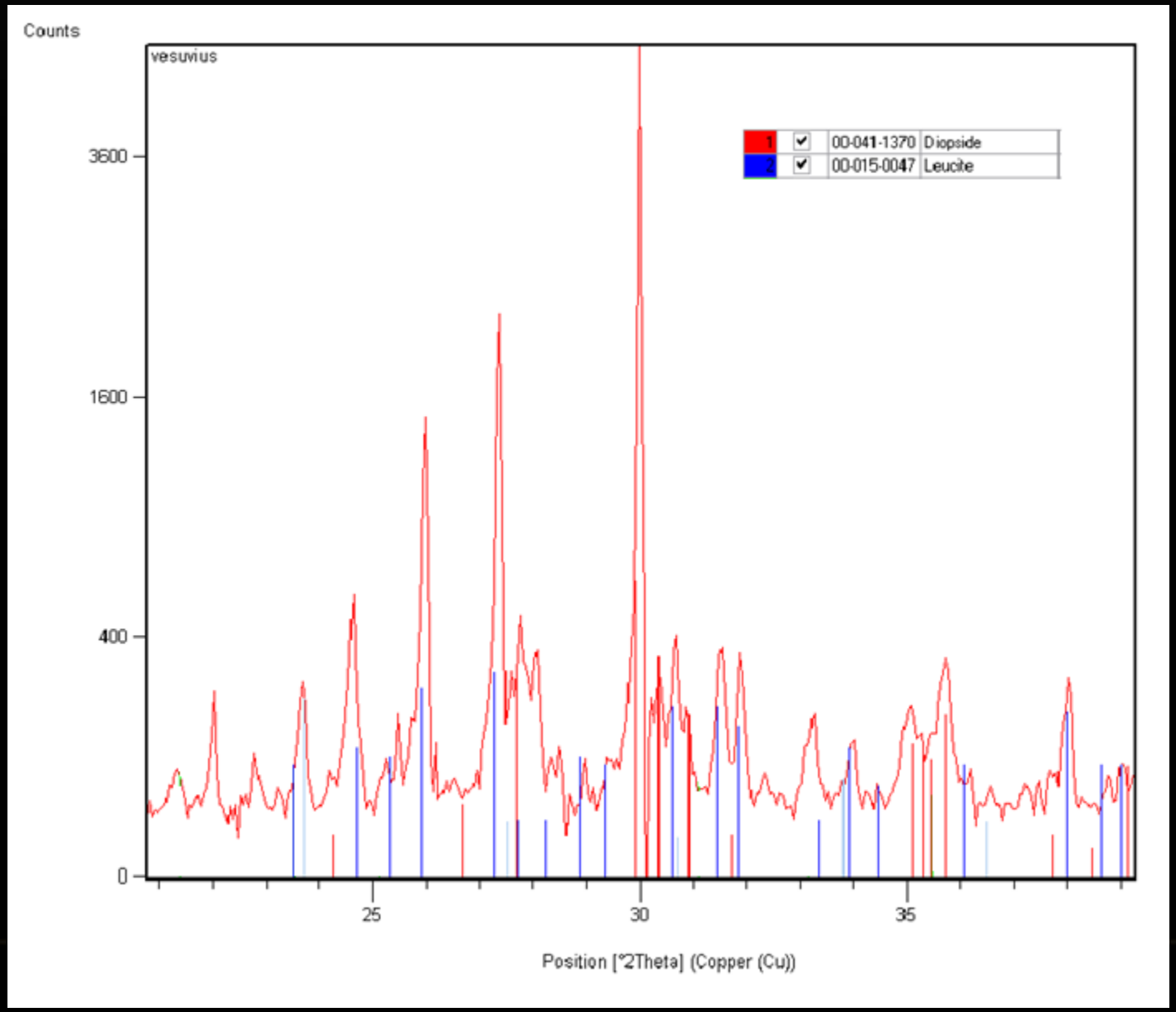




http://www.sciencedirect.com/science/article/pii/S0012821X10003286

Between 472 A.D. and 1944

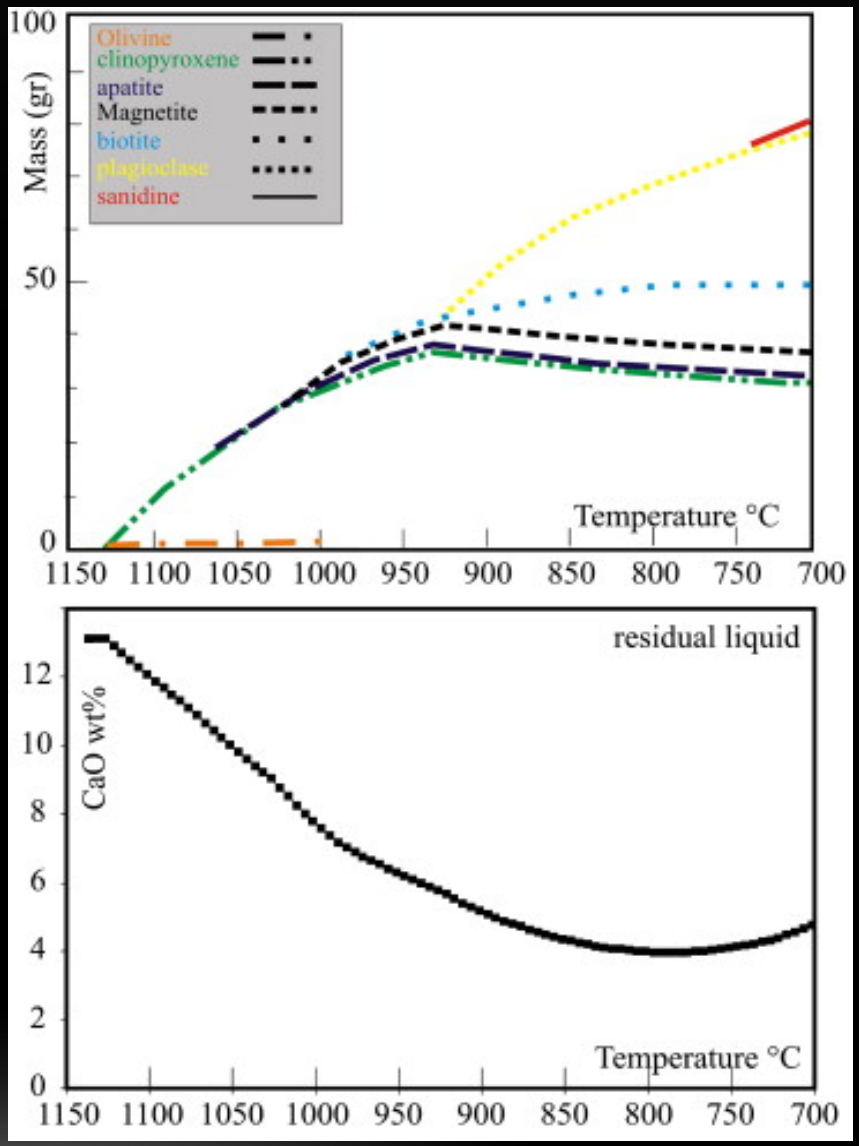
XRD Peaks


Counts
vesuvius
3600
1600
400
0
25
30
35
Position [°2Theta] (Copper (Cu))
1
00-041-1370
Diopside
2
00-015-0047
Leucite

-Phono-tephrite occurs in pressures between 350 - 400 Mpa

-Leucite doesn't crystallize at pressures over 100 Mpa and temperatures over 800°C

-CaO values drop in more evolved magmas with lower T and P due to lack of clinopyroxene



Pappalardo et al, 2010

http://www.sciencedirect.com/science/article/pii/S0012821X10003286

XRF and XRD results via Igpet & X'pert Highschore

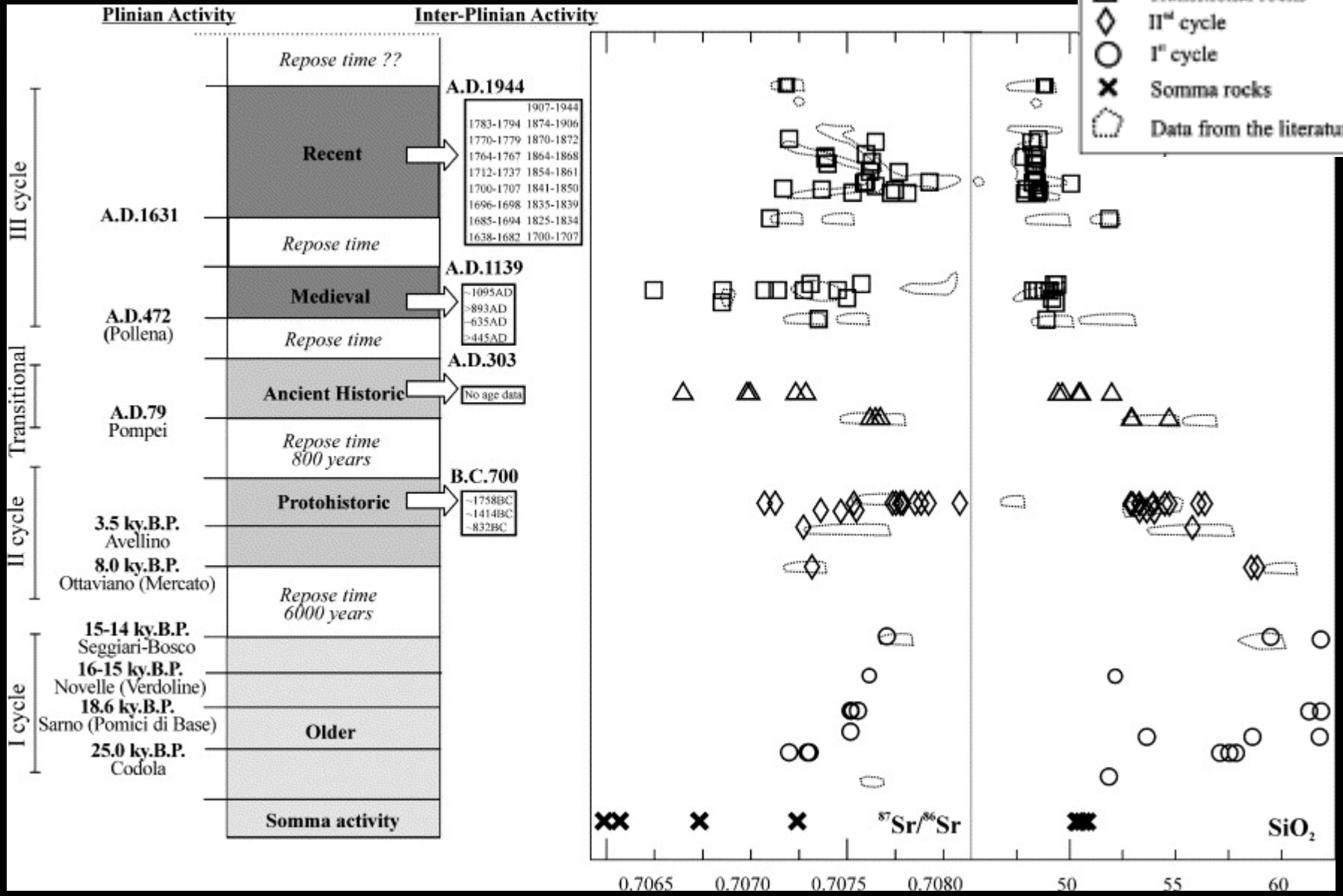
Best matching mineral: Diopside

Empirical formula:
$Al_{0.6}Ca_{1.0}Mg_{0.7}O_6Si_{1.7}$

Chemical formula:
$Ca\ (\ Mg\ ,\ Al\ )\ (\ Si\ ,\ Al\ )_2O_6$

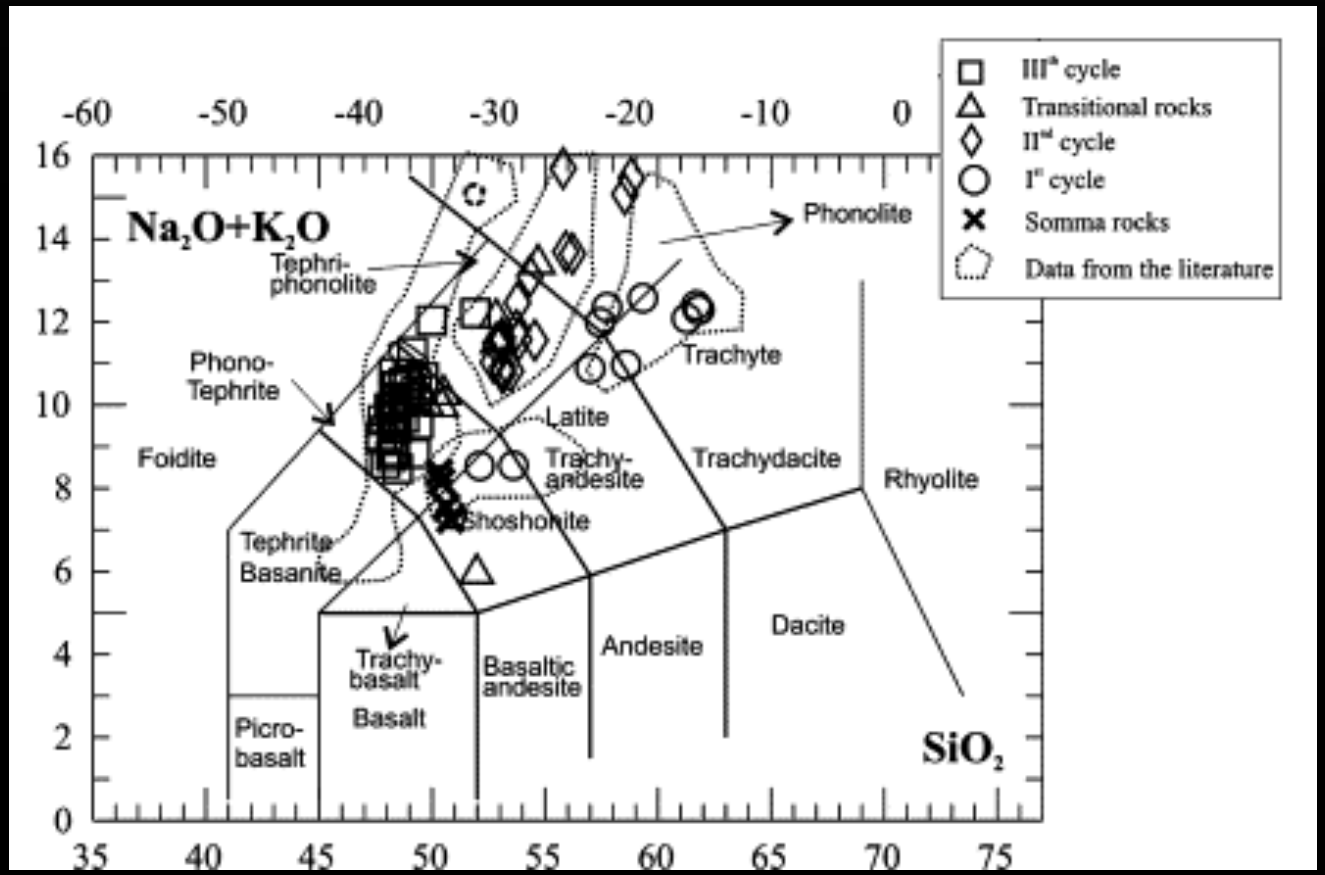
Sample	**VSV-1**
SiO2	49.028
Al2O3	15.57
Fe2O3	6.204
CaO	7.6
MgO	2.272
MnO	0.1
Na2O	1.923
K2O	8.303
P2O5	0.805
TiO2	0.785

Cycles and SiO2 trend over time



http://www.sciencedirect.com/science/article/pii/S0024493705001532

Na2O+K2O vs SiO2 diagram



http://www.sciencedirect.com/science/article/pii/S0024493705001532

Crystal system: Monoclinic
Space group: C2/c
Space group number: 15

Clinopyroxene phenocrysts composition has very narrow limits. They are diopside and diopside-augite

Augite

Diopside

Yanev et al, 2008

Conclusion

- Rock sample is a phono-tephrite
- Was ejected from a lesser explosive eruption at a time from 472 A.D. to present
- XRD and XRF results showed a clinopyroxene composition
- Diopside/Augite phenocrysts
- Age – Use of Rubidium-Strontium dating for accurate calculations

References

Yotzo Yanev, Blazo Boev, Piero Manetti, Rositsa Ivanova, Massimo D'Orazio, Fabrizio InnocentiGEOCHEMISTRY, MINERALOGY AND PETROLOGY • SOFIA. 2008, 46, 35-67. http://www.geology.bas.bg/mineralogy/gmp_files/gmp46/yanev%20et%20al.pdf

Lucia Pappalardo, Giuseppe Mastrolorenzo, Short residence times for alkaline Vesuvius magmas in a multi-depth supply system: Evidence from geochemical and textural studies, Earth and Planetary Science Letters, Volume 296, Issues 1–2, 15 July 2010, Pages 133-143, ISSN 0012-821X, 10.1016/j.epsl.2010.05.010.

Monica Piochi, Robert A. Ayuso, Benedetto De Vivo, Renato Somma, Crustal contamination and crystal entrapment during polybaric magma evolution at Mt. Somma–Vesuvius volcano, Italy: Geochemical and Sr isotope evidence, Lithos, Volume 86, Issues 3–4, February 2006, Pages 303-329, ISSN 0024-4937, 10.1016/j.lithos.2005.05.009.