CURRICULUM VITAE
FOR
MATTEO ALVARO

(Last update July 2016)

I. PERSONAL DETAILS AND CONTACTS

Date of birth: December 3rd 1982
City of birth: Milan (Italy)
Nationality: Italian
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Current Employee: Department of Earth and Environmental Sciences, University of Pavia, Via A. Ferrata, 1, I-27100 Pavia, Italy.
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ResearcherID: B-8451-2013
Google Scholar: http://scholar.google.com/citations?user=yfF0H4oAAAAJ&hl=en

II. ACADEMIC RECORD AND CAREER

February 2016 - present *(Research Scientist)*
Research topic: Elastic geobarometer for UHP metamorphic rocks.
Grant: SIR-MIUR (MILE DEEp, RBSI140351, 449.900€)
Place: University of Pavia, Italy

February 2015 – February 2016 *(Postdoctoral fellow)*
Research topic: Elastic geobarometer for UHP metamorphic rocks.
Grant: Fellowship from University of Pavia
Place: University of Pavia, Italy

April 2013 – January 2015 *(Postdoctoral fellow)*
Research topic: Thermoelastic behavior of mineral inclusions in diamonds.
Grant: ERC – INDIMEDEA (#307322)
Place: University of Padua, Italy
Advisor: F. Nestola

April 2012 –April 2013 *(Postdoctoral fellow)*
Research topic: Comparison between Martian meteorites and their terrestrial analogues for MARS-XRD experiment.
Grant: Italian Space Agency grant (n. I/060/10/0) for the MARS-XRD/ExoMars project
Place: Università G. D'Annunzio (Chieti-Pescara)
Advisor: L. Marinangeli

2010 – 2011 *(Postdoctoral fellow)*
Research topic: Framework minerals at non ambient conditions.
Grant: NSF - EAR 0738692
Place: Virginia Tech Polytechnic Institute and State University.
Advisor: Ross J. Angel

2006 – 2009 *(Ph. D. Research)*
The $P2_1/c - C2/c$ phase transition of pigeonite.
Place: Department of Earth Sciences, University of Pavia, Italy.
Advisor: Prof.ssa M.C. Domeneghetti

2006 *(Master degree – Geology, 110/110 cum laude)*
Dissertation: Investigation on the Fe^{2+}- Mg exchange reaction kinetic for PCA 82506 ureilitic meteorite.
Place: Department of Earth Sciences, University of Pavia, Italy.
Advisor: Prof.ssa M.C. Domeneghetti

2004 *(Bachelor degree – Geology, 110/110 cum laude)*
Dissertation: Study of chondritic meteorite Trenzano.
Place: Department of Earth Sciences, University of Pavia, Italy.
Advisor: Prof.ssa M.C. Domeneghetti

2001 *(High school degree, 68/100),*
Place: Liceo scientifico tecnologico. I.T.I.S. - G. Cardano Pavia, Italy

III. SCIENTIFIC ACTIVITY

A. MAIN RESEARCH TOPICS

My research is mainly focused to the determination of the chemical and physical properties of minerals phases relevant for the Earth and planetary sciences, together with the development of the mineralogical-crystallographic-elastic tools for understanding the behavior such phases under non ambient conditions. The properties of these mineral phases that represent the deep regions of our planet, meteorites from planetary bodies or technological materials provide fundamental information on planet-scale geological processes (such as convection, plate tectonics and subduction), and technological processes optimization. Moreover, my latest results are focused on the development of linear and non-linear elasticity theory applied to two components systems (*i.e.* host-inclusion). The development of my research is supported by experimental and theoretical interests that includes the following main topics:

- **High pressure** study of crystalline material by means of single-crystal X-ray diffraction using DAC (Diamond Anvil Cell) apparatus mounted on point detector and area detector diffractometers (i.e. Oxford diffraction – Agilent, Bruker and Huber systems). In particular, these experiments have a wide variety of applications from Earth's mantle elastic response (e.g. publications 2, 4, 9, 11 etc..) to industrial/commercial (*i.e.* ceramic industry, gemstone industry etc…) development and applications (e.g. publications 6, 8, 10, 17).
- **High temperature** study of crystalline material *in situ* by single-crystal X-ray diffraction using micro-furnace mounted on conventional diffractometer (*i.e.* Philips and Bruker systems). In particular, those experiments have a wide variety of applications from Earth's mantle elastic response (e.g. publication 3, 21) and the planetary bodies spectral analysis (e.g. publication 15) to industrial/commercial (*i.e.* ceramic industry, gemstone industry etc…) development and application (e.g. publications 3, 14, 16). Recently, I have been developing a new apparatus for high-temperature measurements. The considerably improved performances with respect to its predecessors allows determining lattice thermal expansion on single-crystals by means of X-ray diffraction up to 1200K with much higher precision and accuracy than before, using the same methods adopted for high-pressure measurements (e.g. 8-position centring).
- **Kinetic and equilibrium** study of crystalline material at high temperature conditions *ex situ* by single-crystal X-ray diffraction (i.e. Philips and Bruker systems) and using oven for the annealing experiments. In particular, these experiment are relevant for planetary and Earth's processes studies such as cooling rate and history of terrestrial and extraterrestrial rocks (e.g. publications 1, 5, 12, 23).
- **Low temperature** study of crystalline material *in situ* by single crystal X-ray diffraction (i.e. using cryojet system mounted on area detector diffractometer). In particular, these studies are devoted to the investigation of crystalline materials with ferroelectric and magneto-electric properties (e.g. publication 7). Few more applications recently on development regards the analysis of spectroscopic data at low temperature in order to apply the results to the shadow zones on planetary bodies.
- **Elasticity:** All the experimental methods above mentioned are fundamental tools for the characterization of any crystalline material under non-ambient conditions. Analysis of these experimental results requires knowledge of linear and non-linear elasticity. To this aim most of my latest research had been devoted to further extend and simplify elasticity theories to be applied to crystalline material (e.g. publications 18, 21). The recently developed EoSFit7c program allows users with basic knowledge on elasticity to expand their capabilities for data analysis including linear and non-linear elasticity in a simple manner.
- **Host-inclusion systems:** Expanding the limits for linear and non-linear elasticity intrinsically means dealing with more complex system such as "host-inclusion system" where the elastic response of the single phase component needs to be combined to allow the evaluation of the elastic response of the multicomponent system (e.g. publication 19, 22, 26, 27). Such multicomponent systems are among the most common cases on several disciplines going from earth sciences to material sciences (i.e. from mantle minerals to cements). Within the framework of the recently developed EoSFit7c program (publication 18) the "isomeke tool" has been developed and is still currently under development. Such tool will allow to retrieve the entrapment pressure

by means of linear and non-linear elasticity of two isotropic spherical components (host-inclusion) system also accounting for elastic relaxation effects. Furthermore, current development is aimed to expand to program capabilities to handle anisotropic and non-spherical inclusion-host systems.

- **Diamonds** are of fundamental carrier of information from the deep Earth and from the outer space. The investigation of mineral inclusions in diamonds can provide a wealth of information on the Earth mantle state and processes (e.g. publications 33, 34). I started to carry out research on such topic while member of the INDIMEDEA project funded by the European community to F. Nestola (#307322). At the same time, diamond itself can be used to retrieve insight into large scale planetary processes such as impact cratering as well as to shed light on the origin of primordial carbon in the early solar system. Currently this part of my research is sustained by a small research grant awarded by the Barringer Family (Barringer award for impact cratering research) to one of my master student (Mara Murri) to carry out the project IMPACt (Stack**I**ng disorder in dia**M**onds as a tool for investigating im**PA**ct **C**ra**T**ers)

B. PRIZES AND AWARDS: 2 national and international awards.

- **2016 "Ugo Panichi"** prize from the Italian society of Mineralogy and Petrology for the scientific activity in the field of mineralogy.
- **2015 iUCr** prize for the best scientific communication at the European Crystallography meeting, Croatia.

C. FUNDED RESEARCH PROPOSALS: 1 funded research proposal as principal investigator and 5 national and international funded research projects as team member.

- **2010-2011**: PRIN (PI: M.F. Brigatti)
- **2010-22013**: MARS-XRD/ExoMars (Italian Space Agency grant n. I/060/10/0 to L. Marinangeli)
- **2013-2018**: INDIMEDEA (ERC Starting grant #307322 PI, F. Nestola)
- **2014-2017**: PRNA (PI: L. Folco)
- **2015-2018**: TOMOX (PI: L. Marinangeli)
- **2015-2018**: *MILE DEEp* - Mineral IncLusionElasticity for a new deep subDuction gEobaromEter (MIUR-SIR, 449.900 € RBSI140351).

D. FUNDED RESEARCH PROPOSALS AT LARGE SCALE FACILITIES: 5 funded applications for beamtime at three beamlines.

- **2013:** Chromite inclusion in natural diamonds: a picture of deep earth (Diamond Light Source, DLS: I15 experiment number EE7616)
- **2014:** Diopsides in diamonds: new geobarometric approaches (Diamond Light Source, DLS: I15 experiment number EE8754)
- **2015:** The effect of cracking systems on diamond-inclusion geobarometry (Swiss Light Source, SLS: TOMCAT experiment number e15427)
- **2016:** Coesite in Diamond: a unique piezothermometer for geology (Diamond Light Source, DSL: I19, experiment number EE14928)
- **2016:** The smaller, the harder: multiphase micro-inclusions in majoritic garnet as signatures of deep Earth mantle conditions (Diamond Light Source, DSL: I15, experiment number EE14855)

E. BIBLIOMETRIC RECORDS

- 34 Research publications in ISI journals
- 82 scientific communications to national and international conferences (5 invited talks)
- More than 260 citations in the past 5 years
- H-index = 8

F. PUBLICATIONS IN PEER-REVIEWED JOURNALS: 39 publications on more than 15 high-ranked international peer reviewed journals with more than 260 citations in the past 5 years.

1. Fioretti A.M., Domeneghetti M.C., Molin G., Cámara F., **Alvaro M**., Agostini L. (2007) - Reclassification and thermal history of Trenzano chondrite. *Meteoritics & Planetary Science*, 42,10.
2. **Alvaro M.**, Nestola F., Ballaran T.B., Camara F., Domeneghetti M.C., and Tazzoli V. (2010) High-pressure phase transition of a natural pigeonite. *American Mineralogist*, 95(2-3), 300-311.
3. Redhammer G.J., Cámara F., **Alvaro M**., Nestola F., Tippelt G., Prinz S., Simons J., Roth G. and Amthauer G. (2010) Thermal expansion and high-temperature $P2_1/c$–C2/c phase transition in clinopyroxene-type $LiFeGe_2O_6$ and comparison to $NaFe(Si,Ge)_2O_6$. *Physics and Chemistry of Minerals*, 37(10), 685-704.
4. **Alvaro M**., Nestola F., Cámara F., Domeneghetti M.C., And Tazzoli V. (2011) High-pressure displacive phase transition of a natural Mg-rich pigeonite. *Physics and Chemistry of Minerals*, 38(5), 379-385.
5. **Alvaro M**., Cámara F., Domeneghetti M.C., Nestola F., And Tazzoli V. (2011) HT $P2_1/c$ to C2/c phase transition and kinetics of Fe^{2+}-Mg order-disorder of an Fe-poor pigeonite: implications for cooling history of ureilites. *Contributions to Mineralogy and Petrology*, 163(3), 599-613.
6. Gatta G.D., Angel R.J., Zhao J., **Alvaro M**., Rotiroti N., Carpenter M.A. (2011) Phase-stability, elastic behavior and pressure-induced structural evolution of kalsilite: a ceramic material and high-T/high-P mineral. *American Mineralogist*, 96(8-9), 1363-1372.
7. Gatta G.D., **Alvaro M**., Bromiley G. (2012) A low temperature X-ray single-crystal diffraction and polarised infra-red study of epidote. *Physics and Chemistry of Minerals*, 39(1), 1-15.
8. Periotto B., Nestola F., Balic-Zunic T., Pasqual D., **Alvaro M**., Ohashi H. (2012) High-pressure systematic of $NaMe^{3+}Si_2O_6$ silicates. *Solid State Communication*, 152(2), 132-137.
9. **Alvaro M**., Angel R.J., Cámara F. (2012) High-pressure behaviour of zoisite. *American Mineralogist*, 97, 1165-1176.
10. Periotto B., Angel R., Nestola F., Balić-Žunić T., Fontana C., Pasqual D., **Alvaro M**., Redhammer G. (2013). High-pressure X-ray study of LiCrSi2O6 clinopyroxene and the general compressibility trends for Li-clinopyroxenes. *Physics and Chemistry of Minerals*, 40, 378-399.
11. Dobson D. P., Miyajima N., Nestola F., **Alvaro M**., Casati N., Liebske C., Wood I.G. and Walker A.M. (2013) Inherited textures during the perovskite to post-perovskite transition and seismic anisotropy in D". *Nature Geosciences*, 6, 575-578.
12. Domeneghetti M.C., Fioretti A.M., Cámara F., McCammon C., **Alvaro M**. (2013) Thermal history of nakhlites: a comparison between MIL-03346 and its terrestrial analogue theo's flow. *Geochimica and Cosmochimica acta*, 121, 571-581.
13. Guastoni A., Nestola F., Gentile P., Zorzi F., **Alvaro M**., Lanza A., Peruzzo L, Schiazza M., and Casati N. (2013) Deveroite-(Ce) : a new REE-oxalate from Mount Cervandone, Devero Valley, Western-Central Alps, Italy. *Mineralogical Magazine*, 77(7), 3019-3026 (IMA 2013-003. CNMNC Newsletter No. X, Month 2013, page X).
14. R. Arletti, G. Vezzalini, S. Quartieri, F. Cámara, **M. Alvaro** (2013) A new framework topology in the dehydrated form of zeolite levyne. *American Mineralogist*, 98, 2063-2074
15. Ferrari S., Nestola F., Massironi M., Maturilli A., Helbert J., **Alvaro M**., Domeneghetti M.C., Zorzi F. (2014) In-situ high-temperature emissivity spectra and thermal expansion of C2/c pyroxenes. *American Mineralogist*, 99(4), 786-792 (DOI: 10.2138/am.2014.4698.)
16. Gatta G.D., Comboni D., **Alvaro M**., Lotti P., Cámara F., Domeneghetti M.C. (2014) Thermoelastic behavior and dehydration process of cancrinite. *Physics and Chemistry of Minerals*, 41(5), 373-386 (DOI:

10.1007/s00269-014-0656-2).

17. **Alvaro M**., Nestola F., Ross N.L., Domeneghetti M.C. and Reznitsky L. (2014) High pressure behavior of thiospinel $CuCr_2S_4$. *American Mineralogist* 99(5), 908-913 (DOI: 10.2138/am.2014.4689).
18. Angel R.J., Gonzalez-Platas J., **Alvaro M**. (2014) EosFit-7 and a Fortran module (library) for equation of state calculations. *Zeitschrift fuer Kristallographie*, 229(5), 405-419 (DOI: 10.1515/zkri-2013-1711)
19. Angel R.J., Mazzucchelli M.L., **Alvaro M.**, Nimis P., and Nestola F. (2014) Geobarometry from host-inclusion systems: the role of elastic relaxation. *American Mineralogist*, 99 (10), 2146-2149 (DOI: 10.2138/am-2014-5047).
20. Dobson D., Lindsay-Scott A., Wood I.G., Nestola F., **Alvaro M**., Casati N., Liebske C., Knight K.S. (2014) Time-of-flight neutron powder diffraction with milligram samples: the crystal structures of $NaCoF_3$ and $NaNiF_3$ post-perovskites. *Journal of Applied Crystallography* (47) 1-9 (doi:10.1107/S1600576714021803).
21. Pandolfo F., Cámara F., Domeneghetti M.C., **Alvaro M.**, Nestola F., Karato S., Amulele G.(2015) Volume thermal expansion along the jadeite–diopside join. *Physics and Chemistry of Minerals*, 42 (1), 1-14 (DOI: 10.1007/s00269-014-0694-9)
22. Angel R.J., **Alvaro M**., Nestola F., Mazzucchelli M.L. (2015) Diamond thermoelastic properties and implications for determining the pressure of formation of diamond inclusion systems. *Russian Geology and Geophysics*, 56, 225-234.
23. **Alvaro M.**, Domeneghetti M.C., Marinangeli, L. (2015) A new calibration to determine the closure temperatures of Fe-Mg ordering in augite from nakhlites. *Meteoritics and Planetary Science*, 50: 3, 499-507.
24. Malaspina N., **Alvaro M.**, Campione M., Wilhelm W., Nestola F. (2015) Dynamics of mineral crystallization from precipitated slab-derived fluid phase: first in-situ synchrotron x-ray measurements. *Contributions to Mineralogy and Petrology*, 169: 26, 1-12.
25. Scandolo L., Mazzucchelli M.L., **Alvaro M.**, Domeneghetti M.C., Nestola F. (2015) Thermal expansion behavior of orthopyroxenes: the role of the Fe-Mn substitution. *Mineralogical Magazine*, 79(1), 71-87.
26. Milani S., Nestola F., **Alvaro M**., Mazzucchelli M.L., Domeneghetti M.C., Geiger C.A. (2015) Diamond-garnet geobarometry: The role of garnet compressibility and expansivity. *Lithos*, 227, 140-147.
27. Angel R.J., Nimis P., Mazzucchelli M.L., **Alvaro M.**, and Nestola F. (2015) How large are departures from lithostatic pressure? Constraints from host-inclusion elasticity. *Journal of Metamorphic Geology*, 33 (8), 801-813 (doi: 10.1111/jmg.12138).
28. Periotto B., Anzolini C., Andreozzi G., Woodland A., Lenaz D., **Alvaro M.**, Princivalle F. (2015) Equation of state of hercynite spinel, $FeAl_2O_4$, and high-pressure systematics of Mg-Fe-Cr-Al spinels. *Mineralogical Magazine*, 72(2), 285-294.
29. **M. Alvaro**, R.J. Angel, C. Marciano, S. Milani, G. Zaffiro, L. Scandolo, M.L. Mazzucchelli, G. Rustioni, M.C. Domeneghetti, F. Nestola (2015) A new micro-furnace for "in situ" high-temperature single crystal X-ray diffraction measurements. *Journal of Applied Crystallography,* 48 (4), 1192-1200.
30. Angel R.J., Milani S., **Alvaro M.**, Nimis P., Nestola F. (2015) OrientXplot: A software for processing host inclusion orientation data. *Journal of Applied Crystallography*, 48 (4), 1330-1334.
31. Nestola, F., Burnham, A.D., Peruzzo, L., Tauro, L., **Alvaro, M.**, Walter, M.J., Gunter, M., Kohn, S.C. (2016): Tetragonal Almandine-Pyrope Phase, TAPP: finally a name for it, the new mineral jeffbenite. *Mineralogical Magazine*, **79**, (in press).
32. M. Murri, L. Scandolo, A. Fioretti, M.C. Domeneghetti and **M. Alvaro** (2016). Fe-Mg equilibrium behaviour in augite: implications for the thermal history of terrestrial and extraterrestrial rocks. *American mineralogist* (accepted).
33. P. Nimis, **M. Alvaro**, F. Nestola, R.J. Angel, K. Marquardt, G. Rustioni, J. Harris (2016) First evidence of hydrous silicic fluid films around solid inclusions in gem-quality diamonds. *Lithos*, in press.
34. Angel R.J., Milani S., **Alvaro M.**, Nestola F. (2016) High quality structures at high pressure? Insights from inclusions in diamonds. *Zeitschrift für Kristallographie*, in press.
35. J. Gonzalez-Platas, **M. Alvaro**, F. Nestola and R.J. Angel (2016) EosFit7-GUI: A new GUI tool for equation of state calculations, analyses, and teaching. *Journal of Applied Crystallography*, in press.
36. S. Milani, R.J. Angel, L. Scandolo, M.L. Mazzucchelli, T. Boffa-Ballaran, S. Klemme, M.C. Domeneghetti,

R. Miletich, K. Scheidl, M. Derzsi, K. Tokár, M. Prencipe, **M. Alvaro**, F. Nestola (2016) Elastic behaviour of grossular garnets at high pressure and temperature. *American Mineralogist*, (accepted).

37. Nestola F., **Alvaro M.**, Casati M.N., Wilhelm H., Kleppe A., Jephcoat A.J., Domeneghetti M.C., Harris J.W. (2016) Peridotitic vs eclogitic diamonds: clues from in situ synchrotron X-ray diffraction on clinopyroxenes still trapped within diamonds. *American Mineralogist*, (accepted).
38. Jones AP, **Alvaro M**, Nestola F, Dobson D, Hazael R, McMillan P, Moore M, Prencipe M, Salzmann C, Wyllie R (2016) Structural characterization of natural diamond shocked to 60 GPa; implications for Earth and planetary systems. *LITHOS* special issue, Diamond (Eds Nestola, Alvaro et al), accepted.

G. PUBLICATIONS (NON-PEER-REVIEWED JOURNALS)

1. **Alvaro M.** (2009) Pigeonite under non-ambient conditions. *Scientifica Acta*, 3, 17-22.
2. **Alvaro M.** (2010) Pigeonite under non-ambient conditions. *Plinius* 37 (SIMP Ph.D. thesis).
3. Nimis, P., Angel, R.J., **Alvaro, M.**, Nestola, F. From mineralogy to petrology: The example of diamond and its inclusions. *Rendiconti Online Societa Geologica Italiana*, 37, 47-49.

H. EDITORIAL ACTIVITY: Editor and reviewer for several national and international peer reviewed journals.

1. ***Editor for:*** Frontiers (Earth and Planetary Material division, editorial board member); Lithos (guest editor for the special issue "The nature of diamonds and their use in Earth's sciences)
2. ***Manuscript reviewer for:*** Acta Crystallographica section B; American Mineralogist; Mineralogical Magazine; Physics and Chemistry of minerals, Science China, Lithos.

I. MEETINGS CONFERENCES, SEMINARS AND WORKSHOPS: Over 80 contributions to national and international conferences)

2006

1. **Alvaro M**., Cámara F., Domeneghetti M.C., Pistorino M., Zema M., Tazzoli V. Cinetica del processo di ordine-disordine Fe^{2+} - Mg in una pigeonite P21/c povera in ferro. **SIMP 2006**, Sept. 27-30th 2006. Fulminimaggiore, IT
2. Short course: "High-Pressure Experimental Techniques seminar: Basic principles of high-pressure single-crystal X-ray diffraction technique by means of diamond anvil cell". Nov. 8th 2006. Parma, IT

2007

3. **Alvaro M**., Nestola F., Boffa Ballaran T., Cámara F., Domeneghetti M. C., Tazzoli V. High-pressure phase transition and crystal structure evolution of natural pigeonite. **GEOITALIA 2007**, Sept. 11 – 14th 2007. Rimini, IT
4. **Alvaro M**., Cámara F., Nestola F., Ohashi H. Solid solution of (R3+Li) molecule in Pbca pyroxene. **GEOITALIA 2007**, Sept. 11 – 14th 2007. Rimini, IT
5. **Alvaro M**., Cámara F., Domeneghetti M.C., & Tazzoli V. P21/c → C2/c phase transition and kinetics of Fe^{2+}-Mg order-disorder in Fe-poor P_21/c pigeonite. **SMEC2007**, Apr. 15 – 20th 2007. Miami, FL
6. DMG-Short Course "Doktorandenkurs": "High-Pressure Experimental Techniques and Applications to the Earth's Interior". Feb. 19 – 24th 2007. Bayreuth, D

2008

7. F. Nestola, F. Cámara, **M. Alvaro**, M.C. Domeneghetti, V. Tazzoli, H. Ohashi. High-pressure behaviour of a Li-bearing orthopyroxene. **1st SIMP-AIC joint meeting**, Sept. 7-12th 2008. Sestri levante (GE), I
8. G.J. Redhammer, F. Cámara, **M. Alvaro**, F. Nestola, H. Ohashi. High-temperature P21/c – C2/c phase transition of LiFe3+Ge2O6. **1st SIMP-AIC joint meeting**, Sept. 7-12th 2008. Sestri levante (GE), I

9. Short course: Mineral physics at non ambient conditions (R. Miletich). Jul. 8 – 12th 2008. Milan, IT
10. **Alvaro M**., Nestola F., Boffa Ballaran T., Cámara F., Domeneghetti M. C., Tazzoli V. HP – phase transition of a natural P21/c pigeonite: spontaneous strain and structure evolution. **EGU 2008**, Apr. 11 – 18th 2008. Wien, A
11. **Alvaro M**., Nestola F., Boffa Ballaran T., Cámara F., Domeneghetti M. C., Tazzoli V. HP study of a natural pigeonite. International school of mineralogy 2008: "HP-HT Mineral Physics: implications for geosciences". Feb. 11 – 15th 2008. Bressanone, IT

2009

12. **Alvaro M**., Nestola F., Cámara F., Domeneghetti M. C., Tazzoli V. Composition Vs transition pressure: a model for clinopyroxenes. GEOITALIA 2009, Sept. 9 – 11th 2009. Rimini, IT
13. Nuove applicazioni della spettroscopia raman nei minerali. (New application of raman spectroscopy to minerals). **Workshop GNM**, Feb. 12th 2009. Parma, IT

2010

14. Angel R.J., Ross N., Sochalski-Kolbus L.M., and **Alvaro M.** Structure-based thermodynamic properties of feldspars. **2010 GSA Annual meeting**, Oct 31st – Nov 3rd 2010. Denver, CO, USA
15. Cámara F., **Alvaro M**., Gatta G.D., R.J. Angel. HT-study of the P31c ↔ P63 phase transition in kalsilite, KAlSiO4. **SIMP 2010**, Sept 13th – 17th 2010 Ferrara, Italy
16. **Alvaro M**., Cámara F., Gatta G.D., R.J. Angel. Elastic behaviour of zoisites and their geological implications. **SIMP 2010**, Sept 13th – 17th 2010 Ferrara, Italy
17. Periotto B., Nestola F., Balic-Zunic T., Pasqual D., **Alvaro M**. High-pressure systematic of NaMe3+Si2O6 pyroxenes: volume compression vs Me3+ cation radius. **EGU 2010**, May 2nd – 7th 2010 Wien, A
18. Software fayre: going from raw data to hkl file". **ECM26 2010 Workshop**, Aug 29th – Sept 5th 2010 Darmstad, D. ***Invited talk***
19. **Alvaro M**., Nestola F., Cámara F., Domeneghetti M. C., Tazzoli V. and R.J. Angel. P21/c to C2/c phase transition in clinopyoxenes and the geodynamic implications. **ECM26 2010**, Aug 29th – Sept 5th 2010 Darmstad, D
20. **Alvaro M**., Nestola F., Cámara F., Domeneghetti M. C., Tazzoli V. and R.J. Angel. Phase transition mechanisms in clinopyroxenes under non-ambient conditions. **ACA 2010**, Jul 23rd – Jul 27th. Chicago, USA

2011

21. Gatta, G.D., **Alvaro M**., Bromiley G. The effects of temperature on the crystal structure of a natural epidote. **Geoitalia 2011**, Sept 19th – 23rd 2011. Turin, I
22. VT meeting series: Series of weekly seminars organized by the geosciences department at Virginia Tech. 2010-2011, Blacksburg, USA

2012

23. Arletti R., Quartieri S., Vezzalini G., **Alvaro M**., Càmara F. A New Zeolite Topology Deriving From Levyne Dehydration. **OXYDE 2012**, Sep 23rd - 27th 2012. Turin, I
24. Domeneghetti M.C., Fioretti A.M., Cámara F., McCammon C., **Alvaro M**. Thermal history of nakhlites: a comparison between MIL03346 and its terrestrial analogue Theo's flow. **EMC 2012**, Sep 2nd – 6th 2012. Frankfurt, D
25. Arletti R., Quartieri S., Vezzalini G., **Alvaro M**., Càmara F. Dehydration dynamics of levyne: a combined synchrotron XRPD and single crystal diffraction study. **EMC 2012**, Sep 2nd – 6th 2012. Frankfurt, D

2013

26. Ferrari S., Nestola, F., Helbert, J., Maturilli, A., D'Amore, M., **Alvaro, M.**, Domeneghetti, M., Massironi, M., Hiesinger, H. Calcium pyroxenes at Mercurian surface temperatures: investigation of in-situ emissivity spectra and thermal expansion. **AGU Fall meeting 2013**, December 9-13th 2013. San Francisco, CA, USA

27. F. Cámara, D. Comboni, D.G. Gatta, **M. Alvaro**, P. Lotti. New Thermal Expansion Parameter And Dehydration Behavior Of Cancrinite. **ECM 28,** Aug 25th – 29th 2013. Warwick, UK
28. P. Lotti, G.D. Gatta, D. Comboni, **M. Alvaro**, F. Cámara, N. Rotiroti. Cancrinite-group minerals ([CAN]-framework type) at non-ambient conditions. **GIC-AIZ 2013**, Sept 15th – 18th 2013. Riccione, I
29. **M. Alvaro**. The role of mineral physics for the understanding of the Earth and planetary bodies. Invited seminar speaker. Jul 2013. Pavia, I
30. Rossella Arletti, Simona Quartieri, Giovanna Vezzalini, **Matteo Alvaro**, Fernando Cámara. Dehydration dynamics of levyne: evidence for a new zeolite topology. **AIZ 2013**, Jul 7th – 12th 2013. Moscow, RU
31. **M. Alvaro**. The role of mineral physics for the understanding of the Earth and planetary bodies. Invited seminar speaker. May 2nd – May 4th 2013. Chieti, I .
32. Sula Milani, Matteo Mazzucchelli, Fabrizio Nestola, **Matteo Alvaro**, Ross J. Angel, Charles A. Geiger, and Chiara Domeneghetti. The P-T conditions of garnet inclusion formation in diamond: thermal expansion of synthetic end-member pyrope (pico). **EGU 2013**, Apr 7th – 12th 2013. Wien, A

2014

33. **M. Alvaro**, R.J. Angel, M.L. Mazzucchelli, F. Nestola, M.C. Domeneghetti. Isomekes: Fundamental tool to determine the formation pressure for the diamond-inclusion pair. **EGU 2014**, April 27th May 2nd 2014. Wien, A
34. R.J. Angel, **M. Alvaro**, M.L. Mazzucchellli, P. Nimis, and F. Nestola. How much differential stress can a rock support? **EGU 2014**, April 27th May 2nd 2014. Wien, A
35. Casati N., Nestola F., **Alvaro M.**, Wilhelm H., Kleppe A., Nimis P., Harris J.W. Clinopyroxenes still trapped in diamonds: high-energy synchrotron X-ray diffraction as a chemical probe. **EGU 2014**, April 27th May 2nd 2014. Wien, A
36. P. Lotti, G.D. Gatta, V. Kahlenberg, M. Merlini, **M. Alvaro**, and F. Cámara (2014) Cancrinite-group minerals behavior at non-ambient conditions. **EGU 2014**, April 27th May 2nd 2014. Wien, A
37. J.Gonzalez-Platas, R.J. Angel, **M. Alvaro**, F. Nestola. EosFit7: A new program for equation of state analyses and calculations. **DGK 2014**, March 17th – 20th 2014. Berlin, D
38. F. Cámara, M. E. Ciriotti, E. Bittarello, **M. Alvaro**. New data on the crystal-chemistry of arrojadite: an HT study. **IMA 2014**, Sep. 1st – 5th 2014. Gauteng, South Africa.
39. Fioretti AM, **Alvaro M.**, Domeneghetti M.C., Marinangeli, L. (2014) New augite geothermometer for Nakhlites. **77th Annual Meeting of the Meteoritical-Society**. Sep. 8th – 13th 2014. Casablanca, Morocco. METEORITICS & PLANETARY SCIENCE 49, A118
40. Paolo Lotti, G. Diego Gatta, Marco Merlini, Fernando Cámara, Nicola Rotiroti, Davide Comboni, **Matteo Alvaro**. Cancrinite-group minerals at non-ambient conditions: a model of the thermo-elastic and structure behavior. **SIMP-SGI 2014**, Sep. 10th -12th 2014. Milano, I.
41. Malaspina N., **Alvaro M.**, Nestola F. Slab-derived fluid phase precipitation at high pressures. **SIMP-SGI 2014**, Sep. 10th -12th 2014. Milano, I.
42. Lorenzo Scandolo, Mazzucchelli M.L., Chiara M. Domeneghetti, **Matteo Alvaro**, Fabrizio Nestola, Francesco Pandolfo. Thermal expansion behavior of orthopyroxenes: the role of the Fe-Mn substitution. **SIMP-SGI 2014**, Sep. 10th -12th 2014. Milano, I.
43. Domeneghetti M.C., Alvaro M., Fioretti A.M., Cámara F., Marinangeli L. New augite geothermometer for nakhlites. **SIMP-SGI 2014**, Sep. 10th -12th 2014. Milano, I.
44. Milani S., **Alvaro M.** & Nestola F. Diamond-garnet geobarometry using isomekes: the role of garnet compressibility and thermal expansion. **SIMP-SGI 2014**, Sep. 10th -12th 2014. Milano, I.
45. Nestola F., **Alvaro M.**, Nimis P., Angel R.J., Milani S., Bruno M., Prencipe M. & Harris J.W. Diamond-olivine host-inclusion system: crystallography and depth of formation. **SIMP-SGI 2014**, Sep. 10th -12th 2014. Milano, I.
46. **Alvaro M.**, Angel R.J., Mazzucchelli M.L., Nestola F. & Nimis P. Isomekes: a chemically-independent method for geobarometry of UHPM rocks. **SIMP-SGI 2014**, Sep. 10th -12th 2014. Milano, I.

47. Mazzucchelli M.L., Angel R.J., **Alvaro M.**, Nestola F. & Nimis P. : Geobarometry for host-inclusion systems: the role of elastic relaxation. **SIMP-SGI 2014**, Sep. 10th -12th 2014. Milano, I.
48. Ross J. Angel, Javier Gonzalez-Platas, **Matteo Alvaro**, Fabrizio Netsola. EosFit7: A new program for equation of state analysis. **2nd Joint AIC-SILS conference**, Sep. 15th -18th 2014. Florence, I.

2015

49. **Alvaro M.**, Domeneghetti M.C., Fioretti A.M.. Pyroxenes Fe-Mg exchange reaction and its application to planetary studies. **XII Congresso Nazionale di Scienze Planetarie**, Feb 2nd-6th 2015. Bormio, I
50. **M**. **Alvaro**. Thermal expansion measurements on single crystals. April 2015. Invited seminar. PhD programme of the "Fakultät für Geowissenschaften, Geographie und Astronomie" University of Wien, A.
51. Mattia L. Mazzucchellli, Ross Angel, **Matteo Alvaro**, Paolo Nimis, Chiara Maria Domeneghetti and Fabrizio Nestola. Elastic geobarometry for ultra-high pressure metamorphic (UHPM) rocks **EGU 2015**, April 12th 17th 2015. Wien, A
52. **M.Alvaro**, R.J. Angel, C. Marciano, G. Zaffiro, L. Scandolo, M. L. Mazzucchelli, S. Milani, G. Rustioni, C. M. Domeneghetti, and F. Nestola. Development of a new micro-furnace for "in situ" high-temperature single crystal X-ray diffraction measurements **EGU 2015**, April 12th 17th 2015. Wien, A
53. N. Malaspina, **M. Alvaro**, M. Campione, and F. Nestola. Dynamics of mineral crystallization at inclusion-garnet interface from precipitated slab-derived fluid phase: first in-situ synchrotron x-ray measurements **EGU 2015**, April 12th 17th 2015. Wien, A
54. P. Nimis, F. Nestola, R.J. Angel, S. Milani, **M. Alvaro**, C. Anzolini, M. Schiazza, M. Bruno, M. Prencipe, J.W. Harris, and M.T. Hutchison. Crystallographic relationships between diamond and its inclusions **EGU 2015**, April 12th 17th 2015. Wien, A
55. **M. Alvaro**, R.J. Angel, C. Marciano, G. Zaffiro, L. Scandolo, M.L. Mazzucchelli, S. Milani, G. Rustioni, C.M. Domeneghetti, and F. Nestola. Development of a new micro-furnace for "in situ" high-temperature single crystal X-ray diffraction measurements **EGU 2015**, April 12th 17th 2015. Wien, A
56. N. Malaspina, **M. Alvaro**, M. Campione, and F. Nestola. How Mineral Infillings Crystallize In Multiphase Inclusions From UHP Fluid Phase: First In Situ Synchrotron X-ray Measurements. European Current Research On Fluid Inclusions (**ECROFI-XXIII**)
57. **M. Alvaro**, R.J. Angel, C. Marciano, S. Milani, L. Scandolo, M.L. Mazzucchelli, G. Zaffiro, G. Rustioni, M. Briccola, M.C. Domeneghetti, F. Nestola. A new micro-furnace for "in situ" high-temperature single crystal X-ray diffraction measurements **ECM 2015,** August 22nd – 29th 2015, Rovinj, HR.
58. Scandolo L., **Alvaro M.**, McCammon C., Milani S., Di Prima M., Domeneghetti M.C., Nestola F. The role of oxidation on the high-temperature behavior of almandine. **Congresso congiunto SIMP-AIV-SoGeI-SGI**. September 2nd - 4th 2015. Florence, I
59. G. Zaffiro, R.J. Angel, **M. Alvaro**, F. Nestola, M.C. Domeneghetti, L. Scandolo, M.L. Mazzucchelli, S. Milani, G. Rustioni, C. Marciano. New micro-furnace for "in situ" high-temperature single crystal X-ray diffraction measurements. **Congresso congiunto SIMP-AIV-SoGeI-SGI**. September 2nd - 4th 2015. Florence, I
60. **M. Alvaro**, R.J. Angel, M.L. Mazzucchelli, M.C. Domeneghetti, F. Nestola. Elastic geobarometry for UHPM rocks: A link between mineralogy and petrology. **Congresso congiunto SIMP-AIV-SoGeI-SGI**. September 2nd - 4th 2015. Florence, I
61. Murri M., Scandolo L., **Alvaro M.**, Domeneghetti M.C., Fioretti A.M. Clinopyroxene Fe-Mg exchange reaction applied to Martian nakhlites. **Congresso congiunto SIMP-AIV-SoGeI-SGI**. September 2nd - 4th 2015. Florence, I
62. G. Rustioni, R.J. Angel, S. Milani, M.L. Mazzucchelli, P. Nimis, M.C. Domeneghetti, F. Marone, **M. Alvaro**, J.W. Harris, F. Nestola. Elastic geobarometry for host-inclusion systems: Pressure release and the role of brittle failure. **Congresso congiunto SIMP-AIV-SoGeI-SGI**. September 2nd - 4th 2015. Florence, I
63. S. Milani, L. Scandolo, G. Zaffiro, M. Di Prima, M.L. Mazzucchelli, **M. Alvaro**, M.C. Domeneghetti, F. Nestola. On the determination of the entrapment pressure for garnet inclusions in diamond. **Congresso congiunto SIMP-AIV-SoGeI-SGI**. September 2nd - 4th 2015. Florence, I

64. M.L. Mazzucchelli, R.J. Angel, **M. Alvaro**, P. Nimis, M.C. Domeneghetti, F. Nestola. Host-inclusion geobarometry for ultra-high pressure metamorphic (UHPM) rocks. **Congresso congiunto SIMP-AIV-SoGeI-SGI**. September 2nd - 4th 2015. Florence, I
65. S. Ferrari, **M. Alvaro**, F. Nestola, A. Maturilli, J. Helbert, M. C. Domeneghetti, M. Massironi and F. Zorzi. Thermal Expansion of C2/c Pyroxenes: Implications for the Thermal Infrared Spectroscopy of Solar System Bodies. **Congresso congiunto SIMP-AIV-SoGeI-SGI**. September 2nd - 4th 2015. Florence, I
66. Chiara Anzolini, Fabrizio Nestola, Antony D. Burnham, Luca Peruzzo, Leonardo Tauro, **Matteo Alvaro**, Michael J. Walter, Mickey Gunther and Simon C. Kohn Diffraction and spectroscopic characterization of jeffbenite: a high-pressure marker in diamonds. **ECMS 2015**. September 9-11th 2015. Rome, I
67. Niccolò Menegoni, Fabrizio Nestola, **Matteo Alvaro** and Sula Milani. A combined micro-Raman spectroscopy and single-crystal X-ray diffraction approach: an example on natural and synthetic garnets. **ECMS 2015**. September 9-11th 2015. Rome, I
68. S. Milani, F. Nestola, **M. Alvaro** and V. Stagno. Diamond-eclogitic garnet pair: A test case to elastic geobarometry. **Goldschmidt 2015**.
69. Jones Adrian, Fabrizio Nestola, **Matteo Alvaro**, David Price. High-pressure shock behavior of diamond, laboratory experiments, synchrotron characterization and application to natural systems: examples and discussion. CECAM (Carbon at extreme conditions). October 26th - 30th 2015. Lugano, Swiss.
70. Nimis, P., Angel, R.J., Alvaro, M., Nestola, F. From mineralogy to petrology: The example of diamond and its inclusions. Geologia delle Alpi, Venezia November 20th 2015. Rendiconti Online Societa Geologica Italiana, 37, 47-49.

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71. **M. Alvaro**, R.J. Angel, C. Marciano, G. Zaffiro, L. Scandolo, M.L. Mazzucchelli, S. Milani, G. Rustioni, C.M. Domeneghetti, and F. Nestola. Development of a new micro-furnace for "in situ" high-temperature single crystal X-ray diffraction measurements. **24th Annual Meeting of the German Crystallographic Society (DGK)**, March 14th – 17th 2016, Universität Stuttgart, D.
72. R.J. Angel, **M. Alvaro**, P. Nimis, M.L. Mazzucchelli, F. Nestola. Single Inclusion Piezobarometry Reveals High-temperature decompression path for Varisican Granulites. **EGU 2016,** April 17th 22nd 2016. Wien, A
73. M.L. Mazzucchelli, R.J. Angel, G. Rustioni, S. Milani, P. Nimis, M.C. Domeneghetti, F. Marone, J.W. Harris, F. Nestola, **M. Alvaro**. Elastic geobarometry and the role of brittle failure on pressure release. **EGU 2016,** April 17th 22nd 2016. Wien, A
74. P. Nimis, **M. Alvaro**, F. Nestola, R.J. Angel, K. Marquardt, G. Rustioni, J.W. Harris. Hydrous Silicic Fluid Films around Solid Inclusions in Gem-Quality Diamonds. **IGC 2016**, 35th International Geological Congress, 27 August - 4 September 2016, Cape Town, South Africa.
75. M. Murri, L. Scandolo, A.M. Fioretti, M.C. Domeneghetti, **M. Alvaro.** Fe-Mg exchange reaction in clinopyroxene and its application to the thermal history of planetary bodies. Lunar and Planetary Science Conference 21st -25th March, Houston, Texas (USA).
76. Angel R.J., **M. Alvaro**, Gonzalez-Platas J. & Nestola F. New features in EosFit: fitting elastic moduli and phase transitions. European Mineralogical Conference – **EMC 2016**, 11th-15th September, Rimini, Italy.
77. Nimis P., **Alvaro M.**, Nestola F., Angel R.J., Marquardt K., Rustioni G. & Harris J.W. Hydrous silicic fluid films around solid inclusions in gem-quality diamonds. European Mineralogical Conference – **EMC 2016**, 11th-15th September, Rimini, Italy.
78. Nestola F., Angel R.J., Nimis P., **Alvaro M.**, Milani S., Harris J.W. The crystallographic orientations between diamond and its Mg-chromite inclusions. European Mineralogical Conference – **EMC 2016**, 11th-15th September, Rimini, Italy.
79. G. Rustioni, R.J. Angel, M.L. Mazzucchelli, S. Milani, P. Nimis, M.C. Domeneghetti, F. Marone, J.W. Harris, F. Nestola & **M. Alvaro**. Pressure release for host – inclusion systems: the interplay between brittle failure and fluid phase. European Mineralogical Conference – **EMC 2016**, 11th-15th September, Rimini, Italy.

80. **Alvaro M.**, Angel R.J., Mazzucchelli M.L., Nestola F. New constraints on PT evolution of metamorphic rocks from single inclusion piezobarometery. European Mineralogical Conference – **EMC 2016**, 11th-15th September, Rimini, Italy.
81. M. Murri, L. Scandolo, A.M. Fioretti, M.C., F. Nestola, Domeneghetti & **M. Alvaro**. new insights on Theo's flow lava using intracrystalline thermometry on augites. European Mineralogical Conference – **EMC 2016**, 11th-15th September, Rimini, Italy.
82. Mazzucchelli M.L., Burnley P., Angel R.J., Domeneghetti M.C., Nestola F., **Alvaro M.** Elastic geobarometry: uncertainties arising from the shape of the inclusion. European Mineralogical Conference – **EMC 2016**, 11th-15th September, Rimini, Italy.

J. ORGANIZATION OF MEETINGS, CONFERENCES, SEMINARS AND WORKSHOPS: Active part of the organizing committee for several national and international workshops and conferences. Convener for 3 sessions at international conference.

1. Organization committee for **International Diamond School** "The nature of diamonds and their use in Earth's study". Bressanone-Brixen, 27-31st January 2015.
2. Co-convener for the session **"**High-pressure and high-temperature mineral physics: a link between petrology, geophysics and geodynamics" (GMPV3.2) at **EGU 2015** (European Geoscience Union 2015), Wien.
3. Co-convener for the session **"**Inclusion-host systems: melt, fluid and solid inclusions and their importance in Earth Sciences" (GMPV4.2) at **EGU 2015** (European Geoscience Union 2015), Wien.
4. **Elasticity course**, within the framework of the PhD programme of the University of Pavia (3 CFU).
5. **EosFit Workshop** at 29th European Crystallographic Meeting (ECM-2015) in Rovinj, Croatia.
6. Sponsorship organization committee for **EMC 2016** (European Mineralogical Conference 2016), Rimini
7. Convener for session "Inclusions in minerals as record of geological processes: new analysis methods and application" (S9) at **EMC 2016** (European Mineralogical Conference 2016), Rimini.
8. Organizing committee and lecturer for the workshop "Inclusions in minerals as record of geological processes: New analysis methods and application" at **EMC 2016** (European Mineralogical Conference 2016), Rimini.

IV. TEACHING ACTIVITIES

- Tutoring for Mineralogy and Laboratory course for students of first and second year of the degree in Geological Sciences at the University of Pavia (a.y. 2006-2007, 2007-2008, 2008-2009, 2012-2013, BSc)
- Lecturer for the course "analytical methologies" (a.y. 2015-2016, M.Sc., 3 CFU)
- Lecturer for the course "Analytical methodologies applied to geosciences" (a.y. 2016-2017, M.Sc. degree, 6CFU)

V. SUPERVISING ACTIVITIES

- **Bachelor degree students**

1. **Davide Comboni** *(Now PhD at University of Milan, I)*: New thermoelastic parameters, thermal expansion behaviour and dehydration of cancrinite. *July 2013*
2. **Mattia Luca Mazzucchelli:** Diamond inclusions: new thermoelastic parameters for pyrope. *July 2013*
3. **Mara Murri:** Critical reassessment of the thermoelastic properties for diamond. *July 2014*
4. **Greta Rustioni:** The role of fractures on the entrapment pressure for diamond-inclusion pair. *September 2014*
5. **Gabriele Zaffiro:** Development of a new resistance furnace for in situ high temperature single-crystal X-Ray diffraction. *January 2015*
6. **Matteo Di Prima:** Almandine garnet at high-temperature: the role of controlled oxygen fugacity. *July 2015*

- **Master degree students**

7. **Mattia Luca Mazzucchelli:** Pressure of formation determination for host-inclusion systems. *July 2015*
8. **Mara Murri** *(now partially funded by The Barringer award for Impact related research)***:** Geothermometer calibration for augites.
9. **Greta Rustioni** *(Now PhD at BGI, Bayreuth D)***:** Brittle deformation in minerals.
10. **Gabriele Zaffiro:** Characterization of the stress distribution in synthetic host-inclusion pairs.

- **Doctoral degree students**

11. Lorenzo Scandolo: Thermal expansion of mantle minerals inclusions in diamonds (2013-2016).
12. Mattia L. Mazzucchelli: Finite Element Modelling (FEM) of elastic anisotropy for host inclusion systems (2015-2018).