AYUNTAMIENTO DE SABERO · *Avda. 10 de Enero*, 4 · 24810 · *Sabero* · *León*
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La investigadora leonesa M.Carmen Sánchez Valle, vecina de nuestro municipio, ha visto reconocido su trabajo sobre los Supervolcanes, tanto a nivel nacional como internacional. Desde nuestro municipio estamos orgullosos de ello y por eso la traemos a nuestra página web y reproducimos alguno de los artículos relacionados.
Existen numerosas publicaciones que pueden ser examinadas a través de internet. Aquí colgamos algunas de ellas.

dl | león 08/01/2014

La investigadora leonesa Carmen Sánchez-Valle ha publicado un artículo sobre supervolcanes en la prestigiosa revista Nature Geoscience, que revela los mecanismos de activación de estas erupciones y que hasta ahora eran un misterio.Un grupo de geólogos del Instituto Federal de Tecnología Suizo (ETH Zurich) dirigidos por Sánchez-Valle ha demostrado que la presión generada debido a la diferencia de densidad entre el magma y las rocas circundantes es suficiente para provocar la erupción de uno de estos gigantes geológicos.
Los supervolcanes no son volcanes comunes y sus erupciones son explosivas y violentas, formando agujeros gigantes en la corteza terrestre —calderas— de hasta 100 kilómetros de diámetro y con una actividad muy baja —una erupción cada 100.000 años—. Así, la última supererupción tuvo lugar hace aproximadamente 26.500 años en Lago Taupo (Nueva Zelanda), por lo que los investigadores solo obtienen vagaas evidencias sobre estos fenómenos por medio del estudio de los depósitos de ceniza y rocas que sobreviven tras la erupción. Un grupo de investigadores que encabeza la profesora Sánchez-Valle ha identificado recientemente un mecanismo activador de supererupciones basándose en medidas experimentales de la densidad de magma.
Ahora la hipótesis ha sido confirmada por el equipo en torno a la española Carmen Sánchez-Valle, de la Escuela Federal Superior Técnica (ETH) de Zúrich, que estableció la densidad del magma de los supervolcanes con ayuda de rayos X del European Synchrotron Radiation Facility (Laboratorio Europeo de Radiación Sincrotrón) en Grenoble.
El equipo analizó combinaciones de magma fabricadas artificialmente en diferentes condiciones de presión y temperatura, y llegó a la conclusión de que las diferencias de densidad entre el magma y las rocas circundantes pueden generar tanta presión que hagan explotar la cámara.
"El efecto se puede comparar con el impulso de una pelota de fútbol inflada con aire bajo el agua, que debido a que el agua que la rodea es más pesada es empujada hacia arriba", escribe el autor principalWim Malfait.

"Los resultados muestran que con una cámara magmática de tamaño suficiente la presión causada solamente por las diferencias de densidad alcanza para poner en marcha una erupción y romper la costra terrestre", explicó Sánchez-Valle.
Otros mecanismos como tensiones tectónicas pueden contribuir a la super-erupción, pero no son imprescindibles, subrayan los científicos. Los resultados pueden ayudar ahora a controlar mejor a los supervolcanes "dormidos".
Investigadores en torno a Luca Caricchi, de la Universidad de Ginebra, llegaron a una conclusión similar. Utilizaron modelos informáticos, datos conocidos de erupciones de supervolcanes y 1,2 millones de simulaciones para resolver el misterio de estos procesos.

Sanchez-Valle, Carmen, Prof.

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Carmen Sanchez-Valle has been tenure track Assistant Professor of Experimental Geochemistry/Mineral Physics at the Institute of Geochemistry and Petrology since January 2007. Carmen Sanchez-Valle earned a Bachelor degree in Physics at the University of Valladolid (Spain) in 1999 and a Master degree in Condensed Matter at the University Claude Bernard Lyon 1 (Lyon, France) a year later. In 2003 she received her PhD degree in Earth Sciences at the Ecole Normale Supérieure (ENS) de Lyon. She spent three years as a post-doctoral research associate at the University of Illinois at Urbana-Champaign (UIUC, USA) before moving to ETH Zurich to lead the Experimental Geochemistry/Mineral Physics group.

Carmen Sanchez-Valle's research covers a broad range of topics aimed at understanding the evolution and dynamics of the deep Earth and planets through direct investigation of the physical and chemical properties of geomaterials (solids, fluids or melts) under high pressure and temperature conditions.

Research interest includes investigations of:
1) the thermodynamic properties of fluids and melts and their reactivity with minerals at high pressure to quantify mass transfer and recycling in subduction zones;
2) the physical properties and stability of hydrous minerals at ultra-high pressures to constrain water storage and circulation in the mantle;
3) the sound velocities and elasticity of mantle minerals to interpret seismic observations;
4) the properties of planetary ices to understand the internal dynamics of ice satellites.

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combined with in-house and synchrotron-based spectroscopic techniques for the characterization of samples under in situ conditions.

Research

Research Highlights:
- Deep waters
- Titan Ocean

List of publications.pdf

Latest publications (pdf files)

Zr complexation in high pressure fluids and silicate melts and implications for the mobilization of HFSE in subduction zones. Marion Louvel, Carmen Sanchez-Valle, Wim J. Malfait, Denis Testemale, Jean-Louis Hazemann, Geochimica et Cosmochimica Acta 104 (2013), 281-299.pdf

Effect of water and network connectivity on glass elasticity and melt fragility. Wim J. Malfait, Carmen Sanchez-Valle, Chemical Geology 346 (2013), 72-80.pdf

Thermodynamic properties of aqueous NaCl solutions to 1073 K and 4.5 GPa, and implications for dehydration reactions in subducting slabs. Mantegazzi, D., Sanchez-Valle C., Driesner Th., Geochim. Cosmochim. Acta 121 (2013), 263-290, doi:10.1016/j.gca.2013.07.015.

Shear wave anisotropy in textured phase D and constraints on deep water recycling in subduction zones. Angelika D. Rosa, Carmen Sanchez-Valle, Carole Nisr, Shaun R. Evans, Regis Debord, Sébastien Merkel, Earth and Planetary Science Letters, 377-378 (2013), 13-22.pdf

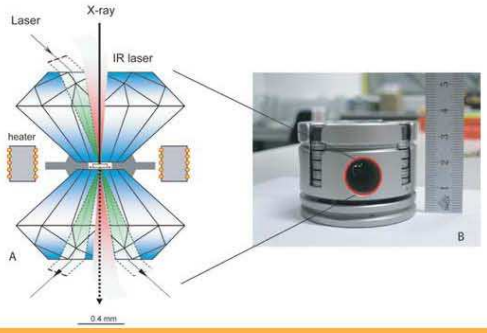
Equation of state, refractive index and polarizability of compressed water to 7 GPa and 673 K. Carmen Sanchez-Valle, Davide Mantegazzi, Jay D. Bass, Eric Reusser. Chemical Physics, 138, 054505 (2013); doi: 10.1063/1.4789359.

Structure and Thermodynamics of Subduction Zone Fluids from Spectroscopic Studies. Carmen Sanchez-Valle, Reviews in Mineralogy & Geochemistry, Vol. 76, Number Chapter 8 (2013).pdf

Solubility and partitioning behavior of Au, Cu, Ag and reduced S in magmas. Zoltan Zajacz, Philip A. Candela, Philip M. Piccoli, Carmen Sanchez-Valle, Markus Wälle. Geochimica et Cosmochimica Acta 112 (2013), 288-304.pdf

Density of phonolitic magmas and time scales of crystal fractionation in magma chambers. R. Seifert, W.J. Malfait, S. Petitgirard, C. Sanchez-Valle, Earth and Planetary Science Letters, 381 (2013), 12-20.pdf

Submitted papers (pdf)



Volatile, melts & the genesis of magmatic-hydrothermal ore deposits

The research in this direction focuses mainly on understanding the role of magmas (composition, volatile content) in the genesis of ore deposits. Research has been conducted to understand the solubility of Au and Cu in high temperature volatiles and silicate melts, and on the determination of volatile/andesite melt partitioning of S and Cl and a number of metals. This research has lead to show the role of alkali metals on the extraction of Au from magmas into the exsolved volatile phase, possibly through the formation of alkali-S-Au complexes that may be key to understand the transport of Au in natural systems. The structure and stability of these new complexes is investigated using computational methods and in situ X-ray absorption spectroscopy at high P-T condition.

Planetology

The newest direction of our research activities aims at understanding the composition and internal dynamics of ice satellites by combining experimental studies of the physico-chemical properties of ices and low temperature aqueous mixtures and geodynamical modeling. In collaboration P. Tackley and F. Deschamps from the Fluid Geodynamics group, we currently focus on understanding the effect of anti-freeze compounds (methanol, NH_3, CH_4, salts) on the crystallization of the primordial ocean of ice satellites. Using available thermodynamic data on methanol-water mixtures and thermal convection models we have shown that if methanol is present in the primordial ocean of Titan, the crystallization of the ice layer may stop and a sub-surface ocean of about 90 km depth may be maintained in the interior of the satellite.

Publications + Resources

Research achievements | Personnel and resources (kFr)

Year	ISI peer-reviewed publications chair	ISI peer-reviewed publications group total	Citations of all publications	PhD Students present	Students graduated/year Master	Students graduated/year Bachelor	Research spending total	Research spending 3rd party funding	Research spending personnel costs of total
2006	-	-	00	-	-	-	0	0(0%)	0(0%)
2007	1	0	00	1			0	0(0%)	0(0%)
2008	2	0	00	3			0	0(0%)	0(0%)
2009	1	0	00	4			0	0(0%)	0(0%)
2010	4	0	00	5			0	0(0%)	0(0%)
2011	2*	0*	-	6					
Total	**10**	0	--	-	-	-	**0**	**0***	**0**

*incl. in press

Annual base financing ETH (2010): - kFr PA, - kFR OK

* 3rd party funding (2006-2010): -% SNF+ ETH projects, -%EU, -%industry and others.

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Due to the interdisciplinary character of this research, Carmen Sanchez-Valle holds strong collaborations with seismologists, geophysicists and fluid geochemists within the Earth Sciences department as well as with other research units at the Paul Scherrer Institute (PSI).

Selected Key Publications <h=8, 148 tot. citations, 40 cit./year (2009-2010)>:

Past ten years

- Deschamps, F., Mousis, O., **Sanchez-Valle, C.**, and Lunine, J.I. (2010) The role of methanol on the crystallization of Titan's primordial ocean. Astrophysical Journal, 724, 887-894.
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Scientific Career Achievements

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- Lakshtanov, D.L., Sinogeikin, S.V., Litasov, K.D., Prakapenka, V.B., Hellwig, H., Wang, J., **Sanches-Valle, C.**, Perrillat, J.P., Chen, B., Somayazulu, M., Ohtani E., and Bass, J.D. (2007). Post-stishovite phase transition in hydrous alumina-bearing SiO2 in the lower mantle of the Earth. Proceedings of the National Academy of Sciences 104, 13588-13590.

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Experimental Geochemistry and Mineral Physics

RESEARCH ACTIVITIES/HIGHLIGHTS

Our main research interests are focused in understanding the structure and dynamic processes occurring in the Earth's deep interior. This task requires an interdisciplinary approach that combines experimental studies of the properties of materials building the Earth's interior with geophysical observations and geochemical records.

Mineral solubilities, element partitioning & speciation in subduction zone fluids

Although the contribution of deep fluids in subduction processes is widely recognized, there remain considerable uncertainties concerning their chemical composition and the exact mechanism that transport elements from the slab to the mantle wedge and eventually to the surface through volcanic activity. In an attempt to constrain the chemistry of these fluids, we determine in situ the solubility of minerals (namely carbonates and silicates) and the partitioning and speciation of selected geochemical tracer between minerals-melts-and aqueous fluids at high pressure. Recent work has focused on the partitioning and speciation of halogens and HFSE element in hydrous fluids and silicate melts, and on the use of As redox state during serpentinization to track mantle wedge hydration processes.

Thermodynamic properties of aqueous fluids & melts

The goal of our research is to improve and extend the available models for the density and thermodynamic properties of aqueous fluids and volatile-bearing melts at upper mantle conditions. Combining acoustic velocity measurements in the diamond anvil cell by Brillouin spectroscopy, efforts in this direction have recently provided the first experimentally based equation of state for NaCl-H_2O and carbonate-bearing aqueous fluids that are proxies for fluids in the upper mantle. Also melts we have used a synchrotron X-ray absorption technique and determined in situ the density of dry and hydrous granitic melts, H_2O and CO_2-bearing alkali magmas and carbonatite melts at upper mantle conditions. In collaboration with T. Driesner and C. Heinrich from the Fluid inclusion group we obtain high precision data on the density and thermodynamic properties of salt and gas solutions (CO_2-H_2O mixtures) at low pressure (< 1 kbar) that are implemented in computational models to constrain fluid circulation in shallow hydrothermal systems (e.g., hydrothermal ore deposits, geothermal wells).

Mineral physics

Research in this field is focused in two main topics: 1) water in the mantle and subdution zones and 2) chemical heterogeneities in the mantle. As seismology is the preferred method to detect hydration and chemical anomalies in the deep Earth, we investigate the elasticity and rheological properties of candidate phases at high pressure conditions to elucidate 1) the seismic signature water in deep subducted slabs, and 2) the effect of minor elements (Al, Ca,) on the seismic velocities and anisotropy of mantle minerals. Investigations have included water carriers in the slabs (e.g., antigorite and the dense hydrous magnesium silicate phases Phase A, E, D and superhydrous B) and provide valuable constrains on the possibility of detecting hydration through seismic observations. Additionally, we have shown that Ca in majorite garnets cannot explain the elevated seismic gradients observed in the transition zone and that Al strongly increases the seismic velocities of orthopyroxenes and could affect the visibility of seismic discontinuities in the upper mantle. With colleagues from the seismology group (L. Boschi and T. Nissen-Meyer) the mineral physics data produced in our laboratory is implemented in forward and inverse models to better interpret seismic observations in terms of mineralogy, composition, temperature and flow patterns.

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Experimental Geochemistry and Mineral Physics

Selected Key Publications Group *(past ten years)*:

- **Malfait, W.J., Sanchez-Valle, C.,** Ardia, P, Médard, E. and Lerch, P.(2011) Compositional dependent compressibility of dissolved water in silicate glasses. American Mineralogist: doi: 10.2138/am.2011.3718.
- **Malfait, W.J.** and Xue, X.Y.(2010) The nature of hydroxyl groups in aluminosilicate glasses: quantifying Si-OH and Al-OH abundances along the SiO_2-$NaAlSiO_4$ join by 1H, 27Al-1H and 29Si-1H NMR spectroscopy. Geochimica Et Cosmochimica Acta, 74: 719-737.
- **Malfait, W.J.** (2009) The 4500 cm-1 infrared absorption band in hydrous aluminosilicate glasses is a combination band of the fundamental (Si,Al)-OH and O-H vibrations. American Mineralogist, 94(5-6): 849-852.
- **Malfait, W.J.** and Halter, W.E. (2008). Structural relaxation in silicate glasses and melts: High-temperature Raman spectroscopy. Physical
- **Malfait, W.J.,** Halter, W.E., Morizet, Y., Meier, B.H. and Verel, R. (2007) Structural control on bulk melt properties: Single and double quantum 29Si NMR spectroscopy on alkali-silicate glasses. Geochimica Et Cosmochimica Acta, 71(24): 6002-6018.
- **Zajacz Z.,** Seo J. H., Candela P.A., Piccoli P.M., and Tossell J. A. (2011) The solubility of copper in high-temperature magmatic vapors: A quest for the significance of various chloride and sulfide complexes. Geochimica Et Cosmochimica Acta 75, 2811-2827.
- **Zajacz Z.,** Seo J. H., Candela P.A., Piccoli P.M., Heinrich C. A., and Guillong M. (2010) Alkali metals control the release of gold from volatile-rich magmas. Earth and Planetary Science Letters 297, 50-56.
- **Zajacz Z.** and Halter W. (2009) Copper transport by high temperature, sulfur-rich magmatic vapor: Evidence from silicate melt and vapor inclusions in a basaltic andesite from the Villarrica volcano (Chile). Earth and Planetary Science Letters 282, 115-121.
- **Zajacz Z.** and Halter W. (2007) LA-ICPMS analyses of silicate melt inclusions in co-precipitated minerals: Quantification, data analysis and mineral/melt partitioning. Geochimica Et Cosmochimica Acta 71, 1021-1040.

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