

Publications scientifiques (2006-2017)

Under Review

- [66] • Morard G., J. Bouchet, A. Rivoldini, D. Antonangeli, M. Roberge, E. Boulard, A. Lincot, A. Denoeud, M. Mezouar (2017) "Liquid properties in the Fe-FeS system under moderate pressure: tool box to model small planetary cores". *Am. Min.*, Under Review.
- [65] • Tetsuya Komabayashi, Giacomo Pesce, **Guillaume Morard**, Daniele Antonangeli, Ryosuke Sinmyo, Mohamed Mezouar (2017) "Phase transition boundary between fcc and hcp structures in the system Fe-Si and its implications for thermodynamics of silicon-bearing Earth's core". *J. Geophys. Res.*, Under Review.
- [64] • Boccato S., Torchio R., Kantor I., **Morard G.**, Anzellini S., Giampaoli R., Briggs R., Smareglia A., Irifune T. and Pascarelli S. (2017) "The melting curve of nickel up to 100 GPa explored by XAS". *J. Geophys. Res.*, Under Review.
- [63] • Antonangeli D., **Morard G.**, Paolasini L., Garbarino G., Murphy C. A., Edmund E., Decremps F., Fiquet G., Bosak A., Mezouar M., Fei Y. (2017) "Sound velocities and density measurements of solid hcp-Fe and hcp-Fe-Si(9wt.%) alloy at high pressure: Constraints on the Si abundance in the Earth's inner core". *EPSL*, Under Review.

2017

- [62] • Suehiro, Sho, Kenji Ohta, Kei Hirose, **Guillaume Morard**, and Yasuo Ohishi. 2017. "The Influence of Sulfur on the Electrical Resistivity of Hcp Iron: Implications for the Core Conductivity of Mars and Earth." *Geophysical Research Letters* 44 (16): 8254–59. doi:10.1002/2017GL074021.
- [61] • **Morard, G.**, D Andraut, D Antonangeli, Y Nakajima, A L Auzende, E Boulard, S Cervera, et al. 2017. "Fe – FeO and Fe – Fe 3 C Melting Relations at Earth ' S Core – Mantle Boundary Conditions : Implications for a Volatile-Rich or Oxygen-Rich Core." *Earth and Planetary Science Letters* 473. Elsevier B.V.: 94–103. doi:10.1016/j.epsl.2017.05.024.
- [60] • **Morard, G.**, Y. Nakajima, D. Andraut, D. Antonangeli, A. L. Auzende, E. Boulard, S. Cervera, et al. 2017. "Structure and Density of Fe-C Liquid Alloys Under High Pressure." *Journal of Geophysical Research: Solid Earth*, 1–11. doi:10.1002/2017JB014779.
- [59] • Albertazzi, Bruno, Norimasa Ozaki, Vasily Zhakhovsky, Anatoly Faenov, Hideaki Habara, Marion Harmand, Nicholas Hartley, et al. 2017. "Dynamic Fracture of Tantalum under Extreme Tensile Stress." *Science Advances* 3 (6): e1602705. doi:10.1126/sciadv.1602705.
- [58] • Hartley, N. J., N. Ozaki, T. Matsuoka, B. Albertazzi, A. Faenov, Y. Fujimoto, H. Habara, et al. 2017. "Ultrafast Observation of Lattice Dynamics in Laser-Irradiated Gold Foils." *Applied Physics Letters* 110 (7): 071905. doi:10.1063/1.4976541
- [57] • Mori, Y., H. Ozawa, K. Hirose, R. Sinmyo, S. Tateno, **G. Morard**, and Y. Ohishi. 2017. "Melting Experiments on Fe–Fe3S System to 254 GPa." *Earth Planet. Sc. Lett.* 464: 135–41.

2016

- [56] • Hirose, Kei, **Guillaume Morard**, Ryosuke Sinmyo, Koichio Umemoto, John W. Hernlund, and Stéphane Labrosse. 2017. "SiO₂ Crystallization and Compositional Evolution of the Earth's Core." *Nature*, 2–12. doi:10.1038/nature21367
- [55] • Dobson, D. P., Hunt, S. A., Ahmed, J., Lord, O. T., Th, E., Santangeli, J., ... Mezouar, M. (2016). The phase diagram of NiSi under the conditions of small planetary interiors. *Physics of the Earth and Planetary Interiors*. In press
- [54] • Boulard, Eglantine, Yijin Liu, Ai L Koh, Mary M Reagan, Julien Stodolna, **Guillaume Morard**, Mohamed Mezouar, and Wendy L. Mao. 2016. "Transformations and Decomposition of MnCO₃ at Earth ' S Lower Mantle Conditions." *Frontiers in Earth Science* 4 (December): 1–9. doi:10.3389/feart.2016.00107.
- [53] • Pikuz, T. A., Faenov, A. Y., Ozaki, N., Hartley, N. J., Albertazzi, B., Matsuoka, T., ... Kodama, R. (2016). Indirect monitoring shot-to-shot shock waves strength reproducibility during pump-probe experiments. *Journal of Applied Physics*, 120(3), 1–8.
- [52] • Torchio, R., Boccato, S., Cerantola, V., **Morard, G.**, Irifune, T., & Kantor, I. (2016). Probing the local , electronic and magnetic structure of matter under extreme conditions of temperature and pressure. *High Press. Res.*, 36(3), 293–302.
- [51] • Denoeud, A., Ozaki, N., Benuzzi-Mounaix, A., Uranishi, H., Kondo, Y., Kodama, R., ... **Morard, G.** (2016). Dynamic X-ray diffraction observation of shocked solid iron up to 170 GPa. *Proceedings of the National Academy of Sciences*, 113(28), 7745–7749.
- [50] • Bolis, R. M., **Morard, G.**, Vinci, T., Ravasio, A., Bambrink, E., Guarguaglini, M., ... Benuzzi-Mounaix, A. (2016). Decaying shock studies of phase transitions in MgOSiO₂ systems: implications for the Super-Earths interiors. *Geophys. Res. Lett.*, 43, 1–9.

- [49] • Decremps, F., **Morard, G.**, Garbarino, G., & Casula, M. (2016). Polyamorphism of a Ce-based bulk metallic glass by high-pressure and high-temperature density measurements. *Physical Review B - Condensed Matter and Materials Physics*, 93(5), 1–7.
- [48] • Amadou, N., De Resseguier, T., Brambrink, E., Vinci, T., Benuzzi-Mounaix, A., Huser, G., **G. Morard**, F. Guyot, K. Miyanishi, N. Ozaki, R. Kodama, and M. Koenig (2016). Kinetics of the iron α - ϵ Phase transition at high-strain rates: Experiment and model. *Physical Review B - Condensed Matter and Materials Physics*, 93(21), 1–6.
- 2015 [47] • Pradhan, G. K., Fiquet, G., Siebert, J., Auzende, A.-L., **Morard, G.**, Antonangeli, D., & Garbarino, G. (2015). Melting of MORB at core–mantle boundary. *Earth and Planetary Science Letters*, 431, 247–255
- [46] • Harmand M. and A. Ravasio, S. Mazevet, J. Bouchet, A. Denoeud, F. Dorchie, Y. Feng, C. Fourment, E. Galtier, J. Gaudin, F. Guyot, R. Kodama, M. Koenig, H.J. Lee, K. Miyanishi, **G. Morard**, R. Musella, B. Nagler, M. Nakatsutsumi, N. Ozaki, V. Recoules, S. Toleikis, T. Vinci, U. Zastrau, D. Zhu, A. Benuzzi-Mounaix, “Melting of iron close to Earth’s inner core boundary conditions and further”, *Phys. Rev. B.*, **92**, 024108.
- [45] • Antonangeli, D., **Morard, G.**, Schmerr N. C., Komabayashi T., Krisch M., Fiquet G., Fei Y., “A mineral physics reference model for the Moon’s core”, *Proc. Nat. Ac. Sc.*, 112(13), 3916–3919.
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- [42] • Andraut D., Trønnes R. G., Konôpková Z., Morgenroth W., Liermann H. P., **Morard G.** and Mezouar M. “Phase diagram and P-V-T equation of state of Al-bearing seifertite at lowermost mantle conditions” *Am. Min.*, 2014, **99**, 2035-2042.
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- [38] • Benuzzi-Mounaix A., Mazevet S., Ravasio A., Vinci T., Denoeud A., Koenig M., Amadou N., Brambrink E., Festa F., Levy A., Harmand M., Brygoo S., Huser G., Recoules V., Bouchet J., **Morard G.**, Guyot F., de Resseguier T., Myanishi K., Ozaki N., Dorchie F., Gaudin J., Leguay P. M., Peyrusse O., Henry O., Raffestin D., Le Pape S., Smith R. and Musella R. “Progress in warm dense matter study with applications to planetology”, 2014, *Phys. Scripta*, 014060
- [37] • **Morard, G.**, Andraut, D., Antonangeli, D., Bouchet J. “Properties of iron alloys under Earth’s core conditions”, *Compte Rendus Acad. Sciences Géosciences*, 2014, **346**, 5-6, 130-139
- [36] • **Morard, G.**, Siebert, J. and Badro J. ” Partitioning of Si and Platinum Group Elements between liquid and solid Fe-Si alloys”, 2014, *Geochim. Cosmochim. Acta*, **132**,94-100.
- [35] • Crépisson, C., **Morard, G.**, Bureau, H., Prouteau, G., PetitGirard, S., Sanloup, C., ”Magmas trapped at depth and the continental lithosphere-asthenosphere boundary”, *Earth Planet. Sc. Lett.*, 390 (2014) 287-295.
- [34] • **Morard, G.**, Garbarino, G., Antonangeli, D., Andraut, D., Guignot, N., Siebert, J., Roberge, M., Boulard, E., and Petitgirard, S., 2013. Density measurements and structural properties of liquid and amorphous metals under high pressure. *High Press. Res.*, 2014, **34**, 1, 9-21.
- 2013 [33] • Amadou, N., Brambrink, E., Benuzzi-Mounaix, A., Huser, G., Guyot, F., Mazevet, S., **Morard, G.**, De Resseguier, T., Vinci, T., Myanishi, K., Ozaki, N., Kodama, R., Boehly, T., Henry, O., Raffestin, D., and Koenig, M., 2013. Direct laser-driven ramp compression

studies of iron: A first step toward the reproduction of planetary core conditions. *High Energy Dens. Phys.* **9**, 243-246.

- [32] • **Morard, G.**, Siebert, J., Andrault, D., Guignot, N., Garbarino, G., Guyot, F., and Antonangeli, D., 2013. The Earth's core composition from high pressure density measurements of liquid iron alloys. *Earth Planet. Sc. Lett.*, **373**, 169-178.
- [31] • Anzellini, S., Dewaele, A., Mezouar, M., Loubeyre, P. and **Morard, G.**, 2013. Melting of Iron at Earth Core Conditions Evidenced by X-Ray Diffraction", *Science*, **340**, 464-466.
- [30] • Wang Y., Nishiyama N., Hilairet N., Yahata N., Tsuchiya T., **Morard, G.**, and Fiquet G., High-pressure, high-temperature deformation of CaGeO₃ (perovskite)±MgO aggregates: implications for multi-phase rheology of the lower mantle, *G-Cube*, In press.
- [29] • Bouchet, J., Mazevet, S., **Morard, G.**, and Guyot, F., 2013. Ab-initio equation of state of iron up to 15 Mbars. *Phys. Rev. B*, 87, 9, 094102.
- [28] • Perrillat, J.-P., Daniel, I., Bolfan-Casanova, N., Chollet, M., **Morard, G.**, and Mezouar, M., 2013. Mechanism and kinetics of the α–β transition in San Carlos olivine Mg_{1.8}Fe_{0.2}SiO₄. *J. Geophys. Res. Solid Earth* **118**, 1-10
- [27] • Amadou, N., Brambrink, E., Benuzzi-Mounaix, A., Vinci, T., De Ressaéquier, T., Mazevet, S., **Morard, G.**, Guyot, F., Ozaki, N., Miyanishi, K., and Koenig, M., 2012. Laser-Driven Quasi-isentropic compression experiments and numerical studies of the iron alpha-epsilon transition in the context of planetology. *SCCM, AIP Conf. Proc., New York* **1426**.
- 2012** [26] • Boulard, E., Menguy, N., Auzende, A. L., Benzerara, K., Bureau, H., Antonangeli, D., Corgne, A., **Morard, G.**, Siebert, J., Perrillat, J.-P., Guyot, F., and Fiquet, G., 2012. Experimental investigation of the stability of Fe-rich carbonates in the lower mantle. *J. Geophys. Res.*, 117, B02208.
- [25] • **Morard, G.**, Andrault, D., Guignot, N., Siebert, J., Garbarino, G., and Antonangeli, D. 2010. Melting of Fe–Ni–Si and Fe–Ni–S alloys at megabar pressures: implications for the core–mantle boundary temperature. *Phys. Chem. Miner.*, 38, 767-778.
- 2011** [24] • Chollet, M., Daniel, I., Koga, K. T., **Morard, G.**, and Van de Moortele, B., 2011. Kinetics and mechanism of antigorite dehydration at subduction zone conditions. *J. Geophys. Res.*, 116, B04203.
- [23] • **Morard, G.**, Bouchet, J., Valencia, D., Mazevet, S., and Guyot, F., 2010. The melting curve of iron at extreme pressures: Implications for planetary cores. *High Energy Dens. Phys* **7**, 141-144.
- [22] • **Morard, G.**, Mezouar, M., Bauchau, S., Alvarez-Murga, M., Hodeau, J.-L., and Garbarino, G., 2010. Improvements of the multichannel collimator set-up for the study of liquids and low-Z materials under high pressure and high temperature. *Rev. Sci. Inst.*, **82**, 023904.
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- [11] • Lacomba-Perales, R., Martinez-Garcia, D., Errandonea, D., Le Godec, Y., Philippe, J., **Morard, G.** High pressure and high temperature X-ray diffraction studies of scheelite BaWO₄, *High Press. Res.*, 29, 1, 76-82 (2009)
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- 2008** [7] • **Morard G.**, Sanloup C., Guillot B., Fiquet G., Guillot B., Mezouar M., Perrillat J.P., Garbarino G., Mibe K., Komabayashi, T. and Funakoshi, K. "In situ structural investigation of Fe-S-Si immiscible liquid system and evolution of Fe-S bond properties with pressure", *J. Geophys. Res.*, 113, B10205 (2008).
- [6] • **Morard G.**, D. Andraut, N. Guignot, C. Sanloup, M. Mezouar, S. Petitgirard, G. Fiquet, "In-situ determination of Fe-Fe₃S phase diagram and liquid structural properties up to 65 GPa", *Earth Plan. Sc. Lett.*, 270, 620-626 (2008).
- [5] • **Morard G.**, Sanloup C., Fiquet G., Mezouar M., Rey, N., Poloni, R. and Beck, P., "Structural evolution of the eutectic liquid in the Fe-FeS system from 5 to 16 GPa: Implications for the extrapolation of its physical properties to Earth's core relevant pressure", *Earth Plan. Sc. Lett.*, 263, 128-139 (2007).
- 2007** [4] • **Morard G.**, Mezouar M., Rey N., Poloni R., Merlen A., Le Floch S., Toulemonde P., Pascarelli S., San Miguel A., Sanloup C. and Fiquet G., "Optimization of Paris-Edinburgh press cell assemblies for *in situ* monochromatic X-ray diffraction and X-ray absorption", *High Press. Res.*, 27, 1-11 (2007).
- [3] • Guignot N., Andraut D., **Morard G.**, Bolfan-Casanova N. and Mezouar M., "Elastic properties of the MgSiO₃ post-perovskite phase: Experimental determination to the core mantle boundary P-T conditions", *Earth Planet. Sc. Lett.*, **256**, 162-168, (2007).
- [2] • Andraut D., **Morard G.**, Bolfan-Casanova N., Ohtaka O., Fukui H., Arima H., Guignot N., Kunakoshi K., Lazor P., Mezouar M., "Study of partial melting at high pressure using *in situ* X-ray diffraction", *High Press. Res.*, **26**, 267 (2006).
- 2006** [1] • Sanloup C., Fiquet G., Gregoryanz E., **Morard G.** and Mezouar M., "Effect of Si on liquid Fe compressibility: Implications for sound velocity in core materials", *Geophys. Res. Lett.*, **31(7)**, L07604, (2004).

Communications récentes (2011-2014)

- 2014** - European High Pressure Research Group, Lyon, France, Septembre 2014
- *Invited talk* : **Morard G.**, D. Andraut, D. Antonangeli, J. Siebert, N. Guignot, F. Guyot, O. Lord, G. Garbarino, M. Mezouar "Study of liquid iron alloys under high pressure: implications for planetary cores"

- Workshop High Pressure Science at 3rd Generation Synchrotron Facilities: State-of-the-art and Future Prospects, Grenoble, France, Février 2014
 - *Invited talk* : **Morard G.**, Antonangeli D., Amadou N., Brambrink E., Vinci T., Benuzzi-Mounaix A., Huser G., Brygoo S., Guyot F., de Resseguier T., Mazevet S., Miyanishi K., Ozaki N., Kodama R., Henry O., Raffestin D., Boehly T., Koenig M., Mezouar M., Andrault D. “Experimental studies of planetary cores”
- 2013**
- Workshop Approach to the Center of the Earth, Sendai, Japon, Février 2013
 - *Invited talk* : **Morard G.**, D.Antonangeli, J.Siebert, D.Andrault, N.Guignot, F.Guyot, G.Garbarino, “Properties of liquid iron alloys under high pressure: implications for the Earth’s core”.
 - Goldschmidt Conference, Florence, Italie, Aout 2013
 - *Oral presentation* : **Morard G.**, D.Antonangeli, J.Siebert, D.Andrault, N.Guignot, F.Guyot, G.Garbarino, “Composition of the Earth’s core from density measurements of liquid iron alloys at megabar pressure”.
 - AGU Fall meeting, San Francisco, USA, Décembre 2013
 - *Invited talk* : **Morard G.**, G. Garbarino, D. Antonangeli, D. Andrault, N. Guignot, J. Siebert, M. Roberge, E. Boulard, A. Lincot, A. Denoeud, S. Petitgirard, “Density measurements and structural properties of liquid and amorphous metals under high pressure studied by in situ X-ray scattering”.
 - *Invited talk* : **Morard G.**, D.Antonangeli, J.Siebert, D. Andrault, N.Guignot, F.Guyot, O.Lord, G.Garbarino, M.Mezouar “Melting properties of iron alloys under Earth’s core conditions”.
- 2012**
- CECAM workshop: New insights on metals under extreme conditions, Décembre 2012
 - *Invited talk* : **Morard G.**, “Melting properties and equation of state of Fe-Ni-S and Fe-Ni-Si liquid alloys up to megabar pressures”.
 - AGU Fall Meeting 2012, Décembre 2012
 - *Convener of a session* : “High-Pressure Melting, Phase Diagrams, and Planetary Cores”
Conveners: Morard, G., Terasaki, H., Lord, O.
 - *Poster* : Bouchet, J., **Morard, G.**, Guyot, F., Mazevet, S., “Ab-initio study of Fe and Fe₃S at high pressures”.
 - *Invited talk* : Sanloup, C., Crépisson, C., **Morard, G.**, Bureau, H., Prouteau, G., Petitgirard, S., “Magmas trapped at depth and the continental lithosphere-asthenosphere boundary”.
 - *Poster* : **Morard G.**, D.Antonangeli, J.Siebert, D.Andrault, N.Guignot, F. Guyot, G.Garbarino, “Melting properties and densities of Fe-Ni-S and Fe-Ni-Si liquid alloys up to megabar pressure”.
 - *Poster* :Antonangeli D., T. Komabayashi, **G. Morard**, G. Fiquet, Y. Fei, “Sound velocity measurements on iron at high pressure and high temperature: an experimental test of the Birch’s law”.
 - Joint 2012 COMPRES Annual Meeting and High-Pressure Mineral Physics Seminar-8, Lake Tahoe, Juillet 2012.
 - *Poster* :**Morard G.**, D.Antonangeli, J.Siebert, D.Andrault, N.Guignot, M.Mezouar, G.Garbarino, “Melting properties of iron alloys under high pressure”.
- 2011**
- Workshop on Analysis of Diffraction Data in Real Space, Grenoble, Octobre 2011.
 - *Poster* : **Morard G.**, M. Mezouar, S. Bauchau, M. Álvarez-Murga, J.-L. Hodeau, J.Siebert, D.Antonangeli, M.Roberge, E.Boulard, G.Garbarino, “Improvements of the multichannel collimator set-up on ID27, ESRF: applications to liquid iron alloys study under high pressure and high temperature”.
 - Goldschmidt Conference, Prague, Aout 2011.
 - *Oral presentation* : **Morard G.**, Siebert, J., Antonangeli, D., and Badro, J., “Partitionning of Pt-Re-Os between solid and liquid metal in the Fe-Ni-Si system”.
 - 3rd Japan-France Workshop and School on High Density Energy Science, Les Houches, Janvier 2011.
 - *Invited talk* : **Morard G.** “Study of Super Earth's internal structure”.