

# Adi MacArtney

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## Contact Information

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## Research Interests

Mars: Studying the geology, mineralogy, carbon cycle, and atmosphere of Mars.

## Appointments

Associate lecturer, University of St Andrews Jan 2018 – May 2018. Course lead, astrobiology.

Graduate teaching assistant, University of Glasgow June – present 2018. Course lead on the overseas immersion programme (OIP), Singapore, and University of Electronic Science and Technology of China (UESTC), mechatronics and electrical engineering.

## Education

*Glasgow University, Glasgow, Scotland Nov 2013 - 2018*

Ph.D. in Geology and Space Engineering, completed. Advisors: Prof. Martin Lee and Dr Patrick Harkness. Thesis Title: Atmosphere-crust coupling and carbon sequestration on early Mars. The research explores whether mineral carbonation may have partially caused the loss of the early Mars atmosphere. I compared mineral carbon sequestration in Martian meteorites with terrestrial analogues (Semail and Leka ophiolites), and supported this by conducting chambered geochemical carbonation experiments.

- For the engineering component to my thesis, I created a prototype of a new ultrasonic polisher (the Micro Optic UltraSonic Exfoliator - MOUSE) for potential use on a future Mars rover as part of the Space Glasgow Ultra Sonic Planetary Drilling team.
- I designed, price negotiated, and implemented the chambered experiments conducted at the British Geological Survey.

*Open University, Milton Keynes, UK*

Postgrad courses in Geology (2013): Two modules equalling 50% of an MSc Earth science.

B.Sc. in Geoscience (First Class Honours), Feb 2009 - Nov 2013. Honours Thesis Topic: Vulnerability, consequences and mitigation techniques for settlements in the Bhutanese Po Chu river catchment resulting from glacial lake outburst flood hazards from the Lunana glacial complex.

### **Technical Skills**

- Laboratory geochemistry experiments with high pressure gas chambers.
- Zeiss Sigma and Quanta SEM (WDS/EBSD/EDS) including quantitative SEM and calibration of machines.
- FEI T20 TEM (with FEI DuoMill FIB slice sample preparation).
- Geochemical modelling on PHREEQC and Geochemist Workbench to support practical geochemical hydrothermal pressure-temperature experiments.
- ABAQUS 6.14-2 finite element analysis (FEA) software for exploratory modal analysis (EMA).
- Metrology analysis on Mitutoyo Surftest SJ-210 portable surface roughness tester.
- Assisted with ICPMS laboratory.
- Fluid analysis and data processing.
- Soldering Electronics.

### **Awards & Qualifications**

- Paneth Trust Award (Royal Astronomical Society) for a project on Transmission Kikuchi Diffraction (TKD): Developing a new technique for microstructural analysis of planetary materials, 2015.
- Placed in top 10 international science writers on Biotechnology (2014) by the Oxbridge roundtable.
- Licentiate of the Royal Photographic Society (LRPS).

### **Publications**

MacArtney, A. (2015). Physical properties, chemical formula, and X-ray Bremsstrahlung spectral synthesis of the inosilicate, phyllosilicate, tectosilicate and unclassified silicate minerals. 806 pages. This has been independently published as part of a planned 7 volumes covering all known minerals classified under the Dana system.

Torcea, M., Kumar, N., MacArtney A. (2017). Physical properties, chemical formula, and X-ray Bremsstrahlung spectral synthesis of the sorosilicate, nesosilicate and cyclosilicate minerals. Volume 2 of the published book series above.

MacArtney, A., Li, X., Harkness, P. Ultrasonics can increase the Mars rover rock abrasion tool surface smoothness capability: clearer images for less power consumption. Planned submission in March 2018 to *Ultrasonics*.

MacArtney, A., Lee, M.R., Scott, E.R.D. (to be submitted) Melt glass replaced by carbonate in Martian meteorite ALH 84001: A multiple impact model for the formation of generational carbonates from distinct heterogeneous processes. Planned submission for April 2018 to *Meteoritics & Planetary Science*.

The final chapter of my thesis will be submitted for publication. It is regarding a hydrothermal experiment I conducted with the British Geological Survey monitoring carbonation and sulphur dynamics of varying minerals under differing gas regimes. Currently in prep for submission to the journal *Applied Geochemistry*.

## **Employment**

*May 2018 – present*

*Graduate teaching assistant and course lead at the University of Glasgow.*

Teaching mechatronics and electrical engineering to 3<sup>rd</sup> year undergraduates from OIP (4 weeks) and 1<sup>st</sup> year undergraduates from UESTC (2 weeks) during their summer schools. Responsible for 14 demonstrators, plus technicians. I ran these courses in both 2017 and 2018 and have been offered them for 2019.

*Jan 2018 – May 2018*

*Associate Lecturer at the University of St Andrews.*

Teaching astrobiology to a mixed class ranging from 1<sup>st</sup> to 3<sup>rd</sup> year undergraduates. Subject areas ranged from cosmochemistry and planet formation, the search for exoplanets, Earth and Mars evolutions, first life and experimental geochemistry.

*Nov 2009 - Sep 2013*

*The Open University and Scottish Institute for Enterprise (SIE).*

Initially an intern for SIE, providing student business support and organising student events and conferences. Later as admin in the enrolment and fees department assessing funding applications and providing general student support advice via phone, letter and email. SIE was a part time post (6 hours a week). Prior to starting full time with the OU I set up and ran a small customer service operation.

*Feb 2008 - Aug 2008*

*Sewa Ashram, Delhi. Homeless, TB and HIV medical clinic.*

Primarily a media and networking assistant, acting as liaison between diverse NGOs and creating contacts, although also assisting medically. Awarded the LRPS for photography during this time.

*July 2005 - Feb 2009*

*Wolf Expeditions and World Challenge Expeditions (WCE).*

Initially an expedition leader in the Indian Himalaya for WCE leading young teams on month long trekking routes and social projects. I later formed my own company Wolf Expeditions, doing the same with the addition of mountaineering support and guiding in remote and unclimbed regions.

*July 2001 - July 2005*

*Outdoor activity centres (NST, JCA, Delphi, Scottish Centres).*

Instructing climbing, kayaking, archery, sailing, shooting and fencing to a wide clientele.

### **Teaching Experience**

- Associate lecturer and course lead teaching a semester of astrobiology for a mixed class (1-3<sup>rd</sup> year) at the University of St Andrews, Scotland.
- Graduate teaching assistant for two summer schools, one in mechatronics/robotics for a month-long collaboration with the University of Singapore, another a two-week engineering school for visiting Chinese undergraduates.
- Supervised two undergraduate students in compiling an 800-page book of silicate mineral spectra (to be published June 2017), teaching SEM and INCA software skills.
- Team leader of an undergraduate and postgraduate space balloon team, which launched a successful meteorite contamination experiment to low orbit, making national news.
- Private online tutoring of undergraduates for geology and Earth science via 'Tutor Hunt.' This involved preparing teaching materials on structural geology and mapping.
- Senior member of the student support team for the Open University Edinburgh office, assisting students with a wide variety of issues, both academic/administrative/ financial(2000-2013).
- Assisted in organising geology field trips to Siccar Point, Scotland PhD students.
- Eight years experience of teaching and guiding clients on mountains in Scotland, the Alps, and the Himalaya.

## **Selected Press**

[Royal Society Exhibit: Breaking the greenhouse: storing sky as stone](#)

[How Exploring Mars Could Help Us Fight Climate Change on Earth - Featured in the Huffington Post and in The Conversation](#)

[Why Our Science Institutions Fail Us: The Case Of Boaty McBoatface - Huffington Post](#)

[LGBT STEM Interview](#)

[Rock Head Sciences Interview](#)

## **Conference Organising and Exhibitions**

- Royal Society Summer 2016 Science Exhibition. Storing skies as stone: Breaking the greenhouse.
- Building Habitable Worlds 2015 Astrobiology conference, Principle conference organiser, Glasgow, Scotland, 25th February 2015.

## **Contributed Oral**

- 12th Early Career Planetary Scientists' Meeting, 19th - 20th February 2015, Canterbury, England. Multi-generational carbonate replacement of glass in the Martian meteorite Allan Hills 84001 precludes biological origin.
- Space Glasgow Research Conference, 28th October 2014, Glasgow, Scotland. Investigating mineral carbon sequestration as a mechanism for the loss of the Martian atmosphere.
- EANA The 14th European Workshop on Astrobiology, 13th - 16th October 2014, Edinburgh, Scotland. Carbonates replacing plagioclase glass in the Martian meteorite ALH 84001.
- Sustainable Development Network (SDN) 2nd Festival of Sustainability, 11th June 2014, Glasgow, Scotland. Lessons from Mars: Insights into hyper mineral carbon sequestration from The Red Planet.
- Glasgow University School of Geographical and Earth Sciences Post-graduate conference, June 2014, Glasgow, Scotland.
- Pint of Science 2014 by The Royal Society of Chemistry, 19th - 21st May 2014, Talk and host, Glasgow, Scotland, Run for the Hills! Thunder Dragons and Glacial Lake Flooding in the Himalaya.
- EGU European Geosciences Union General Assembly 2014, 27th April – 2<sup>nd</sup> May 2014, Vienna, Austria. Crust-atmosphere coupling and carbon sequestration on palaeo-Mars.
- Building Habitable Worlds astrobiology conference 2014, 21st February 2014, Edinburgh, Scotland. Geological evidence that fluid flow on Mars was a result of a multiple bar CO<sub>2</sub> dominated palaeo-atmosphere.

## Posters

- Goldschmidt 2015, 16th - 21st August 2015, Prague, Czech Republic. Simulating atmospheric loss and carbonate formation on early Mars using hydrothermal experiments.
- Nordic-Hawaii Summer School: Water, Ice and the Origin of Life in the Universe, 1st - 13th July 2015. Carbonates on Mars and the implications for life.
- The Fourth UK Aurora meeting, 15th May 2015, Burlington House, London, UK. Carbonate replacing melt glass in Martian meteorite ALH 84001: A multiple impact model for the formation of generational carbonates from distinct heterogeneous processes.
- METSOC 77th Annual Meeting of the Meteoritical Society, 7th – 12<sup>th</sup> September 2014, Casablanca, Morocco. Carbonates replacing plagioclase glass in the Martian meteorite ALH 84001.
- European Mineralogical Union (EMU) School in Planetary Mineralogy, 25th August - 4th September 2014, Glasgow, Scotland. Carbonates replacing plagioclase glass in the Martian meteorite ALH84001.
- Fifth international workshop on the Mars atmosphere: Modelling and observations, 13th - 16th January 2014, Oxford, England. Crust-atmosphere coupling and carbon sequestration on palaeo-Mars.

## Mentoring & Service

- I was principal organiser for an exhibit at the Royal Society summer science exhibition 2016, presenting my PhD research. Link to exhibit. <https://goo.gl/CFCSLp>
- I was principal organiser for the 'Building habitable worlds 2015' astrobiology international conference.
- I am on the strategic advisory board for postgraduate students at the University of Glasgow and the Goldschmidt communications committee.

## Public Outreach

During my PhD I have worked hard to communicate what lessons the loss of the Mars atmosphere can provide for terrestrial climate change to a variety of audiences, including articles in the Huffington Post and The Conversation. I am an ardent science outreach enthusiast and run the popular, loud, and brash science communication project called 'Science Hooker', which has twice been nominated for the Annie Maunder Medal Royal Astronomical Society for an outstanding contribution to outreach and public engagement for astronomy or geophysics. Science Hooker reaches a wide audience and has over 10,000+ Twitter followers. The primary goal of Science Hooker is to show that science is for all (not just those from privilege). The Science Hooker Ethos is that learning and ability is not about background. It's about will, thought, curiosity, stubbornness and passion.

### **Interests and Further Information**

I was selected into the top 10 science writers in 2013 by the Oxbridge Biotech roundtable. I enjoy photography and was hired as the official conference photographer at Goldschmidt 2015. I publish articles regularly in the mainstream press (Google Science Hooker media or Adrienne MacArtney on Huffington Post), poems (3rd prize Alastair Buchan 2015), and short stories (1st prize Word Hut 2014). I am also a company director at 'Wild Orbit Films' and we were awarded the contract to provide Goldschmidt 2017 with a week of science cinema.

### **Professional Memberships**

Fellow of the Royal Astronomical Society, Member of The Meteoritical Society, Member of the Mineralogical Society, Member of the European Association of Geochemistry, Member of the American Geophysical Union.

### **Academic References**

Professor Martin Lee (PhD supervisor).  
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Dr. Patrick Harkness (PhD supervisor).  
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Professor Tony Prave (Head of School).

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