

Livio Leonardo Tornabene

Adjunct Research Professor and SETI Research Scientist, Western University, Centre for Planetary Science and Exploration (CPSX), Dept. of Earth Sciences, Biological and Geological Sciences Bldg.
1151 Richmond Street, London, ON N6A 5B7, CANADA

Work: 519-661-2111 x81506, **Cell:** 519-878-6277, **Fax:** 519-661-3159

E-mail: livio@cpsx.uwo.ca

Education:

- 2007 Ph.D., Univ. of Tennessee, Earth and Planetary Sciences, Knoxville
Advisors: Drs. Harry “Hap” Y. McSween Jr. and Jeffrey E. Moersch
 - Dissertation title: *Remote sensing of impact crater-exposed subsurface lithologies and Martian rayed crater systems.*
- 2001 M.S., Univ. of South Florida, Geological Science, Tampa; Advisor: Dr. Jeffrey G. Ryan
 - Thesis title: *The Gatun Structure: A geological assessment of a newly recognized impact structure near Gatun Lake in the Republic De Panama.*
- 1996 B.S., Univ. of Florida, Dept. of. Geology, Gainesville.

Work Experience:

- 2014 – present Adjunct Research Professor (Research Scientist) and SETI Research Scientist, Univ. of Western Ontario, Centre for Planetary Science and Exploration, Dept. of Earth Sciences.
- 2014 – 2014 Limited Term Assistant Professor, Univ. of Western Ontario, Centre for Planetary Science and Exploration, Dept. of Earth Sciences.
- 2011 – present Research Scientist, Univ. of Western Ontario, Centre for Planetary Science and Exploration, Dept. of Earth Sciences.
- 2010 – 2011 Postdoctoral “Charles Lindbergh” Fellow, Center for Earth and Planetary Studies, National Air and Space Museum, Smithsonian Institution.
- 2007-2010 Research Associate, Univ. of Arizona, HiRISE Operations Center, Lunar and Planetary Lab.
- 2006- 2007 Post-Doctoral Fellow, Univ. of Arizona, HiRISE Operations Center, Lunar and Planetary Lab.
- 2001-2006 Research Assistant and Graduate Teaching Assistant, Univ. of Tennessee.
- 1998-2001 Research Assistant and Graduate Teaching Assistant, Univ. of South Florida.

Research Interests

Planetary and terrestrial remote sensing with emphasis on Mars exploration missions, impact cratering as a geologic process on terrestrial bodies, planetary surfaces properties (composition, morphology, thermophysical, etc.), terrestrial analogue sites, human/robotic planetary mission and instrumentation development, and general Earth sciences (e.g., petrology, mineralogy, and geochemistry).

Research Grants, Contracts and Support:

Support pending:

None.

Support currently held:

- 04/2014 – 03/2019 *Principal Investigator, NSERC – Discovery Grant Program*
- Project title: Meteorite impact craters as natural "probes" and "gauges" on planetary surfaces (CAD \$140,000).
- 11/2014 – 10/2017 *Principal Investigator, Canadian Space Agency – International Exploration Missions Co-Investigator*
- Project title: Impact cratering studies in support of the ExoMars Trace Gas Orbiter 2016 mission and CaSSIS high-resolution stereo camera (CAD \$150,000).
- 10/2013 – 09/2018 *Collaborator, NASA Solar System Exploration and Research Virtual Institute*
- Project title: Field Investigations to Enable Solar System Science and Exploration (USD \$5,131,713). Principal Investigator: Jennifer Heldmann
- 04/2011 – 03/2017 *Collaborator, NSERC Collaborative Research and Training Experience (CREATE) Program.*
- Project title: Technologies and Techniques for Earth and Space Exploration (CAD \$1,649,656). Principal Investigator: Gordon Osinski
- 08/2012 – 07/2016 *Co-Investigator, NASA Mars Data Analysis Program - NSPIRES.*
- Project title: Detailed Investigation of Martian Central Pit Craters (USD \$335,765). Principal Investigator: Nadine Barlow
- 08/2012 – 07/2016 *Collaborator, NASA Mars Data Analysis Program - NSPIRES.*
- Project title: Lava Flow Fields of Daedalia Planum, Mars: Distribution, Styles, and Timing of Southern Tharsis Volcanism (USD \$397,528). Principal Investigator: David Crown
- 08/2012 – 07/2015 *Co-Investigator, NASA Planetary, Geology and Geophysics - NSPIRES.*
- Project title: Investigating the mineralogy at Libya Montes, Mars, determining if carbonates are present, and characterizing the geologic history of the aqueous units with respect to the mafic rocks (USD \$362,822). Principal Investigator: Janice Bishop
- 01/2014 – 3/2015 *Principal Investigator, Canadian Space Agency – Development of a Planetary Analogue Field Site*
- Project title: Science Scenario Development for a Planetary Analogue Robotic Field Deployment (Mars Sample Return Scenario): Site Identification and Characterization (CAD \$69,793).

Support previously held:

- 07/2010 – 03/2011 *Co-Investigator, Canadian Space Agency, Field Investigations.*
- Project title: Impact ejecta deposits as windows into the lunar and Martian subsurface (CAD \$49,542). Principal Investigator: Gordon Osinski
- 07/2010 – 03/2012 *Co-Investigator, Canadian Space Agency, Analogue Mission.*
- Project title: Impacts and Ice (I2): A lunar sample return mission to the South Pole–Aitken Basin (CAD \$815,038.00). Principal Investigator: Gordon Osinski
- 04/2009 – 03/2010 *Co-Investigator, Canadian Space Agency, Canadian Analogue Research Network.*
- Project title: Impact ejecta deposits as windows into the lunar and martian subsurface (CAD \$30,000). Principal Investigator: Gordon Osinski

Honors and Awards:

- 2011 • NASA Group Achievement Award – MRO-HiRISE Operations and Science
2010 • Charles Lindbergh Fellow at the Smithsonian Institute - National Air and Space Museum,

- Center for Earth and Planetary Studies
- 2006 • NASA Group Achievement Award – MER Operations and Science – year 3
 - 2006 • Excellence in Ph.D. research award (\$300), Planetary Geosciences Institute, Univ. of Tennessee
 - 2005 • Awarded MEPAG Travel grant (\$750)
 - 2005 • NASA Group Achievement Award – MER Operations and Science – year 2
 - 2005 • Awarded “Outstanding oral presentation at an international conference”, Planetary Geosciences Institute, Univ. of Tennessee
 - 2004 • NASA Group Achievement Award – MER Operations and Science – year 1
 - 2004 • Awarded MEPAG Travel grant (\$700)
 - 2003 • Excellence in Graduate research award (\$300), Planetary Geosciences Institute, Univ. of Tennessee
 - 2003 • Acceptance to NASA/PGandG Hawaii Volcanology Workshop, August 2003
 - 2000 • Geological Society of America Student Research Grant (\$900)
 - 2000 • Sigma Xi Student Research Grant (\$2100)

Professional Service:

Planetary Mission Involvement and Experience

- 2013- • Co-Investigator on Colour and Stereo Surface Imaging System (CaSSIS) onboard the ExoMars 2016 orbiter.
- 2006- • Science team member – High Resolution Imaging Science Experiment (HiRISE) on the 2006 Mars Reconnaissance Orbiter (MRO)
- 2008-2010 • Science team member – Lunar Reconnaissance Orbiter Camera (LROC) on the 2009 Lunar Reconnaissance Orbiter (LRO)
- 2006-2010 • Science team member and Targeting Specialist – HiRISE-MRO.
- 2003-2006 • Science team member – the 2004 Mars Exploration Rovers (MER) – Spirit and Opportunity.
- 2001-2007 • Science team member – Thermal Emission Imaging System (THEMIS) on the 2001 Mars Odyssey.

Analogue Missions & Simulations

- 2014 • CREATE Collaborator and Consultant – Joint CSA and NSERC CREATE Mars Sample Return (MSR) analogue mission deployment at the CSA’s “Mars Yard”
- 2013 • Project Manager – Joint CSA and NSERC CREATE Mars Sample Return (MSR) analogue mission deployment at the CSA’s “Mars Yard”
- 2011 • Science Interpretation Manager – Barringer Lunar Analogue Mission (BLAM), November
- 2011 • Science Interpretation Manager – ILSR Kamestastin analogue mission (KRASH), September
- 2011 • Science Interpretation Manager – ILSR Sudbury Lunar Analogue Mission (SLAM), June

Conference Organizer and Chair/Co-chair Duties

- 2014 • Co-chaired a session at Lunar and Planetary Science Conference, The Woodlands, TX, March.
- 2013 • Co-chaired a session at Large Meteorite Impact Conference V, Sudbury, ON, August.
- 2013 • Scientific and organizing committee for Large Meteorite Impact Conference V, Sudbury, ON.
- 2013 • Co-chaired a session at the Geological Association of Canada annual meeting, May.
- 2012 • NSERC USRA Mentor/Supervisor (via Dr. G. Osinski) for undergraduate Ryan Hopkins
- 2012 • Scientific and organizing committee for 2012 Canadian Space Science Summit, Western University, November, 2012
- 2006 • Co-organized and co-chaired a session for SE-GSA meeting, Knoxville, TN.
- 2005 • Co-organized the Meteoritical Society meeting in Gatlinburg, TN.
- 2005 • Co-organized and co-chaired a session at a special workshop on the role of volatiles and atmospheres on Martian impact craters at APL, Laurel, MD.
- 2004 • Co-chaired a session for the Mars Crater Consortium meeting, Flagstaff, AZ.

Public Education and Outreach Activities

- 2013 • Co-taught a workshop on planetary science and data sets, Canadian Space Agency

- 2013 • Invited talk at Western University's Staff and Leaders conference, Title: "The rocks of Mars from near and far".
- 2012 • Colloquium speaker: CPSX, Western University, Title: "Crater-related pitted materials on Mars and Vesta"
- 2011 • Guest speaker: Mars Day, National Air and Space Museum, Smithsonian Institution, Washington, D.C.
- 2010 • Colloquium speaker: Univ. of Western Ontario, Title: "High-resolution observations of impact craters on Mars through the eyes of the Mars Reconnaissance Orbiter (MRO)"
- 2010 • Colloquium speaker: Univ. of Hawaii, Title: "Meter- to decameter-scale textures and morphology of crater-exposed bedrock as seen by the HiRISE camera on MRO"
- 2007-10 • HiRISE and LROC featured image and caption releases
- 2007-09 • Various K-12 educational outreach activities related to Mars: HiRISE and Phoenix Lander
- 2008 • Colloquium speaker: Brown Univ., Title: "Possible occurrences of impact melt bearing bodies and an impact origin for hydrated silicate-bearing materials on Mars"
- 2008 • Invited talk at the 3rd Mars Science Lab Landing Site Workshop, Sept 2008, Monrovia, CA: Title: "Hydrous silicates in terrestrial impactites: Implications for their formation on Mars"
- 2006 • Colloquium speaker: Univ. of Arizona, Title: "Remote sensing of Martian craters: from rare glimpses of subsurface geology to sample special delivery"
- 2005 • Colloquium speaker: Univ. of South Florida (Tampa, FL.) Title: "Mars from far and near"
- 2000-04 • Co-organized an impact cratering informational session for Earth Science Day held in the Dept. of Earth and Planetary Sciences at the Univ. of Tennessee.
- 2000-02 • Educational outreach sessions at the McClung Museum (local grade school classes), Univ. of Tennessee.
- 1999 • Guest speaker: Southwest Florida Astronomy Association, Fort Meyers, FL: Terrestrial impact cratering

Leadership Roles in Professional Associations and Advisory Groups

- 2014- • Executive Committee Member for the Planetary Crater Consortium
- 2012- • Current Chair of the Planetary Name-bank Subcommittee (IAU Planetary Nomenclature)
- 2003 • Co-founder of the Impact Field Studies Group.

Editorial and Reviews

- 2014- • Editor of GAC-MAC Planetary Sciences Division Newsletter "Planetary Matters"
- 2014 • Planetary Data System (PDS) invited reviewer of a new CRISM derived data set, the Map-projected Targeted Reduced Data Record (MTRDR)
- 2007-14 • Reviewer: JGR-Planets, MAPS, GRL and Icarus papers
- 2009 • Grant proposal review panelist: Mars Fundamental Research Program
- 2007 • Grant proposal external reviewer: Mars Data Analysis Program

Professional Memberships (Past and Present):

- American Geophysical Union
- Geological Association of Canada
- Geological Society of America
- Sigma Xi (Honor Society)

Teaching, Advising and Supervisor Roles:

Courses Taught – Instructor

- 2012 • ASTRO 2232 – Sun, Earth, Planets; University of Western Ontario, Canada.

Courses Taught – Guest Instructor

- 2012-13 • PLANETSCI 9602 – Planetary Science Short Course; University of Western Ontario, Canada.
- 2012 • PLANETSCI 9604 – Impact Cratering Short Course and Field Training Program; University of Western Ontario, Canada.
- 2009 • PTYS 542 – Mars, University of Arizona, USA

Graduate Students – Supervisor and Co-Supervisor

- 2014- • Byung Hun-Choe, PhD. Thesis Department of Earth Sciences, University of Western Ontario, Canada. Co-supervised with Gordon Osinski.
- 2014- • Tanya Harrison, PhD. Thesis Department of Earth Sciences, University of Western Ontario, Canada. Co-supervised with Gordon Osinski.
- 2013- • Bianca D’Aoust, MSc. Thesis Department of Earth Sciences, University of Western Ontario, Canada. Co-supervised with Gordon Osinski.
- 2013- • Bahareh Kasmai, MSc. Thesis Department of Earth Sciences, University of Western Ontario, Canada. Co-supervised with Gordon Osinski.
- 2013- • Zach Morse, MSc. Thesis Department of Earth Sciences, University of Western Ontario, Canada. Co-supervised with Gordon Osinski.
- 2013- • Ryan Schwegman, MSc. Thesis Department of Earth Sciences, University of Western Ontario, Canada. Co-supervised with Gordon Osinski.
- 2012- • Anna Nuhn, MSc. Thesis Department of Earth Sciences, University of Western Ontario, Canada. Co-supervised with Gordon Osinski.

Graduate Students – Thesis Advisory Committee

- 2012- • Byung Hun-Choe, Ph.D. Thesis Department of Earth Sciences, University of Western Ontario, Canada. Advisor: Gordon Osinski.
- 2012- • Mary Kerrigan, Ph.D. Thesis Department of Earth Sciences, University of Western Ontario, Canada. Advisor: Gordon Osinski.
- 2012- • Tanya Harrison, Ph.D. Thesis Department of Earth Sciences, University of Western Ontario, Canada. Advisor: Gordon Osinski.
- 2011- • Marianne Mader, Ph.D. Thesis Department of Earth Sciences, University of Western Ontario, Canada. Advisor: Gordon Osinski.
- 2019-11 • Michael Peter Lucas, MSc. Thesis Department of Geological Sciences, University of South Florida. Advisor: Jeffrey Ryan.

Undergraduate Students – Supervisor and Co-Supervisor

- 2014 • Michael Bramble, NSERC USRA, Department of Earth Sciences, University of Western Ontario, Canada.
- 2013- • Ryan Hopkins, Undergraduate Honours Thesis, Department of Physics, McMaster University, Canada. Co-supervised with Gordon Osinski.

Mentoring

- 2012-14 • Victor Ling (Central High School Student), Local, Provincial and National Science Fair Mentor
- 2014 • Ryan Hopkins, Summer Research, Department of Physics, McMaster University, Canada. Co-supervised with Gordon Osinski.
- 2013 • Ryan Hopkins, Summer Research, Department of Physics, McMaster University, Canada. Co-supervised with Gordon Osinski.
- 2012 • Ryan Hopkins, NSERC USRA, Department of Physics, McMaster University, Canada. Co-supervised with Gordon Osinski.
- 2009-12 • Christy Caudill, Undergraduate Honours Thesis, Lunar and Planetary Lab, University of Arizona, Research Supervisor (Advisor: Alfred McEwen).
- 2009-11 • Kaylan Burleigh, Undergraduate Honours Thesis, Lunar and Planetary Lab, University of Arizona, Research Supervisor (Advisor: Jay Melosh).
- 2007-08 • Layne Trinkley, NASA Space Grant Intern, Lunar and Planetary Lab, University of Arizona, Research Supervisor (Advisor: Alfred McEwen).

Media Interactions:

- 2012 • University of Ontario press release, highlighted a recent publication detailing the discovery of volatile-rich impact melt deposits on Mars (and in Solar System)
(<http://communications.uwo.ca/media/marscrater/>)
- 2012 • Interview on the radio program Western Worlds on Astronomy.FM (episode #211).

- 2010 • Live and national TV interview on FOX News with Bill Hemmer: HiRISE images of Mojave Crater
- 2007 • Research/LPSC presentation featured in *Science*: “Meeting briefs: Lunar and Planetary Science Conference - Big Splashes” by Richard Kerr
- 2007 • Live and statewide radio interview on NPR show Here and Now – Science with Steve Goldstein: HiRISE and Mars Exploration
- 2005 • Research/LPSC presentation featured in Astronomy Magazine: “Chipping pieced off of Mars” by Robert Burnham
- 2002 • Master’s research featured in Sigma Xi (Science and Engineering Honor Society) brochure
- 2000 • Tampa Bay NPR radio show The Univ. Beat interview about the Gatun Structure

Publications (Student/HQP authors marked with a *):

Life-time summary (count) according to the following categories:

Papers in refereed journals:	39
Book chapters:	3
Invited Colloquia/Seminars:	5
Invited Conference Talks:	2
Contributed Conference Talks:	13
Invited Reviews:	14
Papers in Non-refereed conference proceedings:	26
Posters:	12

1. **Tornabene L. L.**, and 6 others (including *Craig, M and *Sapers, H.) (2013) An impact origin for hydrated silicates on Mars: A synthesis, *Journal of Geophysical Research-Planets*, 118, doi:10.1002/jgre.20082.
2. Bishop J. L., Tirsch D., **Tornabene L. L.**, and 19 others (2013), Mineralogy and morphology of geologic units at Libya Montes, Mars: Ancient aqueously derived outcrops, mafic flows, fluvial features and impacts, *J. Geophys. Res.*, doi:10.1029/2012JE004151.
3. Osinski G. R., **Tornabene L. L.**, and 11 others (2013), Impact-generated hydrothermal systems on Earth and Mars, *Icarus*, doi: 10.1016/j.icarus.2012.08.030.
4. *Skok J. R., Mustard J. F., **Tornabene L. L.**, and 3 others (2012), A spectroscopic analysis of Martian crater central peaks: Formation of the ancient crust, *Journal of Geophysical Research-Planets*, 117, doi: 10.1029/2012JE004148.
5. *Caudill C. M., **Tornabene L. L.**, and 4 others (2012), Layered Megablocks in Central Uplifts of Impact Craters, *Icarus*, doi: 10.1016/j.icarus.2012.08.033.
6. Boyce J. M., et al. (2012), Origin of small pits in Martian impact craters, *Icarus*, doi: 10.1016/j.icarus.2012.07.027.
7. **Tornabene L. L.**, and 5 others (2012), Widespread crater-related pitted materials on Mars: further evidence for the role of target volatiles during the impact process, *Icarus*, 220, doi:10.1016/j.icarus.2012.05.022.
8. Denevi B. W. et al. (2012), Physical constraints on impact melt properties from LROC NAC images, *Icarus*, doi: 10.1016/j.icarus.2012.03.020.
9. Moores J. E., et al. (2012), A Mission Control Architecture for robotic lunar sample return as field tested in an analogue deployment to the sudbury impact structure, *Advances in Space Research*, 50(12), 1666-1686.
10. *Burleigh K., Melosh J., **Tornabene L. L.**, and 3 others (2012), Impact Airblasts Trigger Dust Avalanches on Mars, *Icarus*, doi:10.1016/j.icarus.2011.10.026.
11. Banks M. E., Watters T., Robinson M., **Tornabene L. L.**, and 2 others (2012), Morphologic analysis of lunar lobate scarps using LROC NAC and LOLA data, *JGR*, doi:10.1029/2011JE003907.
12. Osinski G. R., **Tornabene L. L.** and R. A. F. Grieve (2011), Impact melt and ejecta emplacement on terrestrial planets, *EPSL*, doi:10.1016/j.epsl.2011.08.012.

13. Wray J. J. et al. (2011), Columbus crater and other possible groundwater-fed paleolakes of Terra Sirenum, Mars, *J. Geophys. Res.*, 116, E01001, doi:10.1029/2010JE003694.
14. *Jones A. P., McEwen A. S., **Tornabene L. L.**, and 3 others (2011), A geomorphic analysis of Hale crater, Mars: insights into the effects of impacts into an ice-rich crust, *Icarus*, doi:doi:10.1016/j.icarus.2010.10.014.
15. Okubo C. H., **Tornabene L. L.** and Lanza N. L. (2011), Two-dimensional stability assessment of gully alcoves in Gasa crater, Mars, *Icarus*, doi:10.1016/j.icarus.2010.09.025.
16. Golombek M., Robinson K., McEwen A., Bridges N., Ivanov B., **Tornabene L.** and R. Sullivan (2010), Constraints on Ripple Migration at Meridiani Planum from Opportunity and HiRISE Observations of Fresh Craters, *J. Geophys. Res.*, doi:2010JE003628.
17. Bray V. J., **Tornabene L. L.**, and 8 others (2010), New insight into lunar impact melt mobility from the LRO Camera, *Geophys. Res. Lett.*, 37, L21202, doi:10.1029/2010GL044666.
18. Glotch T. D., Bandfield J. L., **Tornabene L. L.**, and 2 others (2010), Distribution and formation of chloride salts and phyllosilicates in Terra Sirenum, Mars, *Geophys. Res. Lett.*, 37, doi: 2010GL044235.
19. Fairén A. C., Chevrier V., Abramov O., Marzo G. A., Gavin P., Davila A. F., **Tornabene L. L.**, and 10 others (2010), Noachian and more recent phyllosilicates in impact craters on Mars, *Proc. Nat. Acad. Sci. U.S.*
20. Marzo G. A., Davilla A. F., **Tornabene L. L.**, and 7 others (2010), Evidence for Hesperian impact-induced hydrothermalism on Mars, *Icarus*, doi:10.1016/j.Icarus.2010.03.013.
21. Lang N. P., McSween H. Y., Jr., **Tornabene L. L.**, and 2 others (2010) Re-examining the relationship between Apollinaris Patera and basalts of Gusev crater, Mars, *J. Geophys. Res.*, *JGR-Planets*, doi:10.1029/2009JE003397.
22. Delamere W. A., **Tornabene L. L.**, and 14 others (2010), Color imaging of Mars by the High Resolution Imaging Science Experiment (HiRISE), *Icarus*, doi:10.1016/j.Icarus.2009.03.012.
23. Newsom H. E., Lanza N. L. Ollila A. M., Wiseman S. M., Roush T. L., Marzo G. A. **Tornabene L. L.**, and 4 others (2010) Inverted channel deposits on the floor of Miyamoto crater, Mars, *Icarus*, doi:10.1016/j.Icarus.2009.03.030.
24. McEwen, A. S., HiRISE operations and Science team (alphabetical listing) (2010) The High Resolution Imaging Science Experiment (HiRISE) during MRO's Primary Science Phase (PSP), *Icarus*, doi:10.1016/j.Icarus.2009.04.023.
25. Wray. J. J. et al. (2009) Diverse aqueous environments on ancient Mars revealed in the southern highlands, *Geology*, 37, doi:10.1130/G30331A.1.
26. Lang N. P., **Tornabene L. L.**, and 2 others (2009), Tharsis-sourced relatively dust-free lavas and their possible relationship to Martian meteorites, *J. Volcan. Geotherm. Res.*, doi:10.1016/j.jvolgeores.2008.12.014.
27. **Tornabene L. L.**, Moersch, J., McSween, H. Y. Jr., Hamilton V., Piatek J., and P. Christensen (2008), Surface and crater-exposed lithologic units of the Isidis Basin as mapped by co-analysis of THEMIS and TES derived data products, *J. Geophys. Res.*, 113, doi:10.1029/2007JE002988.
28. Brown A. J., Byrne, S., **Tornabene L. L.**, and T. Roush (2008) Louth crater: Evolution of a layered water ice mound, *Icarus*, 196 (2), doi:10.1016/j.Icarus.2007.11.023.
29. McCoy T. J., Sims M. H., Schmidt M. E., Edwards L., **Tornabene L. L.**, and 14 others (2008), Structure, stratigraphy, and origin of Husband Hill, Columbia Hills, Gusev Crater, Mars, *J. Geophys. Res.*, doi:10.1029/2007JE003041.
30. Keszthelyi L., Jaeger W., McEwen A., **Tornabene L. L.**, and 3 others (2008), High Resolution Imaging Science Experiment (HiRISE) images of volcanic terrains from the first 6 months of the Mars Reconnaissance Orbiter Primary Science Phase, *J. Geophys. Res.*, 113, E04005, doi:10.1029/2007JE002968.
31. Osterloo M., Hamilton V. E., Bandfield J. L., Glotch T. D., Baldrige A. M., Christensen P. R., **Tornabene L. L.**, and F. S. Anderson (2008), Chloride-bearing materials in the southern highlands of Mars, *Science*, 319, 1651-1654.
32. Grant J. A., Irwin R. P., Grotzinger J. P., Milliken R. E., **Tornabene L. L.**, and 5 others (2008) HiRISE imaging of impact megabreccia and sub-meter aqueous strata in Holden Crater, Mars, *Geology*, 36, doi: 10.1130/G24340A.1.
33. McEwen A. S., and the HiRISE science and operations team (2007), A Closer Look at Water-Related Geologic Activity on Mars, *Science*, 317, doi: 10.1126/science.1143987.

34. **Tornabene L. L.**, and 6 others (2006), Identification of large (2–10 km) rayed craters on Mars in THEMIS thermal infrared images: Implications for possible Martian meteorite source regions, *J. Geophys. Res.*, 111, E10006, doi:10.1029/2005JE002600.
35. McSween H. Y. et al. (2006) Alkaline volcanic rocks from the Columbia Hills, Gusev crater, Mars, *J. Geophys. Res.*, 111, E09S91, doi:10.1029/2006JE002698.
36. Boyce J. M. et al. (2006) Deep Impact Craters in the Isidis and Southwestern Utopia Planitia Regions of Mars: High Target Material Strength as a Possible Cause, *Geophys. Res. Lett.*, 33, doi:10.1029/2005GL024462.
37. McSween H. Y. et al. (2006) Characterization and petrologic interpretation of olivine-rich basalts at Gusev Crater, Mars, *J. Geophys. Res.*, 111, E02S10, doi:10.1029/2005JE002477.
38. **Tornabene L. L.**, and 5 others (2005) Spaceborne visible and thermal infrared lithologic mapping of impact-exposed subsurface lithologies at the Haughton impact structure, Devon Island, Canadian High Arctic: Applications to Mars, *MAPS*, 40, 1835-1858.
39. Milam K. A. et al. (2003) THEMIS Characterization of the MER Gusev crater landing site, *J. Geophys. Res.*, 108, E12, 8078, doi:10.1029/2002JE002023.

Publications (submitted):

- Tornabene, L. L.**, *Ling, V., Boyce, J. M., Osinski, G. R., Harrison, T. N. and McEwen, A. S., A revised depth-diameter relationship for Mars, *GRL*, submitted October 2014.
- *Skok J. R., Mustard J.F., **Tornabene L. L.** and Karunatillake, S., A Long-Lived Martian Hot Spring System in the Nili Patera Caldera, *JGR-Planets*, submitted October 2014
- *Harrison, T. N., Osinski, G. R. and **Tornabene L. L.**, Global Documentation of Gullies with the Mars Reconnaissance Orbiter Context Camera and Implications for Their Formation, *EPSL*, under revision October 2014.
- *Ding N. et al., The central uplift of Ritchey Crater, Mars, *Icarus*, under revision resubmitted in September 2014.
- *Nuhn, A., Tornabene, L. L., Osinski, G. R. and McEwen, A. S., Morphologic and Structural Mapping of the Central Uplift of Betio Crater, Thaumasia Planum, Mars, *Large Meteorite Impacts and Planetary Evolution V*, under revision August 2014.

Book Chapters:

- Grieve R. A. F., Osinski G. R. and **Tornabene L. L.**, Planetary Impacts. In: Encyclopedia of the Solar System, 3rd edition, Academic Press, Oxford, forthcoming, 2014.
- Wright S. P., **Tornabene L. L.**, and Ramsey M. (2012), Remote Sensing of Impact Craters. In: Osinski, G.R., Pierazzo, E., Grieve, R.A.F. (Eds.), Impact Cratering: Processes and Products, Wiley-Blackwell Publishing, New Jersey.
- Osinski G. R., Grieve R. A. F., and **Tornabene L. L.** (2012), Excavation and Impact Ejecta Emplacement. In: Osinski, G.R., Pierazzo, E., Grieve, R.A.F. (Eds.), Impact Cratering: Processes and Products, Wiley-Blackwell Publishing, New Jersey.

Abstracts

1. **Tornabene L. L. et al.**, (2014) The pre-, syn- and post-impact origin of hydrated phases: A case study based on observations of the Haughton impact structure, Nunavut, Canada, *Geological Association of Canada – Mineralogical Association of Canada Annual Meeting*. Fredericton, Program with Abstracts Volume 36:409. (Oral)
2. **Tornabene L. L. et al.** (2014) The pre-, syn- and post-impact origin of hydrated phases: A case study based on the remote sensing and ground-truth of the Haughton impact structure, Nunavut, Canada, *45th Lunar and Planetary Science Conference*, held March 17-22, 2013 in The Woodlands, Texas. LPI Contribution No. 1777, p.2710. (Oral)
3. **Tornabene L. L. et al.** (2013), Meter- to decameter-scale morphology of melt rocks, breccias, bedrock and structures in central uplifts revealed by the Mars Reconnaissance Orbiter, Large Meteorite Impacts V, held Aug. 5-9th, 2013 in Sudbury, ON. LPI Contribution No. 1737, p.3107. (Oral)
4. **Tornabene L. L. et al.** (2013), A revised global depth-diameter scaling relationship for Mars based on pitted impact melt-bearing craters, *Geological Association of Canada – Mineralogical Association of Canada Annual Meeting*, Program with Abstracts Volume 36:188. (Poster)

5. **Tornabene L. L.** et al. (2013) A revised global depth-diameter scaling relationship for Mars based on pitted impact melt-bearing craters, *44th Lunar and Planetary Science Conference*, held March 17-22, 2013 in The Woodlands, Texas. LPI Contribution No. 1391, p.2592. (Poster)
6. **Tornabene L. L.** et al. (2012), A crater-exposed bedrock database for Mars with applications for determining the composition and the structure of the upper crust, *3rd International conference on Early Mars*, held May 21-25, 2012 in Lake Tahoe, Nevada. p. 7069. (Oral)
7. **Tornabene L. L.** et al. (2012), Wide-spread occurrence of crater-related pitted materials on Mars: Implications for the role of target volatiles during the impact process, Geological Association of Canada – Mineralogical Association of Canada Annual Meeting, Program with Abstracts Volume 35:142. (Oral)
8. **Tornabene L. L.** et al. (2012) Wide-spread occurrence of crater-related pitted materials on Mars: Implications for the role of target volatiles during the impact process, *43rd Lunar and Planetary Science Conference*, held March 19-23, 2012 in The Woodlands, Texas. LPI Contribution No. 1659, p.2418. (Oral)
9. **Tornabene L. L.** et al. (2012) Utility of remote sensing, robotic precursor data and a focused science hypothesis for a follow-on human exploration lunar analogue mission at the Mistastin Lake (Kamestastin) impact structure, *43rd Lunar and Planetary Science Conference*, held March 19-23, 2012 in The Woodlands, Texas. LPI Contribution No. 1659, p.2390. (Poster)
10. **Tornabene L. L.**, et al. (2010) Another putative Hesperian-aged crater-related hydrothermal site in Syrtis Major, Mars, *Euro. Planet. Sci. Congress*, held Sept. 20-24, 2010 in Rome, Italy, vol. 5, p. 644. (Poster)
11. **Tornabene L. L.**, et al. (2010) Crater-exposed bedrock database for Mars and preliminary results from a focused study of hydrated silicates, Mars, *41th Lunar and Planetary Science Conference*, held March 1-5, 2009 in The Woodlands, Texas. LPI Contribution No. 1391, p.1737. (Poster)
12. **Tornabene L. L.**, et al. (2009) Parautochthonous Megabreccias and Possible Evidence of Impact-induced Hydrothermal Alteration in Holden Crater, Mars, *40th Lunar and Planetary Science Conference*, held March 23-27, 2009 in The Woodlands, Texas. LPI Contribution No. 1391, p.1766. (Poster)
13. **Tornabene L. L.**, et al. (2008) Recent Channel Systems Emanating from Hale Crater Ejecta: Implications for the Noachian Landscape Evolution of Mars, *39th Lunar and Planetary Science Conference*, held March 10-14, 2008 in League City, Texas. LPI Contribution No. 1391, p.2180 (abstract only)
14. **Tornabene L. L.**, et al. (2007c) MRO Identification and Characterization of Volatile-rich Impact Melt Bodies on Mars: Implications for Valley Network and Phyllosilicate Formation, American Astronomical Society, DPS meeting #39, #40.04 (Poster)
15. **Tornabene L. L.**, et al. (2007b) Impact Melting and the Role of Sub-Surface Volatiles: Implications for the Formation of Valley Networks and Phyllosilicate-rich Lithologies on Early Mars, *Seventh International Conference on Mars*, held July 9-13, 2007 in Pasadena, California, LPI Contribution No. 1353, p.3288 (Oral)
16. **Tornabene L. L.**, et al. (2007a) Evidence for the Role of Volatiles on Martian Impact Craters as Revealed by HiRISE, *38th Lunar and Planetary Science Conference*, held March 12-16, 2007 in League City, Texas. LPI Contribution No. 1338, p.2215 (Poster)
17. **Tornabene L. L.**, et al. (2006) The Subsurface Geology of Mars: Remote Sensing of Impact Craters Using THEMIS, TES, MOC and MOLA: Presented at the XXXVII Lunar and Planetary Science Conference, # 1739. (Oral)
18. **Tornabene L. L.**, et al. (2005) Subsurface Mineral Heterogeneity in the Martian Crust as seen by the Thermal Emission Imaging System (THEMIS): Views from Natural "Windows" (Impact Craters) into the Subsurface: Abstract presented at the Mars Crater Consortium meeting, #0805. (Oral)
19. **Tornabene L. L.**, et al. (2005) Martian Rayed Craters: Implications for Martian Meteorite Source Regions, Proceedings of 68th Annual Meeting of the Meteoritical Society, held September 12-16, 2005 in Gatlinburg, Tennessee, p.5078 (Oral)
20. **Tornabene L. L.**, (2005) Evidence for the role of sub-surface volatiles in the formation of large rayed crater systems on Mars: Implications for the ejection of the martian meteorites. Presented at the Workshop on the Role of Volatiles and Atmospheres on Martian Craters, July 2005, Laurel, MD, #3025. (Poster)

21. **Tornabene L. L.**, et al. (2005), Recognition of rayed craters on Mars in THEMIS thermal infrared imagery: Implications for Martian Meteorite source regions: Presented at the XXXVI Lunar and Planetary Science Conference, # 1970. (Oral)
22. **Tornabene L. L.**, et al. (2004) Remote Sensing of the Haughton impact structure (HIS): A terrestrial proof of concept for using the remote sensing of martian craters as a probe of subsurface composition: Abstract presented at the XXXV Lunar and Planetary Science Conference, #1764. (Oral)
23. **Tornabene L. L.** (2003) Composition of the Martian crust: Spectral classification of deep-seated and subsurface lithologies in impact Craters using MGS-TES and Odyssey-THEMIS: Abstract presented at the Mars Crater Consortium meeting, #0610. (Oral)
24. **Tornabene L. L.**, et al (2002), The Gatun Structure: a petrographic and geochemical investigation into a possible Tertiary impact structure near Gamboa, Republic de Panama: Abstract presented at the XXXIII Lunar and Planetary Science Conference, #1249. (Poster)
25. **Tornabene L.L.**, et al. (2001) A petrographic and geochemical investigation into the Gatun Structure, a possible Tertiary impact structure near Gamboa, Republic de Panama: Abstract Presented at the AGU Spring Meeting, v. 82, no. 20, p. S249 (Poster)
26. **Tornabene L.L.**, et al. (1999) Characterization and Age of a Probable Tertiary Impact Site near Gamboa, Panama Canal Zone: Abstract Presented at GSA Annual meeting, v. 31, no. 7, p. 174. (Poster)