

Hai Cheng's curriculum vitae



Name Hai Cheng

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Education

Nanjing University, China	Geochemistry	B.S.	1982.02
Chinese Academy of Geological Sciences, China	Geochemistry	M.S.	1985.02
Nanjing University, China	Geochemistry	Ph.D.	1988.02

Position

Academia Sinica, Beijing	Postdoctoral Fellow	1988
Kyoto University	Research Fellow	1989
Macquarie University	Research Fellow	1991-1992
University of Minnesota	Senior Research Scientist	1993-2009
Xi'an Jiaotong University	Professor	2010-present

Recent Honors

The Chinese National Science Fund for Distinguished Oversea Young Scholars (2003)
The Gary C. Comer Abrupt Climate Change Fellowship (2007)
Thomson Reuters China Citation Laureates 2014 *Highly Cited Researcher*
Thomson Reuters China Citation Laureates 2014 *International Citation Impact Award* (*The only one from the entire Chinese geoscience community up to now*)
Sanqin Friendship Award (2014)
Geochemical Fellow of Geochemical Society and European Association of Geochemistry (2015)
Ten major scientific and technological progresses of China's colleges and universities (2016)
Highly Cited Researches (2014 - 2023) (Thomson Reuters/Clarivate Analytics)
Highly Cited Scholars in China (2015 - 2023) (*Elsevier*)
AGU Fellow (2017)
Best Researcher Award of Xi'an Jiaotong University 2018
AGU Eminiani Lecturer, 2019 (*to honor the life and work of the renowned paleoceanography/paleoclimate researcher*)
First-class science and technology award (2020, *Shanxi Academy of Sciences*)
MEL Distinguished Visiting Fellowship 2020
International senior scientist award (*National Natural Science Foundation of China*) (2021)
The 10 Most Astonishing Archaeological Discoveries of 2021 (*by Archaeology*).
The EGU Milutin Milankovic Medal (2022)
Foreign Corresponding Member of the Austrian Academy of Sciences (2022)
Special government allowances of the State Council (2023)

Professional Society Memberships

American Geophysical Union; European Geophysical Union;
Geochemical Society and European Association of Geochemistry;
Chinese Geological Society; Chinese Association of Quaternary Research

Recent Service

Editor-in-chief: *The Innovation Geoscience*

Associate Editor: *The Innovation* (IF: 33.2); *Science Bulletin* (IF: 18.8).

Editorial board member: *Quaternary Geochronology*, *Speleology*, *Journal of Earth Environment*, *Science China-Earth Sciences*, *Scientific Report*, *Geological Review*, and *Quaternary Sciences*

Member of the Earth System Panel of the European Research Council. Member of the Geochemical Fellows Award Committee of the Geochemical Society and the European Association for Geochemistry. Member of selection board of the AGU Eminiani Lecturer. Member of selection board of the EGU Milutin Milankovic Medal. Members of many panels of Chinese National Natural Science Foundation of China. Member of USERN (Universal Scientific Education and Research Network). Scientific Committee member of International Research Center on Karst under the Auspices of UNESCO, etc.

Gradual Students/Postdocs

Master degree students: 14; Ph D degree students: 18; Postdocs: 11

Technical Specialization

Thermal ionization mass spectroscopy
Multi-collector-ICP mass spectroscopy
Trace metal separation techniques
U-series dating techniques
Triple-oxygen-isotope analysis

Synergistic Activities

Role in development of mass spectrometric ^{231}Pa dating techniques of carbonates (coral and speleothems) and $^{231}\text{Pa}/^{235}\text{U}$ measurement of igneous rocks.
Re-determine half-life of ^{234}U and ^{230}Th for U-Th dating.
Development of Uranium-thorium-protactinium dating systematics.
Development of MC-ICP MS U-Th dating technique
Development of laser ablation and isotope dilution U-Pb dating techniques for Quaternary carbonate samples
Development of triple-oxygen-isotope analytical technique
Speleothem study, paleoclimate reconstruction and correlation to global climate change

Mentor and Assistance of Young Scholars

Seraina Badertscher (Switzerland), Ronny Boch (Austria), Yanjun Cai (US), Shitao Chen (China), Hong-Wei Chiang (Taiwan), Alan Chu (Taiwan), Kim Cobb (US), Francisco da Cruz (Brazil), David Dominguez-Villar (Spain), Jeff Dorale (US), Carolyn Dykoski (US), Christina Gallup (US), Ben Hardt (US), Mayuri Inoue (Japan), Xiouyang Jiang (China), Lisa Kanner (US), Gayatri Kathayat (India), Megan Kelly (US), Cutler, Kirsten (US), Xinggong Kong (China), Claire Li (Taiwan), Hongchuan Li (US), Hanyin Li (China), Xianglei Li (China), Xuoyan Li (China), Fuyang Liang (US), Kris Ludwig (US), Yanbin Lv (China), Chengcheng Ma (China), Christian Millo (Brazil), Angela Min (US), Jean-Sebastian Moquet (Brazil), Zhiguo Rao (China), Sushmita Ray (US), Julie Retrum (US), Stacy Rosner (US), Lijuan Sha (China); Guanjuan Shen (China), Chun-Chou Shen (Taiwan), Erik Smith (US), Heather

Stoll (Spain), Nicolas M. Stríkis (Brazil), Liangcheng Tan, Ming Tan (China), Rebecca Thomas (US), Ana M. Vicente (Spain), Xianfeng Wang (US), Yongjin Wang (China), Yao Xu (China), Yan Yang (China), Kan Zhao, (China), Xinnan Zhao (China), Dezhong Zhang (China), Xiaoyan Zhu (China), Yongfeng Ning (China), Baoyun Zong (China), Wenjing Du (China), Jingyao Zhao (China), Pengzhen Duan (China), Jiayu Lu (China), Youwei Li (China), Ye Tian (China), Fan Zhang (China), Maomao Wang (China), Xiyu Dong (China), Jian Wang (China), Binglin Meng (China), Xiaowen Niu (China), Yassine Ait Brahim (Morocco), Carlos Perez-Mejías (Spain), Jonathan Baker Lloyd (US), Gabriella Koltai (Hungary), Jasper Alexander Wassenbury (Germany), Julie B. Retrum (US), Mirona Chirienco (Romania), Valdir Felipe Novello (Brazil), Ny Riavo G. Voarintsoa (Madagascar), David Domínguez-Villar (Espanola), Kristina Krklec (Hrvatsko), Haiwei Zhang (China), Pu Zhang (China), Sasadhar Mahata (India), Xunlin Yang (China), Liang Yi (China), Yuan Yao (China), Weijian Zhou (China), Weiguo Liu (China), Dianbing Liu (China), Youbing Peng (China), Hongbin Zhang (China), Jianjun Yin (China), Jo Kyoung-nam (South Korea), Taotao Zhang (China), Wuhui Duan (China), Fengmei Ban (China), Jiaoyang Ruan (China), and many others.

Collaborators

J. Adkins (US), K.D. Adams (US), Z.S. An (China), Y. Asmerom (US), A.S. Auler (Brazil), S. Bayari (Turkey), M. Bender (US), R. Boch (Austria), W. S. Broecker (US), G.A. Brook (US), S.J. Burns (US), C.D. Charles (US), P. Clark (US), K.M. Cobb (US), F.W. Cruz (Brazil), G.H. Denton (US), D. Domínguez-Villar (Spain), J.A. Dorale (US), R. Drysdale (Australia), H.N. Edmonds (UK), R.L. Edwards (US), V. Ersek (UK), D. Fleitmann (UK), M. Gagan (Australia), C.D. Gallup (US), D. Genty (France), Z.T. Guo (China), P. Hearty (Australia), J. Hellstrom (Australia), Inoue (Japan), A. Klimchouk (Ukraine), M.S. Lachniet (US), Z.H. Li (US); D. McGee (US), A. Mix (US), F.H. Nader (Lebanon), B. Plessen (Germany), R. Potts (US), H. Qing (Canada), J. Quade (US), M.K. Reagan (US), D.A. Richards (UK), B. Sebastian (Germany), C.C. Shen (Taiwan), A. Sinha (US), K. Sieh (Singapore), J. Southern (US), R. Speed (US), C. Spotl (Austria), G.S. Springer (US), L.D. Stott (US), V.C. Tewari (India), M. Tan (China), S. Verheyden (Belgium), R.C. Walter (US), Y.J. Wang (China), X.F. Wang (US), J.F. Wehmiller (US), K.S. Woo (Korean), J. Woodhead (Australia), F.Y. Wu (China), D.X. Yuan (China), P.Z. Zhang (China), B. Luz (Israel), Q.Z. Yin (US), Krause, C.E. (Australian), Y.F. Zheng (China), F.H. Chen (China), H.Y. Lv (China), N.Q. Wu (China), H.Y. Lu (China), H.C. Zhang (China), C.Y. Hu (China), and many others.

Invited Speeches and Lectures

1996 Spring AGU Meeting; 1997 Fall AGU Meeting; 2000, 2002 and 2009 Institute of Karst Geology; 2003 University of Paris; 2004 and 2006, Lanzhou University; 2004 Nanjing University; 2005 Taiwan National University; 2005 Institute of Geology; 2005 University of Southern California; Taiwan; 2005 Lamont Doherty Earth Observatory of Columbia University; 2005 Southern China Normal University; 2005 and 2009 Institute of Geochemistry, Guangzhou; 2006; IQUA Congress; 2006 Goldschmidt Conference; 2007 Institute of Speleology and Karstology, Simferopol, Ukraine; 2007 EGU Meeting, Vienna; 2007 9th International Conference on Paleoceanography; 2008 University of Bern; 2008 EGU Meeting, Vienna; 2008 European Science Foundation; 2009 L'Institut national de recherches archéologiques preventives, France; 2009 U-series and sea-level workshop, WHOI; 2009 University of Sao Poulou. 2010 AGU Taipei Meeting, Taiwan. 2010 AGU Brazil Meeting, Iguassu, Brazil; 2010 Shanghai Global Monsoon Meeting; 2010 Oregon Syntrace Synthesis Workshop; 2011 Institute of Tibetan Plateau Research, Chinese Academy of Sciences; 2011 Global climate change workshop, Chinese NSF; 2011 INQUA (Geochronology session); 2012 Modes of Variability in the Climate System: Past-Present-Future, Obergurgl, Austria (PAGES). AOGS-AGU (WPGM), Singapore, 2012. Helmholtz-Zentrum Potsdam, Deutsches GFZ, Germany, 2012. Symposium on the interplaying between high and low latitude climate systems, Fuzhou, China, 2012. International Symposium on Climate Change- Past, Present and Future, Trends, Variations and Impacts, Agadir, Morocco, 2012. Growth of the Tibetan Plateau and Eastern Asia Climate: Clues to Understanding the Hydrological

Cycle, Workshop, Xian, China 2012; 2013.02 Wadia Institute of Himalayan Geology, Dehradun, India; 2013.04, International Symposium on Karst Water under Global Change Pressure, Guilin, China, 2013.08, Conference on Isotopes of Carbon, Water, and Geotracers in Paleoclimate Research, Bern, Switzerland; 2013.11, Institute of Earth and Environmental Science, University of Potsdam, Potsdam, Germany; 2013.11, Geography Department, Humboldt University, Berlin, Germany; 2014.10, Comer Abrupt Climate Change Meeting, Wisconsin, US; 2015.10, Comer Climate Conference, Wisconsin, US; 2016 Goldschmidt Conference, Japan; 2016.8, 35th International Geological Congress, Capetown, South Africa; 2016.7, 4th Conference on Earth System Science, Shanghai, China; 2016.12, AGU Fall Meeting, US (two); 2017.5, IntCal Working Group Meeting, Belfast, UK; 2017.06, SISAL Workshop, Dublin, Ireland; 2017.09, IODP-PAGES Workshop on Global Monsoon in Long-term Records, Shanghai, China; 2019.11, University of Science and Technology of China, He Fei, China; 2019 AGU Fall Meeting, US (two). Workshop of Abrupt Climate and Ecosystem Transitions in Paleoclimate, 2020.10, Copenhagen. 2021.11, 2020 Northeast Asian Symposium Program, online; 2022.05, PAGES 6th OSM, Agadir. 2022.05, EGU2022, Vienna. 2022.06, Sustainability Research+Innovation Conference, online. 2023.05, Caribbean – Mesoamerican Climate Science Workshop, Puerto Rico. 2023.07, The XXI INQUA Congress, Rome. 2023.12, AGU23 Meeting, San Francisco. 2024.10, Kick-off meeting ERC Synergy project LAST NEANDERTHALS, Ravenna. 2024.11, Milanković's Theory of Climate Changes – Hundred Years Afterwards, Belgrade, and many others.

Research Overview and Highlights

Hai Cheng has over the past three decades been at the leading edge in the technical developments of U-series and other techniques to address many fundamental questions in paleoclimatology and global climate change research. As one of world-leading experts, he has focused largely on studies of cave records worldwide, and produced an incredible body of work, which has led to a clearer understanding of the Earth's climate history on a wide range of timescales. The broad international significance of his contributions is attested by >700 peer-reviewed papers, including 30 in *Nature* and *Science*, >80 in *Nature and Science Sub-Journals* and *PNAS* (Google Scholar: H-index: 125 and citations: >95000). He is a 'Highly Cited Researches' (continuously from 2014 to 2024, Thomson Reuters/Clarivate Analytics). He ranks 8th in the current international ranking of geoscientists, <https://research.com/scientists-rankings/earth-science>.

U-series dating systematics. Cheng's most widely recognized technical achievement is his role in the persistent improvement of U-series dating techniques in U-Th, U-Pa and U-Pb dating systematics, including significant improvements in precision in age, large reductions in sample-size requirements, doubling of the time range appropriate for U/Th dating extending to older times, ^{231}Pa and ^{230}Th dating systematics, and re-determinations of ^{230}Th and ^{234}U half-lives that have been widely accepted and used by the U-series community (e.g., Cheng *et al.*, 1998, 2000, 2013a; Wang (his student) *et al.*, 2022; Niu (his student) *et al.*, 2025). These improvements impact a whole set of fields including geology, oceanography, atmospheric science, anthropology, archeology, and art history. During the last decade, for example, his group has provided innumerable U-series dates for his team and collaborators who have made groundbreaking discoveries on paleoclimatic changes globally, as well as anchoring archeological records of human evolution in Asia, Europe and elsewhere.

Key cave records in numerous climate systems. On the basis of state-of-the-art U-series dating techniques, he has played a key role in the reconstruction of the longest climate history in numerous climate domains using cave records, including the longest East Asian (640 ka, Cheng *et al.*, 2016) and longest Indian (280 ka, Kathayat (his student) *et al.*, 2016) monsoon records, the longest Westerly climate record from West China (500 ka, Cheng *et al.*, 2012), central Asia (150 ka, Cheng *et al.*, 2016) and North America (335 ka, Cheng *et al.*, 2019), and the longest record from the Amazon Basin (250 ka, Cheng *et al.*, 2013b). These records are milestones in the paleoclimate reconstruction in these climate systems and have played an important role in understanding, correlating and calibrating global

climate variability on various timescales. Before his and his colleagues' work, the main long (tens to hundreds of thousands of years) climate records were largely dominated by marine and ice core records. Today, cave records have become the strong third leg of this paleoclimate triumvirate.

Global Monsoon and orbital theory of climate. Cheng and his colleagues have established a large number of cave records that characterize global monsoon variations on orbital-decadal timescales, particularly the Asian (Cheng *et al.*, 2016) and South American (Cheng *et al.*, 2013b) monsoon records. On the basis of new correlation strategies (Cheng *et al.*, 2006, 2009, 2016, 2020, 2021a), he correlated the monsoon records to ice core and marine sediment records, thereby transferring precise cave chronologies to other archives with their own rich proxies of hydroclimate. As one of results, the cave data suggested that the Greenland and Antarctic ice-core chronologies require +320- and +400-year adjustments around the time of Heinrich Stadial 2, respectively (Dong (his student) *et al.*, 2022), which is supported by extant volcanic evidence and radiocarbon ages. The correlations also provided the timing and sequence of events surrounding ice age terminations, proving new insights into the causes and mechanisms involved, especially the positive feedback mechanisms caused by perturbation of the ocean-atmosphere carbon and heat cycles by the initial melting of the ice sheets (Cheng *et al.*, 2009, 2016). Because of the absolutely dated chronology of cave records, the comparison with Earth's insolation kept clear of circular reasoning, which attests that the ice age terminations are separated by four or five precession cycles, supporting the idea that the 100-ka ice age cycle is an average of 4 or 5 discrete precession cycles (Cheng *et al.*, 2016). Taking the advantage of cave records, he has coined two long-standing problems concerning orbital-scale variations of the Asian monsoon ever since 30 years ago as the "Chinese 100 kyr problem" and the "sea-land precession-phase paradox", respectively regarding (1) discrepancies between the dominant 100-ka periodicity in Chinese loess magnetic susceptibility records and almost pure precession periodicity (20-ka) in Chinese cave $\delta^{18}\text{O}$ records, and (2) the nearly opposite precession phases between Asian continental cave records and marine sediment records from oceans surrounding the Asian continent especially the Arabian Sea (Cheng *et al.*, 2021b). He has well reconciled the discrepancies with a new interpretation framework, the "monsoon system science", and showed that the loess, marine, and cave records are complementary, rather than incompatible, with each record preferentially describing a certain aspect of Asian monsoon dynamics/thermodynamics (Cheng *et al.*, 2021b, 2022). From the point of view of orbital dynamic and thermodynamic forcings and climate dual responses in low- and high-latitudes, he proposed blending the global monsoon with Milankovitch orbital theory of climate to formulate a new orbital hypothesis, which explains the observed dual nature of orbital hydrodynamics of the ice sheet and monsoon systems (Cheng *et al.*, 2021b, 2022).

Andes to Amazon climate change. Cheng and his colleagues have carried out a series of work for more than ten years in the South American monsoon domain. His work precisely characterized the timing and nature of pluvial events of South American monsoon that broadly correlate with Heinrich Stadials in the North Atlantic and weak Asian monsoon events (Cheng *et al.*, 2013b, 2020, 2021b). The cave records revealed a quasi-dipole pattern of orbital-scale precipitation between western and eastern Amazonia, and a modest increase in precipitation amount in western Amazonia but a significant drying in eastern Amazonia during the last glacial period. He then suggested that higher biodiversity in western Amazonia, contrary to 'Refugia Hypothesis', is maintained under relatively stable climatic conditions. In contrast, the glacial-interglacial climatic perturbations might have been instances of loss rather than gain in biodiversity in eastern Amazonia (Cheng *et al.*, 2013b). He also showed that while the initial onset in the North Atlantic was essentially synchronous with Amazon rainfall increase, the initial termination of Heinrich Stadial 4 commenced significantly earlier in the South American monsoon, resulting in a large reduction in the Amazon River runoff hundreds of years prior the termination of Heinrich Stadial 4. He thus hypothesized a new mechanism that the runoff reduction may contribute to the resumption of the Atlantic meridional ocean circulation, eventually triggering the Heinrich Stadial 4 termination (Cheng *et al.*, 2021a).

Cultural changes and last stages of hominid evolution. In the research forefront of cultural changes and last stages of hominid evolution, cave work from Cheng and colleagues have shown links between rainfall changes and the rise and fall of Chinese dynasties/Neolithic cultures, for example, summer monsoon rainfall was plentiful during the Northern Song Dynasty when rice became the staple of the Chinese diet and the Chinese population tripled (Zhang, Cheng* *et al.*, 2008); a plausible role of climate change in shaping the important chapters of the history of human civilization in the Indian subcontinent (Kathayat (*his student*), Cheng* *et al.*, 2017, 2022); and chronological framework of the earliest known parietal art in the form of children's hand- and footprints in Tibet (Zhang*, Bennett*, Cheng* *et al.*, 2021); evidence that the Liangzhu culture in the Yangtze River Delta, one of the world's most advanced Neolithic cultures, collapsed within a short and anomalously wet period around 4300 years ago (Zhang*, Cheng* *et al.*, 2021); an important role of climate in the rise and fall of the Neo-Assyrian Empire (Sinha *et al.*, 2019); and many others.

¹⁴C calibration and radiocarbon changes in the atmosphere. Cheng had played a leading role in the ¹⁴C calibration using speleothems, which provided a critical ¹⁴C dataset for reconstruction of atmospheric ¹⁴C back to the ¹⁴C dating limit of around 54,000 years ago (Cheng *et al.*, 2018). A precise and accurate ¹⁴C calibration has been considered the Holy Grail of radiocarbon dating ever since Nobel Laureate Willard Libby originally developed the method about 70 years ago. The older half of the timescale lacked precision and accuracy for a long time. In collaboration with R.L. Edwards & J. Southon and Chinese colleagues, he completed the full calibration of the radiocarbon timescale with reasonable precision and accuracy via paired measurements of U-Th and ¹⁴C ages of two stalagmites from the now iconic Hulu cave (Cheng *et al.*, 2018). The new calibration adjusts calibrated ages for much of the older half of the ¹⁴C timescale, therefore affecting a whole set of ages, such as estimated length of overlap between Neanderthals and Homo sapiens in Europe. The new dataset also allows us to link the ¹⁴C changes with the oceanic carbon cycle and in the geomagnetic field, for instance, the high atmospheric ¹⁴C associated with the Laschamps magnetic excursion as well as Heinrich Stadial 4.

Recent developments. Cheng and his students/postdocs have developed triple-oxygen-isotope analytical technique for carbonate, and obtained for the first time a number of novel ¹⁷O_{excess} datasets from cave and marine samples, which provided new insights (additional to $\delta^{18}\text{O}$) into hydroclimate changes and underlying dynamics in many climate systems (Sha (*his student*) *et al.*, 2020, 2021, 2022, 2024). In the past a few years, Cheng and his students extended cave climate records substantially beyond the U-Th dating upper limit (~650 ka) to the Late Pliocene (~3.6 Ma ago) using U-Pb dating techniques (Wang (*his student*) *et al.*, 2022), leading to potential breakthroughs in the research forefront of the Earth's long-term climate evolution (Niu (*his student*) *et al.*, 2025).

Outreach

The public has always had access to Cheng's researches through reports in Magazines and newspapers. For example, the BBC report, by Roger Harrabin, BBC's Environment analyst, was aired in the context of the United Nations – sponsored climate talks in Tianjin, China in 2010. Harrabin's piece from a field trip to Kulishu cave in Beijing with Cheng and a visit to Cheng's Lab in Xi'an highlighted the research by Hai Cheng's group, including the research history of cave records and the results, which suggests that a multi-decadal weakening trend in the Asia summer monsoon dynamics was largely caused by humans. He always actively communicates scientific results with the public and has made a series of lectures to the public about the challenges and solutions associated with climate change. For example, he gave a lecture for the 2021/2022 China popular science creation conference and annual conference of the China Science Popularization Writers Association entitled “*Asian Monsoon and the Indian-Chinese Civilization history*”. He has also written a number of popular science article, for example, his 2022 article “*Let the stalagmite isotopes speak*” published in a popular magazine “*People's Weekly*”.

Publications

(> 700 papers, including 30 in *Science and Nature*, and > 80 in *PNAS*, *Nature* and *Science* sub-Journals; Google Scholar: citations >95000 & h-index 125)

<https://scholar.google.com/citations?hl=zh-CN&user=cv3SRfMAAAAJ>

2025

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- Chen, J.S., Liang, Y.J.*, Zhao, K., Wang, Y.J.*, Zhang, Z.Q., Duan, F.C., Zhang, J.W., Shao, Q.F., Zhu, J.J., Yang, S.H., Tang, L., Wang, Y.Q., **Cheng, H.**, El Niño-Southern Oscillation signals imprinted in stalagmite $\delta^{18}\text{O}$ from 2005 to 2017, *Quaternary International*, 715(2025), 109631;
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- Gao, Y.H., Zhang, D.D.*, Zhang, H.W.*, Zhang, S.D., Li, T., Chen, S.M., Luo, C.C., **Cheng, H.**, Prehistoric human hand and footprints in Quesang on the central Tibetan Plateau from the Bølling-Allerød Interstadial, *Archaeological and Anthropological Sciences*, 17(3)(2025), 1-17;
- Gupta, A.K.*, Gupta, P., Clemens, S.C.*, Majhi, B., **Cheng, H.***, Extreme events in the Indian monsoon during the Bølling–Allerød interstadials as documented in a core monsoon zone speleothem record, *Global and Planetary Change*, 252(2025), 104902;
- Jia, W., Yang, Y.*, **Cheng, H.**, Li, T.Y., Zhao, J.Y., He, S.N., Liu, G.X., Liu, X., Lei, L.D., Li, M.Y., Edwards, R.L., Hydroclimate variability in southwest China during Marine Isotope Stage 9: Insights from multi-proxy stalagmite records, *Quaternary Science Reviews*, 355(2025), 109268;
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