

WALTER ALVAREZ — CURRICULUM VITAE & PUBLICATIONS (Dec 2025)

Personal:

Born in Berkeley, California, October 3, 1940.

Married to Milly Alvarez, Director Emerita, Towne House Creative Living Center,
Oakland CA

Degrees:

B.A. Carleton College, Northfield, Minnesota, 1962 (Major: Geology).

Ph.D. Princeton University, Princeton, New Jersey, 1967 (Geology).

Positions Held:

American Overseas Petroleum Ltd.:

Geologist (The Hague, Netherlands) 1967-68.

Senior Geologist (Tripoli, Libya) 1968-70.

British Academy at Rome (Italy):

NATO Post-doctoral Fellow, 1970-71.

Lamont-Doherty Geological Observatory of Columbia University:

Research Associate, 1971-77.

Department of Earth and Planetary Science (formerly Geology and Geophysics),

University of California, Berkeley:

Assistant Professor, 1977-79; Associate Professor, 1979-81; Professor, 1981-2011.

Chairman, 1994-1997.

Chancellor's Professor, 1998-2001.

Miller Research Professor, 1986-1987, 2001-2002.

Marian E. and Daniel E. Koshland, Jr. Distinguished Chair, 2010-2015.

Professor of the Graduate School, 2011-present.

Professional Activities:

1963-66: Four field seasons' work in Guajira Peninsula (Colombia, South America).

1966: Oceanographic cruise in the Caribbean on Scripps vessel Thomas Washington.

1967-68: Exploration geology and geophysics in North Sea area.

1968-70: Exploration studies of the geology of western Libya, Algeria, and Tunisia.

1968-71: Field study of volcanic stratigraphy north of Rome, Italy, in connection with archaeological excavations of the British School at Rome.

1972-present: Extensive field work in Italy and nearby areas (Sardinia, the Alps, Corsica, Spain, Cyprus, Tunisia) on problems relating to Mediterranean tectonics and the pelagic stratigraphic record.

1977, 1979: Geological study of induced seismicity at Nurek Reservoir, Tadzhikistan, and Toktogul Reservoir, Kirghizia (Soviet Central Asia), as part of a US-USSR Co-operative Program in Earthquake Prediction.

1977-present: Extensive research on impacts and mass extinctions, in particular the Cretaceous-Tertiary (KT) boundary event, starting with the evidence from an iridium anomaly at Gubbio (Italy) for a massive event at the KT boundary, and culminating in studies showing that the 180-km Chicxulub Crater in the subsurface of the Yucatán Peninsula dates from precisely the time of the KT extinction.

1988-1996: Geological-archaeological research in the Roman Forum.

1992-present: Co-founder and Regent, Geological Observatory of Coldigioco (Italy).

- 1995-2003: Stratigraphic research in Utah.
- 2004-present: Involvement with a few researchers worldwide in early efforts to develop a scholarly-scientific field of “Big History” — the combined study of all of the past, from the Big Bang through cosmic history, Earth history, and life history, to human history. I am using Spain and Portugal as a focus for my contribution to this effort, with field and museum research there.
- 2007-present: Research on synthesizing the history of the Earth, and of life on Earth, in diagrammatic form, with special emphasis on the supercontinent cycle.
- 2011-present: Post-“retirement” research on Big History; impacts, volcanism and extinctions; the history of science (especially the Portuguese voyages of discovery); stratigraphy, structure and tectonics of the Umbria Marche Apennines of Italy; history of meteorite flux to Earth; expansion breccias in limestones; rivers and lakes during wet phases of the Quaternary “green Sahara;” tectonics of the Circum-Pacific rim, the ChronoZoom Time Atlas of Earth History and Big History, new evidence for existence and dating of the Pliocene Megalake Sudd on the River Nile in the Sudan Basin, natural explosion structures in rocks.

Honors:

- Guggenheim Fellow, 1983-84.
- Fellow of the California Academy of Sciences, 1984.
- G. K. Gilbert Award, Planetary Geology Division, Geological Society of America, 1985.
- Honorary Foreign Fellowship, European Union of Geosciences, 1986.
- Honorary citizenship, Piobbico, Italy, 1986.
- Miller Research Professor, University of California, Berkeley, 1986-87.
- Minor planet "Alvarez" (1985 HC), discovered 1985 by C. S. Shoemaker and E. M. Shoemaker, named for L. W. Alvarez and W. Alvarez, 1988.
- Fellow of the American Geophysical Union, 1989.
- Rennie Taylor Award of the American Tentative Society (Science Journalism), 1991.
- Elected to the National Academy of Sciences, 1991.
- Elected Foreign Member of the Royal Danish Academy of Sciences, 1992.
- Elected to the American Academy of Arts and Sciences, 1993.
- Honorary Doctorate of Humane Letters, Illinois Wesleyan University, 1993.
- Honorary citizenship, Gubbio, Italy, 1994.
- Dickson Medal, Carnegie-Mellon University, 1997.
- Journalism Award of the American Association of Petroleum Geologists, 1998
- Chancellor's Professor, University of California, Berkeley, 1998-2001.
- Miller Research Professor, University of California, Berkeley 2001-2002.
- Penrose Medal, top honor of the Geological Society of America, 2002
- Honorary Doctor of Engineering, Colorado School of Mines, 2003.
- Honorary Member of the Ilustre Colegio Oficial de Geólogos (Spanish Association of Geologists), 2003.
- Laurea ad Honoris Causa (honorary doctorate), Università di Siena (Italy), 2005
- Founders' Council Award of Merit, Field Museum of Natural History, Chicago, 2005
- Nevada Medal of the Desert Research Institute, 2006
- Eugene Shoemaker Memorial Award, *Beyond* (Center for Fundamental Concepts in Science, Arizona State University), 2008
- Doctor Honoris Causa, University of Oviedo, Spain, 2008
- Vetlesen Prize, 2008
- Ordine della Stella della Solidarietà Italiana (Knighthood of the Republic of Italy), 2010
- Faculty Research Lecturer, University of California Berkeley, 2010

Noyce Prize for Excellence in Undergraduate Teaching, University of California Berkeley, 2011

Marian E. and Daniel E. Koshland, Jr. Distinguished Chair of Innovative Teaching and Research, UC Berkeley, beginning 2010-2015

Barringer Award of the Meteoritical Society, for contributions to the field of impact cratering, 2013

Franchi Prize for the best paper published in 2012 in the journals of the Italian Geological Society (Società Geologica Italiana): The Umbria-Marche Apennines as a Double Orogen: Observations and hypotheses: Italian Journal of Geosciences, v. 131, no. 2, p. 258-271, 2012 (M.R. Barchi, W. Alvarez and D. Shimabukuro), 2014

Fossil plant from the Carboniferous of the Douro Valley of Portugal named *Douropteris alvarezii* (Correia, P., Simunek, Z., Cleal, C. J., and Sá, A. A., 2018, *Douropteris alvarezii* gen. nov., sp. nov., a new medullosalen pteridosperm from the Late Pennsylvanian of Portugal: Geological Journal, v. 2018, p. 1-11), 2018

Portrait commissioned by the National Portrait Gallery: Art by Carmen Lomas Garza, San Francisco, 2019

Socio Cinquantennale della Società Geologica Italiana, 2020

Elected to the Accademia Nazionale dei Lincei — the Italian National Academy of Science and Literature, 2021

Geological Society of America Special Paper 557 published: “From the Guajira Desert to the Apennines, and from Mediterranean microplates to the Mexican killer asteroid: Honoring the career of Walter Alvarez.”

Societies:

Geological Society of America (fellow), American Geophysical Union (fellow), Società Geologica Italiana (Socio Cinquantennale — 50 year fellow).

Ph.D. Students Supervised:

1. Roy Kligfield (Columbia University)
Thesis, 1978: “Continental margin deformation in the Northern Apennines (Italy): A structural study in the Alpi Apuane region”
Present position: Entrepreneur in private industry
2. Lung S. Chan
Thesis, 1984: “Paleomagnetism and tectonic studies of the Scaglia rossa pelagic limestones (Upper Cretaceous-Eocene) from the Umbria-Marches Apennines, Italy”
Present position: Professor, University of Hong Kong
3. Alessandro Montanari
Thesis, 1986: “Event stratigraphy of Cretaceous and Tertiary pelagic limestones from the Northern Apennines, Italy”
Present position: Director, Geological Observatory of Coldigioco, Italy
4. Kevin G. Stewart
Thesis, 1987: “A study of compressional and extensional structures in the Northern Apennine fold-and-thrust belt”
Present position: Professor, University of North Carolina, Chapel Hill
5. David M. Bice

- Thesis, 1988 “Studies in carbonate sedimentation and the tectonic evolution of the Northern Apennines”
 Present position: Professor of Geosciences Emeritus, Pennsylvania State University
6. Mark H. Anders
 Thesis, 1989 “Studies of the stratigraphic and structural record of large volcanic and impact events”
 Present position: Professor, Columbia University/ Lamont-Doherty
7. Philippe Claeys (University of California, Davis; finished at UC Berkeley*)
 Thesis, 1993 “Geochemical and sedimentological record of impact events in earth history: Examples from the late Pliocene, Cretaceous-Tertiary boundary and Frasnian-Famennian boundary
 Present position: Professor, Free University of Brussels, Belgium
8. Daniel B. Karner
 Thesis, 1997 “ $^{40}\text{Ar}/^{39}\text{Ar}$ calibration of the 100,000 year Middle Pleistocene climate cycle”
 Present position: Associate Professor of Geology, Sonoma State University
9. Diane D. O'Connor
 Thesis, 2004 “The Permian-Triassic boundary in the Great Basin, western U.S.A.”
 Present position: Senior Geologist, Evaluation/Regional Studies Team, ExxonMobil Exploration Company, Houston, TX 77060
10. David H. Shimabukuro
 Thesis, 2012 “Tectonics of Calabria, southern Italy.”
 Present position: Professor, California State University Sacramento

Masters Students Supervised

1. Mark G. Rowan, Thesis, 1982: The Helminthoid Flysch of the Northern Apennines and Maritime Alps of Italy and France: Correlation, Provenance, and Paleogeography, 117 p.
2. Emily Burns (University of California, Davis; final advising at UC Berkeley*), Thesis, 1995: The Cretaceous-Tertiary boundary impact at Chicxulub, Yucatán, Mexico: geological effects and the sedimentary record
2. Aron K. Clymer, Thesis, 1996: Discovery and trace element geochemistry of late Eocene shocked quartz: Insights into the Late Eocene impacts
4. Eric J. Staley, Thesis, 2000: Origin and paleoceanographic implications of a 20 Myr hiatus in Jurassic pelagic limestones: Umbria-Marche Apennines, Italy
5. Cheyenne Waldman, 2012 (no thesis)

* After the untimely passing of primary advisor, my close UC Davis colleague, Stanley V. Margolis.

Postdoctoral Fellows Supervised:

Michael D. Carr (US Geological Survey)
 Giusy Lavecchia (University of Chieti, Italy)
 Alessandro Montanari (Geological Observatory of Coldigioco, Italy)
 Peter Keller (Amerada Hess Oil Company, Norway)
 Nicola Swinburne (Musician, no longer in science)
 Philippe Claeys (Free University of Brussels, Belgium)
 Enrico Tavarnelli (University of Siena, Italy)

BIBLIOGRAPHY

Ph.D. Thesis:

- 1967 0. Geology of the Simarua and Carpintero areas, Guajira Peninsula, Colombia: Ph.D. Thesis, Princeton University, 168 p., 1967.

Publications:

- 1965 1. Estudios recientes en la Guajira: Geozóico (Bogotá), v. 1, no. 2, p. 2-4, 1965.
- 1970 2. BOOK: Geology and History of Sicily: Petroleum Exploration Society of Libya, Tripoli, 271 pp., 1970 (W. Alvarez and K.H.A. Gohrbandt, eds.).
3. Introduction to the geology of Sicily, in, Phillips, R.W. (ed.), Road log for Sicily field trip: Petroleum Exploration Society of Libya, Tripoli, p. 1-4, 1970.
- 1971 4. Fragmented Andean belt of northern Colombia: Geological Society of America Memoir 130, p. 77-96, 1971.
- 1972 5. Recent Italian research: Geotimes, v. 17, no. 2, p. 14-17, 1972.
6. Rotation of the Corsica-Sardinia microplate: Nature Physical Science, v. 235, p. 103-105, 1972 (LDGO no. 1758).
7. The Treia Valley north of Rome: volcanic stratigraphy, topographic evolution, and geological influences on human settlement: Geologica Romana, v. 11, p. 153-176, 1972 (LDGO no. 1786).
8. Uncoupled convection and subcrustal current ripples in the Western Mediterranean, in, Shagam, R. (ed.), The H.H. Hess volume: Studies in Earth and Space Science: Geological Society of America Memoir 132, p. 119-132, 1972.
- 1973 9. The ancient course of the Tiber River near Rome: an introduction to the middle Pleistocene volcanic stratigraphy of Central Italy: Geological Society of America Bulletin, v. 84, p. 749-758, 1973 (LDGO no. 1838).
10. The application of plate tectonics to the Mediterranean region, in, Tarling, D.H. and Runcorn, S.K. (eds.), Implications of continental drift to the earth sciences: Academic Press, London, v. 2, p. 893-908, 1973 (LDGO no. 1793).

11. Palaeomagnetism of Plio-Pleistocene basalts from northwest Sardinia: *Nature Physical Science*, v. 243, p. 10-11, 1973 (W. Alvarez, S. Franks, and A.E.M. Nairn, LDGO no. 1937).
12. Base surge deposits in Pleistocene volcanic ash near Rome: *Bulletin Volcanologique*, v. 37, no. 4, p. 553-572, 1973 (P.H. Mattson and W. Alvarez, LDGO no. 2078).
- 1974 13. Rotation of the Italian peninsula: *Nature*, v. 251, p. 285-288, 1974 (W. Lowrie and W. Alvarez, LDGO no. 2074).
14. Sardinia and Corsica: one microplate or two?: *Rendiconti del Seminario della Facoltà di Scienze, Università di Cagliari*, supplemento, p. 1-4, 1974 (LDGO no. 2038).
15. The tectonics of central-eastern Sardinia and the possible continuation of the Alpine chain to the south of Corsica: *Rendiconti del Seminario della Facoltà di Scienze, Università di Cagliari*, supplemento, p. 5-34, 1974 (W. Alvarez and T. Cocozza, LDGO no. 2056).
16. Fragmentation of the Alpine orogenic belt by microplate dispersal: *Nature*, v. 248, p. 309-312, 1974 (W. Alvarez, T. Cocozza, and F.C. Wezel, LDGO no. 2056).
17. Paleomagnetismo della scaglia rossa umbra e rotazione della penisola italiana: *Società Geologica Italiana, Bollettino*, v. 93, p. 883-891, 1974 (W. Alvarez and W. Lowrie, LDGO no. 2184).
- 1975 18. The Pleistocene volcanoes north of Rome, in, Squyres, C. (ed.), *Geology of Italy: Earth Science Society of the Libyan Arab Republic*, Tripoli, p. 355-377, 1975 (LDGO no. 2196).
19. Paleomagnetic evidence for rotation of the Italian Peninsula: *Journal of Geophysical Research*, v. 80, p. 1579-1592, 1975 (W. Lowrie and W. Alvarez).
20. Eruptive source of the "Tufo rosso a scorie nere", a Pleistocene ignimbrite north of Rome: *Geologica Romana (Rome)*, v. 14, p. 141-154, 1975 (W. Alvarez, A. Gordon, and E.P. Rashak, LDGO no. 2344).
- 1976 21. A former continuation of the Alps: *Geological Society of America Bulletin*, v. 87, p. 891-896, 1976 (LDGO no. 2046).
22. Potassium-argon ages on pyroclastic rocks from the Pleistocene Sabatini Volcanic District, north of Rome: *Rendiconti della Società Italiana di Mineralogia e Petrologia*, v. 32, p. 147-152, 1976 (W. Alvarez, M. Nicoletti, and C. Petrucciani, LDGO no. 2326).
23. A propos des relations Corse-Sardaigne: *Bulletin de la Société Géologique de France*, ser. 7, v. 18, p. 1216, 1976.

24. Formation of spaced cleavage and folds in brittle limestone by dissolution: *Geology*, v. 4, p. 698-701, 1976 (W. Alvarez, T. Engelder, and W. Lowrie, LDGO no. 2377).
25. The tectonic significance of Mediterranean volcanoes: *Geologica Romana* (Rome), v. 15, p. 311-313, 1976.
26. Paleomagnetic studies of the Scaglia Rossa limestone in Umbria: Proceedings of the Conference on Paleomagnetic Stratigraphy of Pelagic Carbonate Sediments, Perugia, Italy, September, 1976, *Società Geologica Italiana, Memorie*, v. 15, p. 41-50, 1976 (W. Lowrie and W. Alvarez, LDGO no. 2431).
27. The role of calcium carbonate dissolution in deformation of the Scaglia Rossa limestone: Proceedings of the Conference on Paleomagnetic Stratigraphy of Pelagic Carbonate Sediments, Perugia, Italy, September, 1976, *Società Geologica Italiana, Memorie*, v. 15, p. 33-40, 1976 (W. Alvarez, T. Engelder, and W. Lowrie, LDGO no. 2442).
- 1977 28. In Perugia -- Pelagic carbonates: *Geotimes*, v. 16, no. 4, p. 16-17, 1977 (W. Alvarez).
29. Upper Cretaceous-Paleocene magnetic stratigraphy at Gubbio, Italy, III. Upper Cretaceous magnetic stratigraphy: *Geological Society America Bulletin*, v. 88, p. 374-377, 1977 (W. Lowrie and W. Alvarez, LDGO no. 2378).
30. Upper Cretaceous-Paleocene magnetic stratigraphy at Gubbio, Italy. V. Type section for the Late Cretaceous-Paleocene geomagnetic reversal time scale: *Geological Society America Bulletin*, v. 88, p. 383-389, 1977 (W. Alvarez, M.A. Arthur, A.G. Fischer, W. Lowrie, G. Napoleone, I. Premoli Silva, and W.M. Roggenthen, LDGO no. 2379).
- 30a. Paper 30, reprinted in Kennett, J.P., *Magnetic stratigraphy of sediments* (Benchmark Papers in Geology, v. 54): Dowden, Hutchinson and Ross, Stroudsburg, PA, p. 209-215, 1980.
31. History of the Earth's magnetic field recorded in the Italian Apennines: *Lamont-Doherty Geological Observatory of Columbia University, Yearbook* 1975-1976, p. 46-49, 1977 (W. Alvarez).
32. A former continuation of the Alps -- reply to discussion by G. Chabrier and G. Mascle: *Geological Society America Bulletin*, v. 77, p. 1695-1696, 1977 (W. Alvarez).
33. Late Cretaceous geomagnetic polarity sequence: detailed rock and paleomagnetic studies of the Scaglia Rossa limestone at Gubbio, Italy: *Geophysical Journal International*, v. 51, p. 561-581, 1977 (W. Lowrie and W. Alvarez, LDGO no. 2571).

- 1978** **34.** Paleomagnetism and tectonics in Umbria, Italy: *Earth and Planetary Science Letters*, v. 39, p. 199-210, 1978 (J.E.T. Channell, W. Lowrie, F. Medizza, and W. Alvarez).
- 35.** Classification of solution cleavage in pelagic limestones: *Geology*, v. 6, p. 263-266, 1978 (W. Alvarez, T. Engelder, and P.A. Geiser, LDGO no. 2646).
- 36.** Fold distortion: a new indicator of tectonic transport direction: *Geology*, v. 6, p. 657-660, 1978 (W. Alvarez).
- 37.** Upper Cretaceous palaeomagnetic stratigraphy at Moria (Umbrian Apennines, Italy): verification of the Gubbio section: *Royal Astronomical Society Geophysical Journal*, v. 55, p. 1-17, 1978 (W. Alvarez and W. Lowrie).
- 1979** **38.** A comment on: "Biostratigraphy and magnetostratigraphy of Paleocene terrestrial deposits, San Juan Basin, New Mexico", by E.H. Lindsay, L.L. Jacobs, and R.F. Butler: *Geology*, v. 7, p. 66-67, 1979 (W. Alvarez and D.W. Vann).
- 39.** Paleomagnetism and rock magnetism of the Pliocene rhyolite at San Vincenzo, Tuscany, Italy: *Journal of Geophysics*, v. 45, p. 417-432, 1979 (W. Lowrie and W. Alvarez).
- 40.** Anomalous iridium levels at the Cretaceous/Tertiary boundary at Gubbio, Italy: Negative results of tests for a supernova origin, in, Christensen, W.K., and Birkelund, T. (eds.), *Cretaceous/Tertiary Boundary Events Symposium*, University of Copenhagen, v. 2, p. 69, 1979 (W. Alvarez, L.W. Alvarez, F. Asaro, and H.V. Michel).
- 41.** Extraterrestrial cause for the Cretaceous-Tertiary extinction: Experiment and theory: *Lawrence Berkeley Laboratory Report*, LBL-9666, 86 pp., 1979 (L.W. Alvarez, W. Alvarez, F. Asaro, and H.V. Michel).
- 1980** **42.** Lower Cretaceous magnetic stratigraphy in Umbrian pelagic carbonate rocks: *Royal Astronomical Society Geophysical Journal*, v. 60, p. 263-281, 1980 (W. Lowrie, W. Alvarez, I. Premoli Silva, and S. Monechi).
- 43.** Extraterrestrial cause for the Cretaceous-Tertiary extinction: Experimental results and theoretical interpretation: *Science*, v. 208, p. 1095-1108, 1980 (L.W. Alvarez, W. Alvarez, F. Asaro, and H.V. Michel).
- 43a.** Article 43, reprinted in L. Buzzard, J. Gaunce, D. LePan, M. Moser, and T. Roberts (eds.), *The Broadview Anthology of Expository Prose* (2nd ed.), Broadview Press, Peterborough, ON, Canada, p. 225-242, 2011.
- 44.** A review of magnetic stratigraphy investigations in Cretaceous pelagic carbonate rocks: *Journal of Geophysical Research*, v. 85, p. 3597-3605

- (Norman Watkins Memorial), 1980 (W. Lowrie, J.E.T. Channell, and W. Alvarez).
- 45. Franciscan-complex limestone deposited at 17° south paleolatitude: Geological Society of America Bulletin, Part I, v. 91, p. 476-484, 1980 (W. Alvarez, D.V. Kent, I. Premoli Silva, R.A. Schweickert, and R.L. Larson).
 - 46. Stratigraphic evidence for crustal thickness changes on the southern Tethyan margin during the Alpine cycle: Geological Society America Bulletin, Part I, v. 91, p. 681-689; Part II, v. 91, p. 2558-2587, 1980 (B. D'Argenio, and W. Alvarez).
- 1981
- 47. Asteroidal extinction hypothesis: Science, v. 211, p. 648-656, 1981 (comments on paper no. 43 by D.V. Kent; G.C. Reid; R.E. Brown; reply by L.W. Alvarez, W. Alvarez, F. Asaro, and H.V. Michel).
 - 48. Penrose Conference Report -- Role of pressure solution and dissolution in geology: Geology, v. 9, p. 44-45, 1981 (T. Engelder, P.A. Geiser, W. Alvarez).
 - 49. One hundred million years of geomagnetic polarity history: Geology, v. 9, p. 392-397, 1981 (W. Lowrie and W. Alvarez).
 - 50. Structure and permeability: geologic controls on induced seismicity at Nurek reservoir, Tadjikistan, USSR: Geology, v. 9, p. 440-444, 1981 (W. Leith, D.W. Simpson, W. Alvarez).
 - 50a. Paper 50, reprinted in Spall, H., and Simpson, D.W. (eds.), The Soviet America exchange in earth-quake prediction: U.S. Geological Survey, Open-File Report 81-1150, p. 97-101, 1981.
 - 51. Geochemical anomalies near the Eocene-Oligocene and Permian-Triassic boundaries, in, Papers presented to the Conference on large body impacts and terrestrial evolution: geological, climatological, and biological implications (October, 1981): Lunar and Planetary Institute, p. 2, 1981 (F. Asaro, L.W. Alvarez, W. Alvarez, and H.V. Michel).
 - 52. Upper Cretaceous to Eocene pelagic limestones of the Scaglia Rossa are not Miocene turbidites: Nature, v. 294, p. 246-248, 1981 (W. Alvarez and W. Lowrie).
 - 53. Distribution of iridium and other elements near the Cretaceous/Tertiary boundary in hole 465A: Preliminary results: Initial reports of the Deep Sea Drilling Project, v. 62, p. 847-849, 1981 (H.V. Michel, F. Asaro, W. Alvarez, and L.W. Alvarez).
- 1982
- 54. Results of a dating attempt: Chemical and physical measurements relevant to the cause of the Cretaceous-Tertiary extinctions, in, Currie, L.A. (ed.), Nuclear and chemical dating techniques -- Interpreting and environmental

record: American Chemical Society Symposium series, v. 176, p. 401-409, 1982 (F. Asaro, H.V. Michel, L.W. Alvarez, and W. Alvarez).

- 55.** Iridium anomaly approximately synchronous with terminal Eocene extinctions: *Science*, v. 216, p. 886-888, 1982 (W. Alvarez, F. Asaro, H.V. Michel, and L.W. Alvarez).
- 56.** Paleogene magnetic stratigraphy in Umbrian pelagic carbonate rocks: The Contessa sections, Gubbio: *Geological Society of America Bulletin*, v. 93, p. 414-432, 1982 (W. Lowrie, W. Alvarez, G. Napoleone, K. Perch-Nielsen, I. Premoli Silva, and M. Toumarkine).
- 57.** Geological evidence for the geographical pattern of mantle return flow and the driving mechanism of plate tectonics: *Journal of Geophysical Research*, v. 87, p. 6697-6710, 1982 (W. Alvarez).
- 58.** Mesoscopic fault array of the northern Umbrian Apennines fold belt, Italy: geometry of conjugate shear by pressure-solution slip: *Geological Society of America Bulletin*, v. 93, p. 1013-1022, 1982 (S. Marshak, P.A. Geiser, W. Alvarez, and T. Engelder).
- 59.** Spaced cleavage of solution origin in the Scaglia Rossa, Italy: solution cleavage and estimates of shortening, Umbrian Apennines, in, Borradaile, G.J., Bayly, M.B., and Powell, C.McA. (eds.), *Atlas of deformational and metamorphic rock fabrics*: Berlin, Springer-Verlag, p. 176-179, 210-211, 1982 (W. Alvarez and T. Engelder).
- 60.** Stylolitic solution cleavage from Silurian-Devonian limestones, Pennsylvania, in, Borradaile, G.J., Bayly, M.B., and Powell, C.McA. (eds.), *Atlas of deformational and metamorphic rock fabrics*: Berlin, Springer-Verlag, p. 206-207, 1982 (T. Engelder and W. Alvarez).
- 61.** Iridium and other geochemical profiles near the Cretaceous-Tertiary boundary in a Brazos River section in Texas, in, Maddocks, R.F. (ed.), *Texas Ostracoda (Guidebook of excursions and related papers for the Eighth International Symposium on Ostracoda, 1982)*: Houston, Department of Geosciences, University of Houston, p. 238-241, 1982 (F. Asaro, H.V. Michel, W. Alvarez, L.W. Alvarez, R.F. Maddocks, and T. Bunch).
- 62.** Geochemical anomalies near the Eocene-Oligocene and Permian-Triassic boundaries: *Geological Society of America Special Paper*, v. 190, p. 517-528, 1982 (F. Asaro, L.W. Alvarez, W. Alvarez, and H.V. Michel).
- 63.** Current status of the impact theory for the terminal Cretaceous extinction: *Geological Society of America Special Paper*, v. 190, p. 305-315, 1982 (W. Alvarez, L.W. Alvarez, F. Asaro, H.V. Michel).
- 1983 64.** Magnetic polarity stratigraphy (in U.S. National Report to the International Union of Geodesy and Geophysics): *Reviews of Geophysics and Space Physics*, v. 21, p. 620-626, 1983 (L.S. Chan and W. Alvarez).

65. Spheroids at the Cretaceous-Tertiary boundary are altered impact droplets of basaltic composition: *Geology*, v. 11, p. 668-671, 1983 (A. Montanari, R.L. Hay, W. Alvarez, F. Asaro, H.V. Michel, L.W. Alvarez, and J. Smit).
- 65a. Reply to comment by Bruce Bohor on paper 65: *Geology*, v. 12, p. 696, 1984 (A. Montanari, R.L. Hay, W. Alvarez, F. Asaro, H.V. Michel, L. Alvarez, and J. Smit).
66. Abundance profiles of iridium and other elements near the Cretaceous/Tertiary boundary in Hole 516F of Deep Sea Drilling Project Leg 72: Initial reports of the Deep Sea Drilling Project, v. 72, p. 831-936, 1983 (H.V. Michel, F. Asaro, W. Alvarez, L.W. Alvarez, and D.A. Johnson).
- 1984 67. Impact theory of mass extinctions and the invertebrate fossil record: *Science*, v. 223, p. 1135-1141, 1984 (W. Alvarez, E.G. Kauffman, F. Surlyk, L.W. Alvarez, F. Asaro, and H.V. Michel).
68. The end of the Cretaceous: sharp boundary of gradual transition?: *Science*, v. 223, p. 1183-1186, 1984 (W. Alvarez, L.W. Alvarez, F. Asaro, and H.V. Michel).
69. Magnetic stratigraphy applied to synsedimentary slumps, turbidites, and basin analysis: the Scaglia Limestone at Furlo (Italy): *Geological Society of America Bulletin*, v. 95, p. 324-336, 1984 (W. Alvarez and W. Lowrie).
70. Evidence from crater ages for periodic impacts on the Earth: *Nature*, v. 308, p. 718-720, 1984 (W. Alvarez and R.A. Muller).
- 70a. Reply to comments on paper 70: *Nature*, v. 312, p. 380, 1984 (R.A. Muller, P. Hut, M. Davis, W. Alvarez).
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