

References

- Ahmad, T., and Tamep, J., 1994. Geochemistry and petrogenesis of late Archaean Aravalli volcanics, basement enclaves and granitoids, Rajasthan. *Precambrian Res.* 65, 1–23.
- Amelin, Y., Krot, A.N., Hutcheon, I.D., Ulyanov, A.A., 2002. Lead Isotopic Ages of Chondrules and Calcium-Aluminum – Rich Inclusions. *Science.* 297, 1678–1683.
- Anders, E., and Grevesse, N., 1989. Abundances of the elements: Meteoritic and Solar. *Geochim. Cosmochim. Acta* 53, 197–214.
- Andreasen, R., and Sharma, M., 2009. Fractionation and mixing in a thermal ionization mass spectrometer source: Implications and limitations for high-precision Nd isotope analyses. *Int. J. Mass Spectrom.* 285, 49–57. doi:10.1016/j.ijms.2009.04.004
- Andreasen, R., and Sharma, M., 2007. Mixing and Homogenization in the Early Solar System: Clues from Sr, Ba, Nd, and Sm Isotopes in Meteorites. *Astrophys. J.* 665, 874–883. doi:10.1086/518819
- Andreasen, R., and Sharma, M., 2006. Solar Nebula Heterogeneity in p-Process Samarium and Neodymium Isotopes. *Science.* 314, 806–809. doi:10.1126/science.1131708
- Andreasen, R., Sharma, M., Subbarao, K. V., Viladkar, S.G., 2008. Where on Earth is the enriched Hadean reservoir? *Earth Planet. Sci. Lett.* 266, 14–28. doi:10.1016/j.epsl.2007.10.009
- Arndt, N.T., 2013. The Formation and Evolution of the Continental Crust. *Geochemical Perspect.* 2, 405. doi:10.7185/geochempersp.2.3
- Basu, A.R., Renne, P.R., Dasgupta, D.K., Teichmann, F., Poreda, R.J., 1993. Early and Late Alkali Igneous Pulses and a High-³He Plume Origin for the Deccan Flood Basalts. *Science* 261, 902–906. doi:10.1126/science.261.5123.902
- Bennett, V.C., Brandon, A.D., Nutman, A.P., 2007. Coupled ¹⁴²Nd-¹⁴³Nd isotopic evidence for Hadean mantle dynamics. *Science.* 318, 1907–1910. doi:10.1126/science.1145928
- Blichert-Toft, J., Albarède, F., 2008. Hafnium isotopes in Jack Hills zircons and the formation of the Hadean crust. *Earth Planet. Sci. Lett.* 265, 686–702. doi:10.1016/j.epsl.2007.10.054
- Bouvier, A., Wadhwa, M., 2010. The age of the Solar System redefined by the oldest Pb – Pb age of a meteoritic inclusion. *Nat. Geosci.* 3, 637–641. doi:10.1038/ngeo941
- Bowring, S.A., and Williams, I.S., 1999. Priscoan (4.00 - 4.03 Ga) orthogneisses from northwestern Canada. *Contrib. to Mineral. Petrol.* 134, 3 – 16.

- Boyet, M., Blichert-Toft, J., Rosing, M., Storey, M., Télouk, P., Albarède, F., 2003. ^{142}Nd evidence for early Earth differentiation. *Earth Planet. Sci. Lett.* 214, 427–442. doi:10.1016/S0012-821X(03)00423-0
- Boyet, M., and Carlson, R.W., 2006. A new geochemical model for the Earth's mantle inferred from ^{146}Sm - ^{142}Nd systematics. *Earth Planet. Sci. Lett.* 250, 254–268. doi:10.1016/j.epsl.2006.07.046
- Boyet, M., and Carlson, R.W., 2005. ^{142}Nd evidence for early (>4.53 Ga) global differentiation of the silicate earth. *Science*. 309, 576.
- Boyet, M., Carlson, R.W., Horan, M., 2010. Old Sm-Nd ages for cumulate eucrites and redetermination of the solar system initial $^{146}\text{Sm}/^{144}\text{Sm}$ ratio. *Earth Planet. Sci. Lett.* 291. doi:10.1016/j.epsl.2010.01.010
- Brandon, A.D., Lapen, T.J., Debaille, V., Beard, B.L., Rankenburg, K., Neal, C., 2009. Re-evaluating $^{142}\text{Nd}/^{144}\text{Nd}$ in lunar mare basalts with implications for the early evolution and bulk Sm/Nd of the Moon. *Geochim. Cosmochim. Acta* 73, 6421–6445. doi:10.1016/j.gca.2009.07.015
- Burkhardt, C., Borg, L.E., Brennecka, G.A., Shollenberger, Q.R., Dauphas, N., Kleine, T., 2016. A nucleosynthetic origin for the Earth's anomalous ^{142}Nd composition. *Nature* 537, 394–398.
- Carlson, R.W., and Boyet, M., 2008. Composition of the Earth's interior: the importance of early events. *Philos. Trans. A. Math. Phys. Eng. Sci.* 366, 4077–4103. doi:10.1098/rsta.2008.0166
- Carlson, R.W., Boyet, M., O'Neil, J., Rizo, H., and Walker, R.J., 2015. *The Early Earth: Accretion and Differentiation*, First. ed. John Wiley & Sons.
- Caro, G., 2011. Early Silicate Earth Differentiation. *Annu. Rev. Earth Planet. Sci.* 39, 31–58. doi:10.1146/annurev-earth-040610-133400
- Caro, G., Bourdon, B., 2010. Non-chondritic Sm/Nd ratio in the terrestrial planets: Consequences for the geochemical evolution of the mantle-crust system. *Geochim. Cosmochim. Acta* 74, 3333–3349. doi:10.1016/j.gca.2010.02.025
- Caro, G., Bourdon, B., Birck, J., 2003. ^{146}Sm – ^{142}Nd evidence from Isua metamorphosed sediments for early differentiation of the Earth's mantle. *Nature* 423, 428–432. doi:10.1038/nature01639.1.
- Caro, G., Bourdon, B., Birck, J.L., Moorbath, S., 2006. High-precision $^{142}\text{Nd}/^{144}\text{Nd}$ measurements in terrestrial rocks: Constraints on the early differentiation of the Earth's mantle. *Geochim. Cosmochim. Acta* 70, 164–191. doi:10.1016/j.gca.2005.08.015
- Caro, G., Morino, P., Mojzsis, S.J., Cates, N.L., Bleeker, W., 2016. Sluggish Hadean geodynamics: Evidence from coupled $^{146,147}\text{Sm}$ - $^{142,143}\text{Nd}$ systematics in Eoarchean supracrustal rocks of the Inukjuak domain (Québec). *Earth Planet. Sci. Lett.* 457, 23–37. doi:10.1016/j.epsl.2016.09.051

- Cavosie, A.J., Valley, J.W., Wilde, S.A., 2005. Magmatic $\delta^{18}\text{O}$ in 4400-3900 Ma detrital zircons: A record of the alteration and recycling of crust in the Early Archean. *Earth Planet. Sci. Lett.* 235, 663–681. doi:10.1016/j.epsl.2005.04.028
- Choudhary, A.K., Gopalan, K., Anjaneya, C., 1984. Present status of the geochronology of the Precambrian rocks of Rajasthan. *Tectonophysics* 105, 131–140.
- Condie, K.C., 2012. *Earth as an evolving planetary system*, Second. ed. Elsevier.
- Crawford, A.R., 1970. The Precambrian geochronology of Rajasthan and Bundelkhand, northern India. *Can. J. Earth Sci.* 7, 91–110. doi:10.1139/e70-007
- Crawford, A.R., 1969. Reconnaissance Rb-Sr dating of the Precambrian rocks of northern Peninsular India. *J. Geol. Soc. India* 10, 117–166.
- Debaille, V., O'Neill, C., Brandon, A.D., Haenecour, P., Yin, Q.Z., Mattielli, N., Treiman, A.H., 2013. Stagnant-lid tectonics in early Earth revealed by ^{142}Nd variations in late Archean rocks. *Earth Planet. Sci. Lett.* 373, 83–92. doi:10.1016/j.epsl.2013.04.016
- Dickin, A.P., 2005. *Radiogenic Isotope Geology*, Second. ed. Cambridge University Press.
- Gautam, I., Ray, J.S., Bhutani, R., Balakrishnan, S., Dash, J.K., 2017. Role of fractionation correction in accurate determination of $^{142}\text{Nd}/^{144}\text{Nd}$ by TIMS: A case study of 1.48 Ga alkaline rocks from Khariar, India. *Chem. Geol.* 466, 479–490. doi:10.1016/j.chemgeo.2017.06.036
- Gopalan, K., Macdougall, J.D., Roy, A.B., Murali, A.V., 1990. Sm-Nd evidence for 3.3 Ga old rocks in Rajasthan, northwestern India. *Precambrian Res.* 48, 287–297. doi:10.1016/0301-9268(90)90013-G
- Gwalani, L.G., Jaques, A.L., Downes, P.J., Rao, N.V.C., 2016. Kimberlites, lamproites, carbonatites and associated alkaline rocks: a tribute to the work of Rex T. Prider. *Mineral. Petrol.* 110, 149–153. doi:10.1007/s00710-016-0429-3
- Habfast, K., 1998. Fractionation correction and multiple collectors in thermal ionization isotope ratio mass spectrometry. *Int. J. Mass Spectrom.* 176, 133–148. doi:10.1016/S1387-3806(98)14030-7
- Harper, C. L. Jr & Jacobsen, S.B., 1992. Evidence from coupled ^{147}Sm - ^{143}Nd and ^{146}Sm - ^{142}Nd systematics for very early (4.5-Gyr) differentiation of the Earth's mantle. *Nature* 360, 728–732.
- Harrison, T.M., Schmitt, A.K., McCulloch, M.T., Lovera, O.M., 2008. Early (≥ 4.5 Ga) formation of terrestrial crust: Lu-Hf, $\delta^{18}\text{O}$, and Ti thermometry results for Hadean zircons. *Earth Planet. Sci. Lett.* 268, 476–486. doi:10.1016/j.epsl.2008.02.011
- Hart, S.R., Hauri, E.H., Oschmann, L.A., Whitehead, J.A., 1992. Mantle plumes and entrainment: Isotopic evidence. *Science*. 256, 517–520.

- Hauri, E.H., Whitehead, J.A., Hart, S.R., 1994. Fluid dynamic and geochemical aspects of entrainment in mantle plumes. *J. Geophys. Res.* 24, 275–300.
- Heron, A.M., 1924. The soda bearing rocks of Kishangarh. Rajputana. *Rec. Geol. Surv. India* 56, 179–197.
- Jackson, M.G., Carlson, R.W., 2011. An ancient recipe for flood-basalt genesis. *Nature* 476, 316–319. doi:10.1038/nature10326
- Jackson, M.G., Carlson, R.W., Kurz, M.D., Kempton, P.D., Francis, D., Blusztajn, J., 2010. Evidence for the survival of the oldest terrestrial mantle reservoir. *Nature* 466, 853–856. doi:10.1038/nature09287
- Jackson, M.G., Jellinek, A.M., 2013. Major and trace element composition of the high $^3\text{He}/^4\text{He}$ mantle: Implications for the composition of a nonchondritic Earth. *Geochemistry, Geophys. Geosystems*. 14, 2954–2976. doi:10.1002/ggge.20188
- Jacobsen, S.B., 2005. The Hf-W isotopic system and the origin of the Earth and Moon. *Annu. Rev. Earth Planet. Sci.* 33, 531–70. doi:10.1146/annurev.earth.33.092203.122614
- Jacobsen, S.B., Ranen, M.C., Petaev, M.I., Remo, J.L., O’Connell, R. J., Sasselov, D.D., 2008. Isotopes as clues to the origin and earliest differentiation history of the Earth. *Phil. Trans. R. Soc. London* 366A, 4129–4162. doi:10.1098/rsta.2008.0174
- Jacobson, S.A., Morbidelli, A., Raymond, S.N., O’Brien, D.P., Walsh, K.J., Rubie, D.C., 2014. Highly siderophile elements in Earth’s mantle as a clock for the Moon-forming impact. *Nature* 508, 84–7. doi:10.1038/nature13172
- Jacobson, S.A., and Walsh, K.J., 2015. *The Early Earth: Accretion and Differentiation*, First Edit. ed. John Wiley & Sons.
- Jochum, K.P., Nohl, U., Herwig, K., Lammel, E., Stoll, B., Hofmann, A.W., 2005. GeoReM: A New Geochemical Database for Reference Materials and Isotopic Standards. *Geostand. Geoanalytical Res.* 29, 333–338. doi:10.1111/j.1751-908X.2005.tb00904.x
- Kargel, J.S., and Lewis, J.S., 1993. *The Composition and Early Evolution of Earth*. Icarus 105, 1–25.
- Kinoshita N., Paul M., Collon P., Deibel M., DiGiovine B., Greene J.P., Henderson D.J., Jiang C.L., Marley S.T., Nakanishi T., Pardo R.C., Rehm K.E., Robertson D., Scott R., Schmitt C., Tang X.D., Vondrasek R.Y.A., 2012. A Shorter ^{146}Sm half-life measured and implications for ^{146}Sm - ^{142}Nd chronology in the solar system. *Science*. 335, 1614–1617.
- Kleine, T., Touboul, M., Bourdon, B., Nimmo, F., Mezger, K., Palme, H., Jacobsen, S.B., Yin, Q., Halliday, A.N., 2009. Hf – W chronology of the accretion and early evolution of asteroids and terrestrial planets. *Geochim. Cosmochim. Acta* 73, 5150–5188. doi:10.1016/j.gca.2008.11.047

- Leelanandam, C., Burke, K., Ashwal, L.D., Webb, S.J., 2006. Proterozoic mountain building in Peninsular India: an analysis based primarily on alkaline rock distribution. *Geol. Mag.* 143, 195–212. doi:10.1017/S0016756805001664
- Lodders, K., 2010. Solar system abundances of the elements. *Astrophys. Sp. Sci. Proc.* 379–417.
- Lodders, K., 2003. Solar system abundances and condensation temperatures of the elements. *Astrophys. J.* 591, 1220–1247.
- Lodders, K., Palme, H., Gail, H.-P., 2009. Abundances of the elements in the Solar System. *Landolt-Börnstein, New Ser. Astron. Astrophys.* doi:10.1007/978-3-540-88055-4_34
- Marks, N.E., Borg, L.E., Hutcheon, I.D., Jacobsen, B., Clayton, R.N., 2014. Samarium-neodymium chronology and rubidium-strontium systematics of an Allende calcium-aluminum-rich inclusion with implications for ^{146}Sm half-life. *Earth Planet. Sci. Lett.* 405, 15–24. doi:10.1016/j.epsl.2014.08.017
- Martin, H., 1987. Petrogenesis of Archaean Trondhjemites, Tonalites, and Granodiorites from Eastern Finland: Major and Trace Element Geochemistry. *J. Petrol.* 28, 921–953.
- Martin, H., Moyen, J.F., 2002. Secular changes in tonalite-trondhjemite-granodiorite composition as markers of the progressive cooling of Earth. *Geology* 30, 319–322. doi:10.1130/0091-7613(2002)030<0319:SCITTG>2.0.CO
- Mcculloch, M.T., Bennett, V.C., 1993. Evolution of the early Earth - Constraints from ^{143}Nd - ^{142}Nd isotopic systematics. *Lithos* 30, 237–255. doi:10.1016/0024-4937(93)90038-E
- Mcdonough, W.F., Sun, S., 1995. The composition of the Earth. *Chem. Geol.* 120, 223–253.
- Mittal, R.S. and Jain, R.S., 1955. On the origin of nepheline syenite of Kishangarh, Rajasthan. *J. Sci. Res. Banaras Hindu Univ.* 37 – 46.
- Moyen, J.F., Martin, H., 2012. Forty years of TTG research. *Lithos* 148, 312–336. doi:10.1016/j.lithos.2012.06.010
- Murphy, D.T., Brandon, A.D., Debaille, V., Burgess, R., Ballentine, C., 2010. In search of a hidden long-term isolated sub-chondritic $^{142}\text{Nd}/^{144}\text{Nd}$ reservoir in the deep mantle: Implications for the Nd isotope systematics of the Earth. *Geochim. Cosmochim. Acta* 74, 738–750. doi:10.1016/j.gca.2009.10.005
- Nimmo, F., and Kleine, T., 2015. *The Early Earth: Accretion and Differentiation*. John Wiley & Sons.
- Niyogi, D., 1966. Petrology of the alkalic rocks of Kishangarh, Rajasthan, India. *Geol. Soc. Am. Bull.* 77, 65–82.
- O'Neil, J., Carlson, R.W., Francis, D., Stevenson, R.K., 2008. Neodymium-142 Evidence for Hadean Mafic Crust. *Science*. 321, 1828–1832. doi:10.1126/science.1161925

- O'Neill, H.S., and Palme, H., 2008. Collisional erosion and the non-chondritic composition of the terrestrial planets. *Philos. Trans. R. Soc. A Math. Phys. Eng. Sci.* 366, 4205 LP – 4238.
- Palme, H., Lodders, K., Jones, A., 2013. Solar System Abundances of the Elements. *Treatise Geochemistry Second Ed.* 2, 15–36. doi:10.1016/B978-0-08-095975-7.00118-2
- Palme, H.A., O'Neill, Hugh. St C., 2014. *Cosmochemical Estimates of Mantle Composition*, 2nd ed. Elsevier Ltd. doi:10.1016/B978-0-08-095975-7.00201-1
- Pande, K., 1988. Isotopic and chemical studies of ultramafic nodules in alkali basalts from Kutch, Western India.
- Puchtel, I.S., Blichert-Toft, J., Touboul, M., Horan, M.F., and Walker, R.J., 2016. The coupled ^{182}W - ^{142}Nd record of early terrestrial mantle differentiation. *Geochemistry Geophys. Geosystems* 17, 2168– 2193. doi:10.1002/2016GC006324
- Rao, N.V.C., Wu, F., Mitchell, R.H., Li, Q., Lehmann, B., 2013. Mesoproterozoic U – Pb ages, trace element and Sr – Nd isotopic composition of perovskite from kimberlites of the Eastern Dharwar craton, southern India : Distinct mantle sources and a widespread 1.1 Ga tectonomagmatic event. *Chem. Geol.* 353, 48–64. doi:10.1016/j.chemgeo.2012.04.023
- Ray, J.S., 2009. Radiogenic Isotopic Ratio Variations in Carbonatites and Associated Alkaline Silicate Rocks : Role of Crustal Assimilation. *J. Petrol.* 50, 1955–1971. doi:10.1093/petrology/egp063
- Ray, J.S., 1997. Stable and radioisotopic constraints on carbonatite-alkaline complexes of India.
- Ray, J.S., Pande, K., 2001. ^{40}Ar - ^{39}Ar age of carbonatite-alkaline magmatism in Sung Valley, Meghalaya, India. *Proc. Indian Acad. Sci. Earth Planet. Sci.* 110, 185–190. doi:10.1007/BF02702233
- Ray, J.S., Pande, K., Bhutani, R., Shukla, A.D., Rai, V.K., Kumar, A., Awasthi, N., Smitha, R.S., Panda, D.K., 2013. Age and geochemistry of the Newania dolomite carbonatites, India: Implications for the source of primary carbonatite magma. *Contrib. to Mineral. Petrol.* 166, 1613–1632. doi:10.1007/s00410-013-0945-7
- Ray, J.S., Ramesh, R., 2006. Stable Carbon and Oxygen Isotopic Compositions of Indian Carbonatites. *Int. Geol. Rev.* 48, 17–45. doi:10.2747/0020-6814.48.1.17
- Ray, J.S., Trivedi, J.R., Dayal, A.M., 2000. Strontium isotope systematics of Amba Dongar and Sung Valley carbonatite-alkaline complexes , India: evidence for liquid immiscibility , crustal contamination and long-lived Rb / Sr enriched mantle sources. *J. Asian Earth Sci.* 18, 585 – 594.
- Ray, J.S., and Pande, K., 1999. Carbonatite alkaline magmatism associated with continental flood basalts at stratigraphic boundaries: Cause for mass extinctions. *Geophys. Res. Lett.* 26, 1917–1920.

- Ray, J.S., 1998. Trace element and isotope evolution during concurrent assimilation, fractional crystallization, and liquid immiscibility of a carbonated silicate magma. *Geochim. Cosmochim. Acta* 62, 3301–3306.
- Ray, J.S., Pande, K., and Pattanayak, S.K., 2003. Evolution of the Amba Dongar carbonatite complex: Constraints from ^{40}Ar - ^{39}Ar chronologies of the inner basalt and an alkaline plug. *Int. Geol. Rev.* 45, 857–862.
- Regelous, M., Collerson, K.D., 1996. ^{147}Sm - ^{143}Nd , ^{146}Sm - ^{142}Nd systematics of early Archaean rocks and implications for crust-mantle evolution. *Geochim. Cosmochim. Acta* 60, 3513–3520. doi:10.1016/0016-7037(96)00203-7
- Rizo, H., Boyet, M., Blichert-Toft, J., Neil, J.O., Rosing, M.T., Paquette, J., 2012. The elusive Hadean enriched reservoir revealed by ^{142}Nd deficits in Isua Archaean rocks. *Nature* 490, 96–100. doi:10.1038/nature11565
- Rizo, H., Boyet, M., Blichert-Toft, J., Rosing, M., 2011. Combined Nd and Hf isotope evidence for deep-seated source of Isua lavas. *Earth Planet. Sci. Lett.* 312, 267–279. doi:10.1016/j.epsl.2011.10.014
- Roth, A.S.G., Bourdon, B., Mojzsis, S.J., Rudge, J.F., Guitreau, M., Blichert-Toft, J., 2014a. Combined $^{147,146}\text{Sm}$ - $^{143,142}\text{Nd}$ constraints on the longevity and residence time of early terrestrial crust. *Geochemistry Geophys. Geosystems* 15, 2329–2345. doi:10.1002/2014GC005313. Received
- Roth, A.S.G., Bourdon, B., Mojzsis, S.J., Touboul, M., Sprung, P., Guitreau, M., Blichert-Toft, J., 2013. Inherited ^{142}Nd anomalies in Eoarchean protoliths. *Earth Planet. Sci. Lett.* 361, 50–57. doi:10.1016/j.epsl.2012.11.023
- Roth, A.S.G., Scherer, E.E., Maden, C., Mezger, K. and Bourdon, B., 2014b. Revisiting the ^{142}Nd deficits in the 1.48Ga Khariar alkaline rocks, India. *Chem. Geol.* 386, 238–248. doi:10.1016/j.chemgeo.2014.06.022
- Roy, A.B., and Dutt, K., 1995. Tectonic evolution of the nepheline syenite and associated rocks of Kishengarh, District Ajmer, Rajasthan.
- Rubie, D.C., Nimmo, F.A., Melosh, H.J., 2015. Formation of the Earth's Core, *Treatise on Geophysics*. Elsevier B.V. doi:10.1016/B978-0-444-53802-4.00154-8
- Saha, A.K., 1994. Crustal evolution of Singhbhum-North Orissa, Eastern India. *Memoir G.S. of India*,;27.
- Saji, N.S., Wielandt, D., Paton, C., Bizzarro, M., 2016. Ultra-high-precision Nd-isotope measurements of geological materials by MC-ICPMS. *J. Anal. At. Spectrom.* 31, 1490–1504. doi:10.1039/C6JA00064A
- Solanki, A.M., 2011. A petrographic, geochemical and geochronological investigation of deformed granitoids from SW Rajasthan: Neoproterozoic age of formation and evidence of Pan-African imprint. University of the Witwatersrand.

- Srivastava, R.K., 1988. Magmatism in the Aravalli Mountain range and its environs. *Mem. Geol. Soc. India* 7, 78 – 93.
- Stracke, A., Hofmann, A.W., Hart, S.R., 2005. FOZO, HIMU, and the rest of the mantle zoo. *Geochemistry, Geophys. Geosystems* 6. doi:10.1029/2004GC000824
- Sun, S., McDonough, W.F., 1989. Chemical and isotopic systematics of oceanic basalts: implications for mantle composition and processes. *Geol. Soc. London, Spec. Publ.* 42, 313–345. doi:10.1144/GSL.SP.1989.042.01.19
- Tanaka, T., Togashi, S., Kamioka, H., Amakawa, H., Kagami, H., Hamamoto, T., Yuhara, M., Orihashi, Y., Yoneda, S., Shimizu, H., Kunimaru, T., Takahashi, K., Yanagi, T., Nakano, T., Fujimaki, H., Shinjo, R., Asahara, Y., Tanimizu, M., Dragusanu, C., 2000. JNdi-1: A neodymium isotopic reference in consistency with LaJolla neodymium. *Chem. Geol.* 168, 279–281. doi:10.1016/S0009-2541(00)00198-4
- Thirlwall, M.F., 1991. Long-term reproducibility of multicollector Sr and Nd isotope ratio analysis. *Chem. Geol.* 94, 85–104. doi:10.1016/0168-9622(91)90002-E
- Upadhyay, D., Chattopadhyay, S., Kooijman, E., Mezger, K., Berndt, J., 2014. Magmatic and metamorphic history of Paleoproterozoic tonalite–trondhjemite–granodiorite (TTG) suite from the Singhbhum craton, eastern India. *Precambrian Res.* 252, 180–190. doi:10.1016/j.precamres.2014.07.011
- Upadhyay, D., Raith, M.M., Mezger, K., Bhattacharya, A., Kinny, P.D., 2006. Mesoproterozoic rifting and Pan-African continental collision in SE India: Evidence from the Khariar alkaline complex. *Contrib. to Mineral. Petrol.* 151, 434–456. doi:10.1007/s00410-006-0069-4
- Upadhyay, D., Scherer, E.E., Mezger, K., 2009. (¹⁴²Nd) evidence for an enriched Hadean reservoir in cratonic roots. *Nature* 459, 1118–1121. doi:10.1038/nature08089
- Valdiya, K.S., 2010. *The Making of India: Geodynamic Evolution*. Springer.
- Valley, J.W., Cavosie, A.J., Ushikubo, T., Reinhard, D.A., Lawrence, D.F., Larson, D.J., Clifton, P.H., Kelly, T.F., Wilde, S.A., Moser, D.E., Spicuzza, M.J., 2014. Hadean age for a post-magma-ocean zircon confirmed by atom-probe tomography. *Nat. Geosci.* 7, 219–223. doi:10.1038/ngeo2075
- Valley, J.W., Lackey, J.S., Cavosie, A.J., Clechenko, C.C., Spicuzza, M.J., Basei, M.A.S., Bindeman, I.N., Ferreira, V.P., Sial, A.N., King, E.M., Peck, W.H., Sinha, A.K., Wei, C.S., 2005. 4.4 billion years of crustal maturation: oxygen isotope ratios of magmatic zircon. *Contrib. to Mineral. Petrol.* 150, 561–580. doi:10.1007/s00410-005-0025-8
- Veena, K., Pandey, B.K., Krishnamurthy, P., Gupta, J.N., 1998. Pb, Sr and Nd Isotopic Systematics of the Carbonatites of Sung Valley, Meghalaya, Northeast India: Implications for Contemporary Plume-Related Mantle Source Characteristics. *J. Petrol.* 39, 1875–1884.

- Wakaki, S., Tanaka, T., 2012. Stable isotope analysis of Nd by double spike thermal ionization mass spectrometry. *Int. J. Mass Spectrom.* 323-324, 45–54. doi:10.1016/j.ijms.2012.06.019
- Wiedenbeck, M., Goswami, J.N., Roy, A.B., 1996. Stabilization of the Aravalli craton of northwestern India at 2 . 5 Ga : An ion microprobe zircon study. *Chem. Geol.* 129, 325–340.
- Wilde, S.A., Valley, J.W., Peck, W.H., Graham, C.M., 2001. Evidence from detrital zircons for the existence of continental crust and oceans on the Earth 4.4 Gyr ago. *Nature* 409, 175–178. doi:10.1038/35051550
- Woolley, A.R., A., Bailey, D.K., 2012. The crucial role of lithospheric structure in the generation and release of carbonatites: geological evidence. *Mineral. Mag.* 76, 259–270. doi:https://doi.org/10.1180/minmag.2012.076.2.02