

## **REFERENCES**

- Ahron P., Schidlowski M. and Singh I. B. (1987) Chronostratigraphic markers in the end-Precambrian carbon isotope record of the Lesser Himalaya. *Nature* **327**, 699-702.
- Allegre C. J. and Luck J. M. (1980) Osmium isotopes as petrogenetic and geological tracers. *Earth Planet. Sci. Lett.* **48** 148-154.
- Arthur M. A. and Sageman B. B (1994) Marine black shales: Depositional mechanisms and environments of ancient deposits. *Ann. Rev. Earth Planet. Sci.* **22**, 499-551.
- Auden J. B. (1934) Geology of Krol Belt. *Rec. Geol. Surv. India* **67**, 357-454.
- Auden J. B. (1937) Structure of Himalaya in Garhwal. *Rec. Geo. Surv. India* **71**, 407-433.
- Azmi R. J., Joshi H. N. and Juyal K. P. (1981) Discovery of Cambro-Ordovician conodonts from the Mussoorie Tal phosphorites: its significance in the correlation of the Lesser Himalaya. In *Contemporary Science Research of Himalaya* (ed. A. K. Sinha), pp. 245-250.
- Azmi R. J. (1983) Microfauna and age of the Lower Tal Phosphorite of Mussoorie Syncline, Garhwal Lesser Himalaya, India. *Him. Geol.* **11**, 373-409.
- Banerjee D. M., Schidlowski M., Siebert F. and Brasier M. D. (1997) Geochemical changes across the Proterozoic-Cambrian transition in the Durmala phosphorite mine section, Mussoorie Hills, Garhwal Himalaya, India. *Palaeogeogr. Palaeoclimatol. Palaeoecol.* **132**, 183-194.
- Bhargava O. N. (1972) Reinterpretation of the Krol Belt. *Him. Geol.* **2**, 47-81.
- Bhargava O. N. and Singh I. B. (1980) Some palaeoenvironmental observations on the Infra-krol formation, Lesser Himalaya. *Jour. Paleont. Soc. India* **25**, 26-32.
- Bhatt D. K., Mamgain V. D. and Mishra R. S. (1985) Small shelly fossils of Early Cambrian (Tommotian) age from Chert-Phosphorite member of Lower Tal formation, Maldeota, Dehradun, Uttar Pradesh. *Geophytology* **13**, 116-123.
- Bhatt D. K. and Mathur A. K. (1990) Comments on the first record of Ediacaran fossils from Krol Formation of Nainital. *Jour. Geol. Soc. India* **35**, 118-119.
- Bhattacharya A. R. (1982) Geology of the Thal-Tejam-Girgaon area, Kumaun Himalaya with special reference to the record of schuppen structures and measurement of flattening in folds. *Geoscience Journal* **3**, 27-42.
- Bhattacharya A. K., Bhatnagar G. S., Das G. R. N., Gupta J. N., Chhabria T. and Bhalla N. S. (1984) Rb/Sr dating and geological interpretation of sheared granite-gneisses of

- Brijranigad-Ingedinala, Bhilangana Valley, Tehri District, U.P., *Him. Geol.*, 12, 212-224.
- Bhattacharya S. K., Jani R. A., Mathur V. K., Absar A., Bodas M. S., Kumar G. and Shanker R. (1996) Stable carbon and oxygen isotopic changes and rare earth elements across Precambrian-Cambrian boundary, Lesser Himalaya. *Geol. Surv. Ind. Spl. Pub.* 21, 225-231
- Bickle M. J., Chapman H. J., Wickham S. M. and Peters M. T. (1995) Strontium and oxygen isotope profiles across marble-silicate contact, Lizzies Basin, East Humboldt Range, Nevada: constraints on metamorphic permeability contrasts and fluid flow. *Contrib. Mineral. Petrol.* 121, 400-413.
- Blum J. D., Gazis C. A., Jacobson A. D. and Chamberlain C. P. (1998) Carbonate versus silicate weathering in Raikhot watershed within the High Himalayan crystalline series. *Geology* 26 411-414.
- Bowring S. A., Grotzinger J. P., Isachen C. E., Knoll A. H., Pelechaty S. M. and Kolosov P. (1993) Calibrating rates of Early Cambrian evolution. *Science* 261, 1293-1298.
- Brasier M. D., Cowie J. and Taylor M. (1994) Decision on the Precambrian-Cambrian boundary stratotype. *Episodes* 17, 3-8.
- Brasier, M. D. and Singh P. (1987) Microfossils and Precambrian-Cambrian boundary stratigraphy at Maldeota, Lesser himalaya. *Geol. Mag.* 124, 323-345.
- Choudhuri B. K., Mukherjee P. K. and Bist K. S. (1991) Structural and geochemical studies across brittle-ductile shear zones: A case study of Bhagirathi Valley, Garhwal Himalaya. *Jour. Him. Geol.* 2, 179-184.
- Cochran J. R. (1990) Himalayan Uplift, sea level, and the record of Bengal Fan sedimentation at the ODP leg 116 sites. *Proc. ODP, Sci. Results*, (ed. J. R. Cochran et al.) 116: College Station, TX (Ocean Drilling Program), 397-414.
- Colodner D., Sachs J., Ravizza G. E., Turekian K. K., Edmond J. M. and Boyle E. (1993) The geochemical cycle of rhenium: a reconnaissance. *Earth Planet. Sci. Lett.* 117, 205-221.
- Compston P., Williams I. S., Kirschvink J. L., Zhang Z. and Ma. G. Zircon (1992) U-Pb ages from the Early Cambrian time-scale. *Jour. Geol. Soc.* 149, 171-184.

- Copeland P. (1997) The when and where of the Growth of the Himalaya and the Tibetan Plateau. In *Tectonic uplift and climate change* (ed. W. F. Ruddiman), pp.20-40, Plenum Press, New York.
- Copeland P., Harrison T. M., Kidd W. S. F., Xu R. and Zhang Y. (1987) Rapid early Miocene acceleration of uplift in the Gangdese Belt, Xizang (southern Tibet), and its bearing on accommodation mechanisms of the India-Asia collision. *Earth Planet. Sci. Lett.* **86**, 240-252.
- Creaser R. A., Papanastassiou D. A. and Wasserburg G. J. (1991) Negative thermal ion mass spectrometry of osmium, rhenium and iridium. *Geochim. Cosmochim. Acta* **55**, 397-401.
- Derry L. A. and France-Lanord C. (1996) Neogene Himalayan weathering history and river  $^{87}\text{Sr}/^{86}\text{Sr}$  : impact on marine Sr record. *Earth Planet. Sci. Lett.* **142**, 59-74.
- Derry L. A. and France-Lanord C. (1997) Himalayan weathering and erosion fluxes: Climate and tectonic controls. In *Tectonic Uplift and Climate Change*, (ed. W. F. Ruddiman), pp. 289-312, Plenum Press, New York.
- Edmond J. M. (1992) Himalayan tectonics, weathering processes, and the strontium isotope record in marine limestone. *Science* **258**, 1594-1597.
- Edmond J. M., Palmer M. R., Measures C. I., Grant B. and Stallard R. F. (1995) The fluvial geochemistry and denudation rate of the Guayana shield in Venezuela, Colombia, and Brazil. *Geochim. Cosmochim. Acta* **59**, 3301-3325.
- Edmond J. M. and Huh Y. (1997) Chemical weathering yields from basement and orogenic terrains in hot and cold climates. In *Tectonic Uplift and Climate Change*, (ed. W. F. Ruddiman), pp. 330-351, Plenum Press, New York.
- Ehrenbrink B. P., Ravizza G. E. and Hofmann A. W. (1995) The marine  $^{187}\text{Os}/^{186}\text{Os}$  record of the past 80 million years. *Earth Planet. Sci. Lett.* **130**, 155-167.
- Esser B.K. (1991) Osmium isotope geochemistry of terrigenous and marine sediments. Ph. D. Thesis, Yale Univ., USA.
- Esser B.K. and Turekian K.K. (1993) The osmium isotopic composition of the continental crust. *Geochim. Cosmochim. Acta* **57**, 3093-3104.
- Falkner K. K. (1992) Summary of Os-191 single - bead experiments, WHOI-report, pp.20



- Faure G. (1986) Principles of isotope geology. John Wiley and Sons, New York.
- France-Lanord C., Derry L., and Michard A. (1993) Evolution of the Himalaya since Miocene time : isotopic and sedimentological evidence from the Bengal Fan. In *Himalayan Tectonics* (eds. P. J. Trelvan, and M. P. Searle), pp. 603-621, Geol. Soc. Spec. Publ. 74.
- France-Lanord C. and Derry L. (1997) Organic carbon forcing of the carbon cycle from the Himalayan erosion; *Nature* 390 65-67.
- Frank W. and Fuchs G. R. (1970) Geological investigations in West Nepal and their significance for the geology of the Himalayas. *Geol. Rdsch.* 59, 552-580.
- Gaillardet J., Dupre B. and Allegre C.J. (1995) A global geochemical mass budget applied to the Congo basin rivers: Erosion rates and continental crust compositions. *Geochim. Cosmochim. Acta* 59, 3469-3485.
- Gaillardet J., Dupre B., Allegre C. J. and Negrel P. (1997) Chemical and physical denudations in the Amazon river basin. *Chem. Geol.* 142, 141-173.
- Galy A. (1999) Etude geochimique de l'erosion actuelle de la chaine himalayenne. Ph. D. Thesis, Centre de Recherches Petrographiques et Geochimiques, Nancy, France.
- Gansser A. (1964) Geology of the Himalayas. Interscience, London.
- Gardner R. and Walsh N. (1996) Chemical weathering of metamorphic rocks from low elevations in the Himalaya. *Chem. Geol.* 127, 161-176.
- Gartner S. (1990) Neogene calcareous nanofossil biostratigraphy, Leg 116 (central Indian Ocean). *Proc. ODP, Sci. Results*, (eds. J. R. Cochran et al.) 116: College Station, TX (Ocean Drilling Program) 165-187.
- Gazis C. A., Blum J. D., Chamberlain C.P. and Poage M. (1998) Isotope systematics of granites and gneisses of the Nanga Parbat Massif, Pakistan Himalaya. *Am. Jour. of Sci.* 298, 673-698.
- Gorokhov I.M., Clauer N., Varshavskaya E., Kutyavin P. and Drannik A.S. (1981) Rb-Sr ages of Precambrian sediments from the Ovruch Mountain Range, northwestern Ukraine (USSR). *Precambrian Research* 16, 55-65.
- Gupta L.N., Ghildiyal H. and Chawla H.S. (1994) Petrochemistry and tectonic environment of granites and porphyries of Amritpur-Ramgarh area, Lesser Himalaya, Uttar Pradesh. *Jour. Him. Geol.* 5, 103-116.

- Hall S. M. and Veizer J. (1996) Geochemistry of Precambrian carbonates : VII Belt supergroup, Montana and Idaho, USA. *Geochim. Cosmochim. Acta* **60**, 667-677.
- Harris N. (1995) Significance of weathering of Himalayan metasedimentary rocks and leucogranites for the Sr isotope evolution of seawater during early Miocene. *Geology* **23**, 795-798.
- Harris N., Bickle M., Chapman H., Fairchild I. and Bunbury J. (1998) The significance of Himalayan rivers for silicate weathering rates: evidence from Bhote Kosi tributary. *Chem Geol* **144**, 205-220.
- Hauri E. and Hart S. R. (1993) Re-Os isotope systematics of HIMU and EMII oceanic island basalts from the south Pacific ocean. *Earth Planet. Sci. Lett.* **114**, 353-371.
- Heumann K. G. (1988) Isotope dilution mass spectrometry. In: *Inorganic Mass Spectrometry* (eds. F Adams et al.) Chap 7 pp 301-376.
- Horan M. F., Morgan J. W., Grauch R. I., Coveney Jr. R. M., Murowchick J. B. and Hulbert L. J. (1994) Rhenium and osmium isotopes in black shales and Ni-Mo-PGE-rich sulfide layers, Yukon Territory, Canada, and Hunan and Guizhou provinces, China. *Geochim. Cosmochim. Acta* **58**, 257-265.
- Kanwar S. S. and Ahluwalia A. D. (1979) Lithostratigraphy of Upper Palaeozoic Tethyan sequence in Chandra Valley Near Bara Lacha La, District Lahaul and Spiti, Himachal Pradesh, India. In Upper Palaeozoics of the Himalayas, Hindustan Publishing Corporation (I), Delhi, 147p.
- Kashyap S. R. (1972) Magmatites of Ramgarh area, district Nainital, U.P. *Him. Geol.* **2**, 271-288.
- Kaur M. and Chamiyal L. S. (1996) The Granitoids of Pindar-Sarju-Ramganga and Goriganga Valleys of Higher Kumaun Himalaya. *Jour. Geol. Soc. India* **47**, 665-674.
- Krishnaswami S., Trivedi J. R., Sariñ M. M., Ramesh R., and Sharma K. K. (1992) Strontium isotope and rubidium in the Ganga-Brahmaputra river system : weathering in the Himalaya, Fluxes to Bay of Bengal and contribution to the evolution of oceanic  $^{87}\text{Sr}/^{86}\text{Sr}$ . *Earth Planet. Sci. Lett.* **109**, 243-253.
- Krishnaswami S. and Singh S. K. (1998) Silicate and carbonate weathering in the drainage basinss of the Ganga-Ghaghara-Indus headwaters: Contributions to major ion and Sr isotope geochemistry. *Proc. Indian Acad. Sci. (Earth Planet. Sci.)* (in press).

- Krishnaswami S., Singh S. K. and Dalai T. K. (1998) Silicate weathering in the Himalaya: Role in contributing to major ions and radiogenic Sr to the Bay of Bengal; In: Proc. INSA Symposium on "Present Trends and Future Directions in Ocean sciences", (in press).
- Kumar G. (1984) The Precambrian-Cambrian Boundary beds, Northwest Himalaya, India and boundary problem. *Proc. Vth Ind. Geophyt. Conf.*, 89-111.
- Kumar G., Bhatt D. K. and Raina B. K. (1987) Skeletal microfauna of Meishucunian and Qiongzhuisian (Precambrian-Cambrian boundary) age from the Ganga Valley, Lesser Himalaya, India. *Geol. Mag.* **124**, 167-171.
- Kumar S. and Tewari C. (1978) A study of oolites from the Gangolihat dolomite, Kothpuria Chhina area, Almora district, U. P. with special reference to diagenetic changes. *Him. Geol.* **8**, 613-624.
- Kumar S. (1998) A note on oxygen isotopes of magnesite and dolostone of Mesoproterozoic Gangolihat dolomite (Formation), Pithoragarh district, Uttar Pradesh, *Jour. Geol. Soc. India* **51**, 367-370.
- Lasaga, A. C., Soler J. M., Ganor J., Burch T. E. and Nagy K. L. (1994) Chemical weathering rate law and global geochemical cycles. *Geochim. Cosmochim. Acta* **58**, 2361-2386.
- Le Fort P. (1975) The anatetic Himalayan Leucogranites with emphasis on the Manaslu Tourmanline Granite. *Recent Res. Geol.* **2**, 76-90.
- Levasseur S., Birk J. L and Allegre C. J. (1998) Direct Measurements of femtomoles of osmium and the  $^{187}\text{Os}/^{186}\text{Os}$  ratio in seawater. *Science* **282**, 272-274.
- Lindner M., Leich D.A., Russ G.P., Bazan J.M. and Borg R.J. (1989) Direct determination of the half life of  $^{187}\text{Re}$ . *Geochim. Cosmochim. Acta* **53**, 1597-1606.
- Luck J. M. (1982) Geochimie du Rhenium- Osmium: Method et applications. Thesis Univ. of Paris VII.
- Luck J. M. and Allegre C. J. (1983)  $^{187}\text{Re}$ - $^{187}\text{Os}$  systematics in meteorites and cosmochemical consequences. *Nature* **302**, 130-132.
- Martin C. E. (1990) Rhenium - Osmium isotope geochemistry of the mantle. Ph. D. Thesis Yale Univ., USA.

- Mattinson J. M. (1969) Preparation of Hydrofluoric, Hydrochloric, and Nitric Acids at ultralow lead levels. *Anal. Chem.* **41** 2088-2089.
- McCauley S. E. and DePaolo D. J. (1997) The marine  $^{87}\text{Sr}/^{86}\text{Sr}$  and  $\delta^{18}\text{O}$  records, Himalayan Alkalinity Fluxes and Cenozoic climate models. In: *Tectonic Uplift and Climate change* (ed. W. F. Ruddiman), pp. 428-467, Plenum Press, New York, USA.
- Medlikott H. B. (1864) On the geological structure and the relations of the southern portion of the Himalayan range between the rivers Ganges and Ravee. *Mem. Geol. Surv. India* **3**, 1-212.
- Mehr S. S. (1977) Structural studies in the parts of Kumaun Himalaya. *Him. Geol.* **7**, 26-42.
- Meyer F. M. and Robb L. J. (1996) The geochemistry of black shales from the Chuniespoort Group, Transvaal Sequence, Eastern Transvaal, South Africa. *Econ. Geol.* **91**, 111-121.
- Mirota M. D. and Veizer J. (1994) Geochemistry of Precambrian carbonates: VI. Aphebian Albanel Formations, Quebec, Canada. *Geochim. Cosmochim. Acta* **58**, 1735-1745.
- Misra R. C., Sharma R. P. and Sinha A. K. (1973) Petrochemistry of the Almora Crystallines, Kumaun himalaya. *Him. Geol.* **3**, 411-435.
- Nautiyal S. P. and Rawat R. S. (1990) Nature and Preliminary petrochemistry of the Amritpur granites, Nainital district, Kumaun Himalaya, U.P., India. *Jour. Him. Geol.* **1**, 199-208.
- Negrel P., Allegre C. J., Dupre B., and Lawin E. (1993) Erosion sources determined by inversion of major and trace element ratio in river water: The Congo basin case. *Earth Planet. Sci. Lett.* **120**, 59-76.
- Nier A. O. (1937) The isotopic constitution of osmium. *Phys. Rev.* **52**, 885.
- Palmer M. R. and Edmond J. M. (1989) The strontium isotope budget of the modern ocean. *Earth Planet. Sci. Lett.* **92**, 11-26.
- Palmer M. R. and Edmond J. M. (1992) Controls over the strontium isotope composition of river water. *Geochim. Cosmochim. Acta* **56**, 2099-2111.

- Pande K., Sarin M. M., Trivedi J. R., Krishnaswami S., and Sharma K. K. (1994) The Indus river system (India-Pakistan): Major ion chemistry, Uranium and Strontium isotopes. *Chem. Geol.* **116**, 245-259.
- Pasava J., Hladikova J. and Dobes P. (1996) Origin of Proterozoic metal-rich black shales from the Bohemian massif, Czech Republic. *Econ. Geol.* **91**, 63-79.
- Pegram W. J., Krishnaswami S., Ravizza G. E. and Turekian K. K. (1992) Record of sea water  $^{187}\text{Os}/^{186}\text{Os}$  variation through the Cenozoic. *Earth Planet. Sci. Lett.* **113**, 569-576.
- Pegram W. J., Esser B. K., Krishnaswami S. and Turekian K. K. (1994) The isotopic composition of leachable osmium from river sediments. *Earth Planet. Sci. Lett.* **128**, 591-599.
- Porcelli D., Sharma M. and Wasserburg G. J. (1998) The behaviour of Os isotopes in the Columbia River estuary. EOS (abstract).
- Potts P. J., Tindle A. G. and Webb P. C. (1992) Geochemical reference material compositions, Whittles Publishing, U.K.
- Prasad B., Maithy P. K., Kumar G. and Raina R. N. (1990) Precambrian-Cambrian Acritarchs from the Blani-Krol-Tal sequence of Mussoorie syncline, Garhwal, Lesser Himalaya, India. *Geol. Soc. Ind. Mem.* **16**, 19-32.
- Quade J., Roe L., DeCelles P. G. and Ojha T. P. (1997) The Late Neogene  $^{87}\text{Sr}/^{86}\text{Sr}$  Record of Lowland Himalayan Rivers. *Science* **276**, 1828-1831.
- Rao A. R. (1968) On the Krol nappe hypothesis. *Jour Geol. Soc. India* **9**, 155-158.
- Rao D. V. (1983) Granites and Granitic Gneisses of the Himalayas. In *Granites of Himalayas Karakoram and Hindukush* (ed. F. A. Shams), Punjab University, Lahore, Pakistan, 55-74.
- Ravizza G. E. and Turekian K. K. (1989) Application of the  $^{187}\text{Re}-^{187}\text{Os}$  system to black shale geochronometry. *Geochim. Cosmochim. Acta* **53**, 3257-3262.
- Ravizza G. E. (1991) Rhenium - Osmium isotope geochemistry of modern and ancient organic rich sediments. Ph. D. Thesis, Yale Univ. USA.
- Ravizza G., Turekian K. K. and Hay B. J. (1991) The geochemistry of Rhenium and osmium in recent sediments from the Black Sea, *Geochim. Cosmochim. Acta* **55**, 3741-3752.

- Ravizza G. E. and Turekian K. K. (1992) The osmium isotopic composition of organic-rich marine sediments. *Earth Planet. Sci. Lett.* **110**, 1-6.
- Ravizza G. E. (1993) Variations of  $^{187}\text{Os}/^{186}\text{Os}$  ratio of sea water over the past 28 million years as inferred from metalliferous carbonates. *Earth Planet. Sci. Lett.* **118**, 335-348.
- Ravizza G. E. and Esser B. K. (1993) A possible link between the seawater osmium isotope record and weathering of ancient sedimentary organic matter. *Chem. Geol.* **107**, 255-258.
- Ravizza G. E. and Ehrenbrink B. P. (1998) Osmium isotope as tracers of organic matter weathering. *Nature* (submitted).
- Rawat R. S. (1984) Petrology of the Naini group (Chail Nappe) metasedimentary rocks from inner Lesser Garhwal Himalaya, U.P., India. *Him. Geol.* **12**, 236-260.
- Raymo M. E. and Ruddiman W. F. (1992) Tectonic forcing of late Cenozoic climate. *Nature* **359**, 117-122.
- Raymo M. E., Ruddiman W. F. and Froelich, P. N. (1988) Influence of late Cenozoic mountain building on ocean geochemical cycles, *Geology* **16**, 649-653.
- Reisberg L., France-Lanord C. and Pierson-Wickmann A.-C. (1997) Os isotopic composition of leachates and bulk sediments from the Bengal Fan. *Earth Planet. Sci. Lett.* **150**, 117-127.
- Reusch D. N., Ravizza G. E., Maasch K. A. and Wright J. D. (1998) Miocene seawater  $^{187}\text{Os}/^{186}\text{Os}$  ratios inferred from metalliferous carbonates. *Earth Planet. Sci. Lett.* **160**, 163-178.
- Richter M., Rowley D. B. and DePaolo D. J. (1992) Sr evolution of sea water: the role of tectonics. *Earth Planet. Sci. Lett.* **109** 11-23.
- Ruddiman W. F. (1997) *Tectonic Uplift and Climate Change*, Plenum Press, New York.
- Rupke J. (1974) Stratigraphic and structural evolution of the Kumaun Lesser Himalaya. *Sediment. Geol.* **11**, 81-265.
- Sarin M. M., Borole D. V. and Krishnaswami S. (1979) Geochemistry and geochronology of sediments from the Bay of Bengal and the equatorial Indian Ocean. *Proc. Ind. Acad. Sci. (Earth Planet. Sci.)* **83**, 131-154.

- Sarin M. M., Krishnaswami S., Dilli K., Somayajulu B. L. K. and Moore W. S. (1989) Major ion chemistry of the Ganga-Brahmaputra river system: Weathering processes and fluxes to the Bay of Bengal. *Geochim. Cosmochim. Acta* **53** 997-1009.
- Sarin M. M., Krishnaswami S., Trivedi J. R., and Sharma K. K. (1992) Major ion chemistry of the Ganga source waters : Weathering in the high altitude Himalaya. *Proc. Ind. Acad. Sci. (Earth Planet. Sci.)* **101**, 89-98.
- Sarin M. M., Bhushan R. and Dutta K. (1997) Determination of organic carbon and nitrogen in marine sediments using elemental analyzer. In *A Conference document on Recent Advances in Elemental Analysis* (eds. Padmanabhan P.K and Mathur P.K.), pp36-38, Indian Soc. Anal. Scientists, Mumbai.
- Sarkar A., Ramesh R. and Bhattacharya S. K. (1990) Effect of sample pretreatment and size fraction on the  $\delta^{18}\text{O}$  and  $\delta^{13}\text{C}$  values of foraminifera in Arabian Sea sediments. *Terra Nova* **2**, 489-493.
- Sarkar A., Roy A., Ghatak G. S. and Bhattacharya S. K. (1996) Strontium isotope study of Krol-Tal carbonates: Implication to the Strontium isotope flux of Himalayan Rivers. *Ind. Jour. Geol.* **68**, 255-262.
- Scaillet B., France-Lanord C. and Le Fort P. (1990) Badrinath-Gangotri plutons (Garhwal, India): petrological and geochemical evidence for fractionation processes in a high Himalayan leucogranite. *J. Volcanol. Geotherm. Res.* **44**, 163-188.
- Shanker R. (1971) Stratigraphy and sedimentation of Krol formation Mussoorie Syncline, Uttar Pradesh. *Jour. Paleont. Soc. India* **16**, 1-15
- Shanker R. and Mathur V.K. (1992) Precambrian-Cambrian sequence in Krol Belt and additional Ediacaran fossil. In Proc "Birbal Sahni Centenary paleobotanical Conference" (eds. B.S. Venkatachala, K.P. Jain and N. Awasthi), *Geophytology* **22**, 27-39.
- Shanker R., Kumar G., Mathur V. K. and Joshi A. (1993) Stratigraphy of Blaini, Infra Krol, Krol and Tal Succession, Krol Belt, Lesser Himalaya. *Indian Jour. Petrol. Geol.* **2**, 99-136.
- Sharma K. K. (1998) Geological and tectonic evolution of the Himalaya before and after the India-Asia collision. *Proc. Indian Acad. Sci. (Earth planet. Sci.)* (in press).

- Sharma K. K., Rao D. R., Azmi R. J., Gopalan K. and Pantulu G. V. C. (1992) Precambrian-Cambrian boundary in the Tal Formation of Garhwal Lesser Himalaya: Rb-Sr age evidence from black shales underlying phosphorites. *Curr. Sci.* **62**, 528-530.
- Sharma M. and Wasserburg G. J. (1997) Osmium in rivers. *Geochim. Cosmochim. Acta* **61**, 5411-5416.
- Sharma M., Papanastassiou D. A. and Wasserburg G. J. (1997) The concentration and isotopic composition of osmium in the oceans. *Geochim. Cosmochim. Acta* **61**, 3287-3299.
- Shen J. J., Papanastassiou D. A. and Wasserburg G.J. (1996) Precise Re-Os determinations and systematics of iron meteorites. *Geochim. Cosmochim. Acta* **60** 2887-2900.
- Shirey S. B. and Walker R. J. (1998) The Re-Os isotope system in cosmochemistry and high- temperature geochemistry. *Ann. Rev. Earth Planet. Sci.* **26**, 423-500.
- Singh I. B. (1978) Sedimentological evolution of the Krol belt sediments. *Him. Geol.* **8**, 657-682.
- Singh I. B. and Rai V. (1978) Some observations of the depositional environment of the Krol Formation in Nainital area. *Him. Geol.* **8**, 633-656.
- Singh I. B. and Rai V. (1983) Fauna and biogenic structures in Krol-Tal succession (Vendian-Early Cambrian), Lesser Himalaya: their biostratigraphic and palaeontological significance. *Jour. Palaeont. Soc. India* **21**, 67-90.
- Singh S. K., Trivedi J. R., Pande K., Ramesh R. and Krishnaswami S. (1998) Chemical and strontium, oxygen, and carbon isotopic compositions of carbonates from the Lesser Himalaya : Implications to the strontium composition of the source waters of the Ganga, Ghaghara and Indus rivers. *Geochim. Cosmochim. Acta* **62** 743-755.
- Singh S. K., Trivedi J. R. and Krishnaswami S. (1999) Re-Os isotope systematics in black shales from the Lesser Himalaya : Their chronology and role in the  $^{187}\text{Os}/^{186}\text{Os}$  evolution of seawater. *Geochim. Cosmochim. Acta* (submitted).
- Stocklin J. (1980) Geology of Nepal and its regional frame. *Jour. Geol. Soc. London* **137**, 1-34.

- Strickland J. D. H. and Parsons T. R. (1972) A practical Hand-book of seawater analysis  
Ottawa: Fisheries Research Board of Canada.
- Tandon S. K., Thakur V. C., Nanda A. C., Azmi R. J., Bagati T. N., Tewari V. C. and  
Kumar R. (1988) Excursion guide Himalayan sequence of Dehradun-Mussoorie  
sector. Geol. Soc. India, Bangalore.
- Tewari A. P. and Gaur R. K. (1977) Geological conditions of formation of pyrite-  
polymetallic deposits of the Himalaya and the great Caucasus-A comparison. *Him.  
Geol.* 7, 234-245.
- Tewari M. and Azmi R. J. (1992) Late-Proterozoic organic-walled microfossils from the  
Infra-krol of Solan, Himachal, Lesser Himalaya: an additional age constraint in the  
Krol Belt succession. *Paleobotanist* 39, 387-394.
- Trivedi J. R. (1990) Geochronological studies of Himalayan granitoids. Ph. D.  
dissertation, Gujarat University, Ahmedabad.
- Trivedi J. R., Pande K., Krishnaswami S. and Sarin M. M. (1995) Sr isotopes in rivers of  
India and Pakistan: A reconnaissance study. *Curr. Sci.* 69, 171-178
- Trivedi J. R., Singh S. K. and Krishnaswami S. (1999) Re-Os Isotope Measurement  
Techniques : Preliminary Results from the Lesser Himalayan Sedimentaries. *Proc.  
Indian Acad. Sci. (Earth Planet. Sci.)* (submitted).
- Turekian K. K. and Pegram W. J. (1997) Osmium isotope record in a Cenozoic deep-sea  
core: Its relation to global tectonic and climate. In Tectonic Uplift and Climate, (ed.  
W.F. Ruddiman), pp. 383-397. Plenum Press, New York.
- Valdiya K. S. (1975) Lithology and age of the Tal formation in Garhwal and implication  
on stratigraphic scheme of Krol Belt in Kumaun Himalaya. *Jour. Geol. Soc. India* 19,  
119-134.
- Valdiya K. S. (1980) Geology of the Kumaun Lesser Himalaya, Wadia Institute of  
Himalayan Geology, Dehradun.
- Valdiya K. S. (1995) Proterozoic sedimentation and Pan-African geodynamic  
development in the Himalaya. *Precambrian Res.* 74, 35-55.
- Veizer J. (1978) Sr abundance in common sediments and sedimentary rock types. In  
*Handbook of Geochemistry* (ed. K. H. Wedepohl) vol. II-5, Chap. 38, pp. 38-k-1-13,  
Springer-Verlag.