M. Satish-Kumar, Ph.D.

Professor
Program:Environmental Science and Technology
Area: Earth Science
Undergraduate: Dept. of Geology
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Professional Expertise

Metamorphic geology, Precambrian geology, Isotope geochemistry

Research Fields of Interest

◆ **Carbon geodynamic cycle**

Carbon is the fourth most abundant element in the solar system and is a life-saving and life destructing element! Its geochemical cycle have implications on the origin and evolution of life, and control the Earth's surface environment. I use *carbon stable isotopes* as a tool to understand the global carbon geodynamic cycle.

◆ **Isotope geochemistry**

My attempt here is to relate the processes of isotope exchange in natural systems and compare it with experimentsl: To understand the link between *Earth's interior and surface processes* that controlled the chemical evolution of Earth, and to model the material circulation, especially in the early stages, during which the Earth was "hot" and "dynamic".

◆ **Antarctica and supercontinent evolution**

Our knowledge on *Gondwana* supercontinent formation and evolution is limited because of lack of information about *Antarctica*. Participating in the Japanese Antarctic Research Expedition twice (JARE-46 & 51), we try to bring in to light the hidden bed rocks that can refine the models of formation of Gondwana and earlier supercontinents.

Finding of "Ruby" from a marble in Antarctica during JARE-51

◆ **Precambrian Earth – a key link between global tectonics and environmental changes**

In this topic I try to unfold the mysterious *relation between global tectonic events and environmental changes*. The case studies I am pursuing now are the "*Cambrian Explosion*" during the Late Neoproterozoic-Cambrian (~650-500 Ma) and the "*Great Oxidation Event*" in the Archean-Proterozoic boundary (3.0 to 2.5 Ga).

Education

1998: Ph.D. Graduate School of Science and Technology, Osaka City University, Japan
1992: M.Sc. Mahatma Gandhi University, Kottayam, Kerala, India
1990: B.Sc. Kerala University, Thiruvananthapuram, Kerala, India

Professional Societies and Activities

I. 1) Geological Society of Japan; 2) Japan Association of Mineralogical Sciences; 3) Geochemical Society of Japan; 4) Geological Society of London; 5) Geochemical Society; 6) American Geophysical Union; 7) International Association of Gondwana Research; 8) Geological Society of India.
II. 1) Vice Chief Editor of "Journal of Mineralogical and Petrological Sciences"; 2) Vice

Executive Editor of “Geochemical Journal”; 3) Associate Editor of “Island Arc”; 4) Member of Books Editorial Committee of the “Geological Society of London”.

Major Publications

Papers

[1] **Satish-Kumar, M.** Hokada, T., Owada, M., Osanai, Y., & Shiraishi, K., Neoproterozoic orogens amalgamating East Gondwana: Did they cross each other? Precambrian Research, (in press) 2013.

[2] Otsuji, N., **Satish-Kumar, M.**, Kamei, A., Tsuchiya, N., Kawakami, T., Ishikawa, M. & Grantham, G.H., Late-Tonian to early-Cryogenian apparent depositional ages for metacarbonate rocks from the Sør Rondane Mountains, East Antarctica., Precambrian Research, (in press), 2013.

[3] Higashino, F., Kawakami, T., **Satish-Kumar, M.**, Ishikawa, M., Maki, K., Tsuchiya, N., Grantham, G.H. & Hirata, T., Chlorine-rich fluid or melt activity during granulite facies metamorphism in the Late Proterozoic to Cambrian continental collision zone – an example from the Sør Rondane Mountains, East Antarctica. Precambrian Research, (in press), 2013.

[4] **Satish-Kumar, M.**, So, H., Yoshino, T., Kato, M. & Hiroi Y., Carbon isotope fractionation in the Fe-C system at HPHT experiments: Reply to the comment by Reutsky and Borzdov. Earth and Planetary Science Letters, 368, 222-224, 2013.

[5] Rajesh, V.J., Arai, S., **Satish-Kumar, M.**, Santosh, M., & Tamura, A., High-Mg low-Ni olivine cumulates from a Pan-African accretionary Belt in southern India: Implications for the genesis of volatile-rich high-Mg melts in suprasubduction setting. Precambrian Research, 227, 409-425, 2013.

[6] Hokada, T., Horie, K., **Satish-Kumar, M.**, Ueno, Y., Nasheeth, A., Mishima, K. & Shiraishi, K., An appraisal of Archaean supracrustal sequences in Chitradurga Schist Belt, Western Dharwar Craton, Southern India. Precambrian Research, 227, 99-119, 2013.

[7] Grantham, G.H., Mendonidis, P., Thomas R.J. & **Satish-Kumar, M.**, Multiple origins of charnockite in the Mesoproterozoic Natal belt, Kwazulu-Natal, South Africa. Geoscience Frontiers, 3, 755-771, 2012.

[8] Taguchi, T., **Satish-Kumar, M.**, Hokada, T., & Jayananda, M., Petrogenesis of Cr-rich calc-silicate rocks from the Bandihalli Schist Belt, Archean Dharwar Craton, India. Canadian Mineralogist, 50, 705-718, 2012.

[9] **Satish-Kumar, M.**, So, H., Yoshino, T., Kato, M. & Hiroi Y., Experimental determination of carbon isotope fractionation between iron carbide melt and carbon: 12C-enriched carbon in the Earth's core? Earth and Planetary Science Letters, 310, 340-348, 2011.

[10] **Satish-Kumar, M.**, Yurimoto, H., Itoh, S. & Cesare B., Carbon isotope anatomy of a single graphite crystal in a metapelitic migmatite revealed by high-spatial resolution SIMS analysis. Contributions to Mineralogy and Petrology, 162, 821-834, 2011.

[11] **Satish-Kumar, M.**, Jaszczak, J.A., Hamamatsu, T. & Wada, H., Relationship between structure, morphology and carbon isotopic composition of graphite in marbles: Implications for calcite-graphite carbon isotope thermometry. American Mineralogist, 96, 470-485, 2011.

[12] **Satish-Kumar, M.**, Hermann, J., Miyamoto, T. & Osanai, Y., Fingerprinting a multistage metamorphic fluid–rock history: Evidence from grain scale Sr, O and C isotopic and trace element variations in high-grade marbles from East Antarctica. Lithos, 114, 217-228, 2010.

[13] Mizuochi, H., **Satish-Kumar, M.**, Motoyoshi, Y. & Michibayashi, K., Exsolution of dolomite and application of calcite-dolomite solvus geothermometry in high-grade marbles: An example from Skallevikshalsen, East Antarctica. Journal of Metamorphic Geology, 28, 509–526. 2010.

[14] Cesare B., **Satish-Kumar, M.**, Cruciani, G., Shabeer, P. & Nodari, L., Mineral chemistry of Ti-rich biotite from pegmatite and metapelitic granulites of the Kerala Khondalite Belt (southeast India): Petrology and further insight into titanium substitutions. American Mineralogist, 93, 327–338. 2008.

[15] **Satish-Kumar, M.**, Hermann, J. Osanai, Y. & Tsunogae, T., Carbonation of Cl-rich scapolite boudins in Skallen, East Antarctica: Evidence for changing fluid condition in the continental crust. Journal of Metamorphic Geology, 24, 241-261. 2006.

[16] **Satish-Kumar, M.**, Graphite-bearing CO2-fluid inclusions in granulites: Insights on graphite precipitation and carbon isotope evolution Geochimica et Cosmochimica Acta, 69, 3841-3856, 2005.

[17] **Satish-Kumar, M.**, Wada, H. & Santosh, M. Constraints on the application of carbon isotope thermometry in high- to ultrahigh-temperature metamorphic terrains. Journal of Metamorphic Geology, 20, 335-350, 2002.

[18] **Satish-Kumar, M.**, Wada, H., Santosh, M. & Yoshida, M., Fluid-rock history of granulite facies humite-marbles from Ambasamudram, southern India. Journal of Metamorphic Geology, 19, 395-410, 2001.

[19] Yoshino, T. & **Satish-Kumar, M.**, Origin of scapolite in deep-seated metagabbros of the Kohistan Arc, NW Himalayas. Contributions to Mineralogy and Petrology, 140, 511-531, 2001.

[20] **Satish-Kumar, M.**, Yoshida, M., Wada, H., Niitsuma, N. & Santosh, M., Fluid flow along microfractures in calcite from a marble from East Antarctica: Evidence from gigantic (21per mil) oxygen isotopic zonation. Geology, 26, 251-254, 1998.

[21] **Satish-Kumar, M.** & Harley, S.L., Reaction textures in scapolite-wollastonite-grossular calc-silicate rock from the Kerala-Khondalite Belt, Southern India: evidence for high-temperature metamorphism and initial cooling. Lithos, 44, 83-99, 1998.

Books

[1] **Satish-Kumar, M.**, Motoyoshi, Y., Osanai, Y., Hiroi, Y. & Shiraishi, K., 2008. Geodynamic evolution of East Antarctica: a key to East-West Gondwana connection. Geological Society of London, Special Publications, 308, p.464.