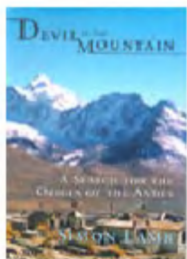


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SUNIL K. PANDYA

Flat 11, 5th Floor,  
Shanti Kutir,  
Marine Drive,  
Mumbai 400 020, India  
e-mail: shunil@vsnl.com



**Devil in the Mountain – A Search for the Origin of the Andes.** Simon Lamb. Princeton University Press, 41, William Street, Princeton, New Jersey 08540, USA. 2004. 335 pp. Price: US \$ 29.95.

*Devil in the Mountain* is a story of the Andes – the greatest mountain chain of the world, after the Himalaya, which defines the western margin of the South American continent. The author of the book, Simon Lamb, who belongs to the Oxford earth sciences faculty, had spent several years in the Bolivian Andes, piloting a project that probed the origin and evolution of this mountain chain. Reading Lamb's book, I was reminded of an astonishing analogy made by K. V. Hodges of MIT, while reviewing the tectonic processes that shaped the Himalaya. With regard to the study of orogenesis (mountain building), he makes

an allusion to two schools of paintings – impressionism and neo-impressionism. While the impressionist depicts the flow of time, as the artist perceives it, the neo-impressionist, in a minimalist way depicts only some 'specks' of reality, leaving viewers to build on their imagination. Part of Lamb's book that describes the historical progression of the Andes' evolution, coloured with his own perspective, may represent the best in the heuristic traditions of classical geology, and may be likened to an impressionistic approach. Occasionally, the author dons the hat of a neo-impressionist, and nudges the reader to appreciate the role of individual components like thermal and magnetic properties of the crust, climatic factors, erosional processes and ocean currents in carving out the sum total of the present architecture of the Andes. To paint a big picture, Lamb exorcises all these 'devils' – a metaphor borrowed from the Bolivian miners who believe in propitiating the spirit whom they think resides in the mountain.

Lamb begins his narration by unfolding the intellectual pleasure of geological fieldwork. To put it in his idiom – how to learn the language of rocks and start 'conversing' with them, a tradition inaugurated by early naturalists like James Hutton, Charles Darwin and Charles Lyell. Throughout the book, the author exudes this excitement for reading the language of the rocks. Lamb essentially describes how he went about searching for the 'root' causes of the Andean evolution – the question of what supports and maintains the mountain ranges. The author discusses in detail two different theories of the 19th century – one by George Biddell Airy, Astronomer Royal of England and the other by Archdeacon of Calcutta, John Henry Pratt. According to Airy, a deep root at the base of the crust supports the high-standing land mass at the surface (thus the mountain floats like an iceberg). The Pratt hypothesis, however, visualizes variation in density within the earth and he says that high topography is supported by low-density material beneath the mountain (similar to risen dough). In the end, Lamb concludes that one may require elements from both these theories to explain the high mountain topography. The other question of why mountains are localized only in certain areas of the globe, is answered with the help of plate tectonic theory – sine qua non of any modern geology book. In the case of the

Andes with its high-rising twin ranges called eastern and western cordilleras, separated by plains of Altiplano, even the variation in the geometry of the subduction plate and the availability of sediments in the trenches seem to have a bearing on the development of this remarkable landscape. Lamb finally takes the reader to modelling of geodynamic processes and finds out the genetic parallels between the Bolivian Altiplano and the Tibetan Plateau, two intriguing high plains that appear in the middle of the mountains. Lamb deals with all these complicated scientific topics with ease and aplomb.

This book may also be taken as an open defence of the author's own research in the Andes, admittedly, most eloquent and on the whole very convincing. I must, however, add here that the jury is still out on many issues related to the evolution of large mountain chains and their eventual demise. Many speculative theories float around and this field continues to be a fertile ground for fresh insights; new imaging techniques help us reach the unreachable under the surface, thus giving us further fodder for thought. Although the author gives a comprehensive review of the work and results of not only his, but also of others, I think he has omitted or only glossed over some of the factors like seismic pattern and productivity along the Andean front, which may have a bearing on the mechanics of deformation of the Andes mountain. Another aspect that requires more elaboration, I think, is the role of the Atacama fault bordering the western foot of the Andes. What is the fault doing there? How does it fit in the overall deformation of the Andes? I think this aspect is the least explained (Lamb's nerve-racking and whimsical solo drive through the shimmering Atacama Desert in a rented car to reach the fault, notwithstanding). Yet another interesting problem that deserves greater attention from the point of view of mantle dynamics is the generation of deep earthquakes under the Bolivian Andes; for example, the focal depth of the 1994 Bolivian earthquake was 600 km, the deepest ever known.

Another function that this book does well is its projection of the Bolivian society and the daily grind of its vast majority of poor but gritty people. Whether they are miners, farmers or even drivers, these people bravely fight many odds on a daily basis to live their lives. The author

interweaves the human stories in his narrative with great compassion and sweetness, and is also able to conjure up some unforgettable images: I can see that little girl standing against the icy wind in a forlorn site in the Bolivian Altiplano from whom Lamb forced himself to buy eggs, knowing well that they would not survive the bumpy roads. On another level, the book is able to reveal the extreme field conditions of what may be one of the most inhospitable terrains in the world. One can only sit back and admire the perseverance and sheer determination of Lamb (and two of his colleagues, of course) in executing the work in a rugged and politically sensitive part of the world. I cannot help quote a memorable passage from the book, wherein he narrates how he scaled Putana – one of the remotest active volcanos in Bolivia, to collect helium sample for determining whether the gas emanates from the crust or the mantle: ‘The final few hundred meters of the climb were the most exhausting of my life. By now my world had focused down to the next ten paces. We had at last reached the snow line, and with each step I sank calf deep into the

soft snow. I willed myself on by selecting a rock a few meters ahead of me, pulling my legs out of the snow and counting my steps. Sometimes I did not even have the energy to reach the rock but would collapse in the snow on my back, panting heavily. In my desperation to finish the climb I was ascending too fast, squandering my remaining resources of energy. . . . Yet I was loath to give up, having come so far. . . .’ In one part of the book he asks if all this effort was worth it – a question some of us would ask ourselves, at least on a few occasions in our lives. Is there something inexplicable or primal in human nature that makes us do extraordinary feats? Like Lamb, why do some of us strain every nerve; stretch endurance beyond its limit, to reach certain goals? Eric Shipton, one of the greatest mountain climbers, when quizzed about his vocation answered this question straight and simple: ‘Because it is there’. What he meant was that challenge had to be met by response. In Lamb, I find a hero, who met his challenge head-on – a reason why I like to qualify this book as a celebration of human spirit and its ultimate triumph.

Success of science as a social construct lies in communication with fellow beings – to interest people in its limitless possibilities as a tool to understand our environment and make it a better place to live. Lamb succeeds enormously in transmitting the excitement of conducting science, a path leading to greater appreciation of our environment. Such books should be made compulsory reading in our university education, particularly for earth sciences students, to let them know that there are things beyond just passing out and getting a degree or even a mediocre job: the joy of risking safety and the terrific urge not to be satisfied with easy answers. If they were to read Lamb’s book, I am sure at least some of them will never leave the field. As the love of science is fast losing out to crass careerism, it is time that they really did.

C. P. RAJENDRAN

*Centre for Earth Science Studies,  
Akkulam,  
Thiruvananthapuram 695 031, India  
e-mail: cp\_r@vsnl.com*