

**Who We Are And How We Got Here: Ancient DNA and the New Science of the Human Past.** David Reich. Pantheon Books, a division of Penguin Random House LLC, New York. 2018. xxvii + 339 pages. Price: US\$ 28.95.

This is an account of the human past derived from applying the latest technology in genomics (the study of DNA), namely Next Generation Sequencing or NGS. The book contains 286 pages of narrative with 30 figures, along with 30 pages of notes. We need to compliment David Reich for making a difficult subject understandable to the common reader and scientist alike, though the small font is a deterrent to comfortable reading. There are a handful of pioneers in the world in the field of ancient DNA studies, and Reich's book proves him to be one. The advent of NGS has benefitted the field of archaeology by enabling the study of even poorly preserved DNA recovered from buried/fossilized bones of our ancestors. DNA is passed down almost faithfully from parents to children; when preserved, it acts as a frozen record of the past. One might say DNA speaks in whispers that convey the story of our species, and how, starting from Africa, it spread to various continents. The approach is based on estimating similarity and differences by comparing DNA from two different sources, and estimating age, how long ago the two DNA sequences came from a common ancestor. The advantage of this ancient DNA over conventional archaeology is that by studying aDNA, one can trace human migrations with greater confidence than possible from artefacts alone. Naturally the book presents many surprises and new information: He asserts no population is pure in the sense of being wholly distinct from the others and it is always constituted from an admixture of several

ancestries. The temperate climates of northern hemisphere have yielded many aDNA, and studying them enabled these admixture events to be visualized.

The author first traces Neanderthal admixture with modern humans in Western Europe to trace the antiquity of modern European populations. A similar phenomenon with Denisovans, another extinct group could be identified further in the East, Papua New Guinea and mainland Eurasia. The interbreeding between these populations occurred 49,000–54,000 years ago and their ancestries are found in 2–5% of all modern world populations, except present day Africans. The 'Out of Africa' (OoA) theory put forth based on NRY and mtDNA is thus modified into 'Mostly OoA'. Thus modern man emigrated OoA, 3–4 times for much longer period, though the last one was the most successful colonization of the world. Using aDNA and modern DNA of humans, Reich interprets the findings identifying 30 major centres of human admixtures and expansion that were important in the formation of modern populations. He further makes it possible to follow how the process of shuffling of our genetic material, carried on 23 pairs of chromosomes, along with a slower change on account of mutations, created human diversity. He has to however struggle to explain the peopling of other regions; here he invents 'ghost' populations. The book is thus divided into three parts: (i) deep history, which deals with the 'Who we are' question; (ii) how we got here, which considers ancient human movements – the Neanderthal and Denisovans admixture story and (iii) the issues of inequality, race and identity which inevitably spring up in discussions of human genetics. In the last part, Reich tries to be cautious and points out that one has to appreciate the roles of philosophy and religion in world of humans. His assertion that no population is 'pure' is apt, though it is not new. Nobody wastes their time on such things today, with the possible exception of fanatics. The lesson that all of us are derived from several genetic ancestries is new, though.

Here is where I differ from Reich. He puts all the emphasis on whole genome sequencing as a panacea guaranteed to aid the discovery of genetic factors behind various illnesses. One needs to strike a balance in terms of which technologies are most appropriate for under-

standing human diseases which are thought to have a strong inherited component. Population-level phenomena well known to anthropologists, such as reproductive isolation, sex biased migrations and stratification can strongly affect the outcome of supposed admixing. In fact Reich struggles hard to explain 'sympatric isolation' (the fact that people living in close proximity may remain reproductively isolated) in India. To what degree our populations derived or differentiated from one another, from a founder or 'admixed' event, is influenced by culture and language, is important. And to what extent they contributed in the formation of modern populations, and how long ago, are major questions that confront Indian population geneticists. Now more than ever, telling the story in right perspective has become essential. Some Western scholars do not understand Indian population structure, and hence tend to misinterpret data, for instance by proclaiming no difference between the castes and tribes. What they miss is that 'tribes' can be associated with every level, in speakers of every language, and with every migration. It requires some insight to choose a right study design that is best suited to decipher the particular question that is asked. Not realizing the importance of the context in which data is interpreted, the general public, and even scientists from other fields, simply believe whatever is said by a supposed 'expert' in a domain. Then there is the matter that the majority of NGS technology-based papers from India have involved collaborations with Western and other foreign laboratories (papers with Indian authors only are often rejected outright, and experience shows that having a Western godparent helps). This can lead to skewed views and interpretations.

In terms of archaeology, the book is a monumental compilation of new discoveries. It covers well, and interprets better, the origin of ancient and modern populations in Europe and the East. Nonetheless, the author seems to be on slippery ground when it comes to regions where the availability of bones or ancient DNA is poor, or where sampling has been entrusted to a third party. An example is his invoking an 'Ancient North Indian' and 'Ancient South Indian' set as the two sources behind the genetic constitution of present-day Indians. It may be that the author is not aware of the vast literature from India bearing on the issue from other

fields. Any story of origins may have to fit with the generally accepted picture (if there is one) based on accepted archaeological, historical, linguistic and sociological studies. When it comes to India, the book misses out in this respect. Nonetheless, his stance and arguments for considering sample identity in various medical studies are in the right direction to go. It would be wrong to blame him for a supposedly 'racialist' attitude. In India, most researchers, and the so called 'elites' generally, are against using population or caste identity in genetic studies. This is ill-advised. Given the prevalence of castes, knowledge of its association with geographical, linguistic and cultural traits, or with disease prevalence, it helps in better interpretation of the past and offers help for the future.

Now for a word of caution. The new field of NGS technology has led to hype (in terms of what it can achieve), hero worship (of its practitioners) and the commercialization of science (ever-more present). Instrument manufacturers and companies that claim to uncover ancestries are becoming rich. They are part of today's 'knowledge economies' that co-opt workers from developing countries as collaborators; researchers from poor countries as cheap labour and small laboratories gleefully piggy-back on them for high index publications and thus promotions. Academic and research institutions in developing countries, India specifically, purchase and showcase the expensive, state-of-the-art equipment needed to implement NGS methods. But they do not make use of the equipment. The reasons are many: lack of suitable infrastructure for maintenance, lack of appropriate funding (consumables are expensive, as is the cost of updating technology and equipment), poor computational power and trained manpower, inefficient administrative procedures,... one can go on. As a result, with the exception of a small minority, Indian laboratories cannot do work that is novel or original, let alone research that compares with that in developing countries. The lack of comradeship and collaborative spirit in our science is another handicap. My guess is that in India, NGS equipment is utilized at 5% capacity in 90% of the places where that has been installed.

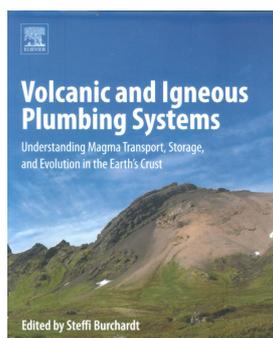
At the end of reading this demanding book, one asks if the author has succeeded in telling our story. In large

measure, yes. But he could have downplayed his pride on his achievements, behavioural modernity and ancestry. He may have the right to feel proud as human being. But he could have been more generous in quoting, refuting or indicting. As the Director of 'The Genographic', Indian chapter, it pained me to read Reich's utterances on the tree metaphor, demic expansions and the Genographic project. One should appreciate the context and background in which studies are made and stories are told.

I have no hesitation in recommending this book to any serious reader, who wants to learn about the history of mankind, while taking sections such as the history of India with a pinch of salt. With its well referenced citations, notes and quotes, the book will be of use in teaching programmes in modern archaeology, anthropology and population genetics, both in developed and developing countries. A better understanding of human past is to be welcomed in an age in which findings based on modern science have to contend with people with closed minds, sometimes fanatics, who refuse to see the evidence or engage with those of different views.

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**Volcanic and Igneous Plumbing Systems: Understanding Magma Transport, Storage, and Evolution in the Earth's Crust.** Steffi Burchardt (ed.). Radarweg 29, P.O. Box 211, 1000 AE Amsterdam, The Netherlands. 2018. xii + 341 pages. Price: US\$ 140.

Volcanoes are some of the most fascinating features not only on the earth but also on some of its counterparts in our own

solar system. For example, Olympus Mons on the Mars is the tallest yet known volcano in our solar system with a height almost three times that of the Mount Everest. Volcanoes are regarded to be the cradle for the development and evolution of life on the earth as well as edifices which have brought countless species (including giant dinosaurs) close to and/or complete extinction. The 1883 Krakatoa volcanic island explosion in Indonesia, where 70% of the island's area and ~35,000 of its inhabitants vanished overnight, and the volcanic ash buried cities of Pompeii and Herculaneum (dating back to AD 79), in Italy serve as chilling testimonies of catastrophic effects of the volcanic eruptions. Over the years, volcanology has emerged as the science of studying volcanic eruptions, their types, products and landforms with an ultimate goal of understanding the physics and chemistry of their mechanism and to forecast the eruptions. However, such an understanding is not straightforward as much of their plumbing systems – termed as volcanic and igneous plumbing system (VIPS) or magma plumbing system – are hidden below the volcanic structures and are not directly and easily accessible. The plumbing system comprises dykes, sills and larger magma bodies that form the pathways and supply system of magma beneath active volcanoes in the earth's crust. Their understanding requires a multi-disciplinary approach involving geological, geochemical, geophysical and geodetic techniques which can help in interpreting what is happening prior to, during and after a volcanic eruption.

The book under review is an attempt to summarize state-of-the-art of our present knowledge about magma transport and storage in various VIPSs and highlight the systematic approaches involved by detailing these aspects in twelve chapters. In the very first chapter dealing with introduction to the volcanic and igneous plumbing systems, Steffi Burchardt has provided an historical overview as to how the concept of magma plumbing system evolved right from the first attempts made by none other than James Hutton, father of geology, in late 18th century. The chapter provides a glimpse of emergence of VIPS as a separate scientific discipline. The author has interestingly brought out different perspectives on the magma plumbing systems from the viewpoint of a child, a