

Illustration credits

Illustration credits are listed in order with page numbers in red. Abbreviations: JC = John Compton, JB = James Berrange; CC = Creative Commons; BY = attribution; SA = Share alike; ND = No derivatives; NC = noncommercial (CC licenses: <https://creativecommons.org/licenses/>); wiki = [https://commons.wikimedia.org/wiki/File](https://commons.wikimedia.org/wiki/File;); flickr = <https://www.flickr.com/photos>, Wellcome = <https://wellcomeimages.org/indexplus/image>. For full references see Further reading, which follows.

Cover and frontispiece © JC, photo used with permission from The Living Culture Foundation Namibia/The Living Museum of the Damara (www.lcfn.info/damara). **Inside cover** Geologic timescale © JC, adapted from Walker and others (2012) and Liseicki and Raymo (2005); big bang image: NASA/WMAP Science Team.

Chapter 1. **12** Adapted from 'timeline of the universe' (NASA/WMAP Science Team). **13** Night sky: Håkon Dahle/ESO; collision by JB © JC. **14** Andromeda: NASA/JPL-Caltech; galaxy clusters © Michael Boylan-Kolchin (Millennium-II Simulation) (Boylan-Kolchin, 2014); artist's conception of the Milky Way: N. Risinger; our solar system and Earth/Sun images: NASA-JPL. **15** Artist's conception of white dwarf: NASA/ESA; Sun: NASA/SDO; Crab Nebula: NASA, ESA, J. Hester/A. Loll (ASU). **16** Orion Nebula: NASA/JPL-Caltech/STScI; Carina Nebula: NASA, ESA, M. Livio and the Hubble 20th Anniversary Team (STScI); artist's conception of planet-forming disk: NASA/FUSE/Lynette Cook. **17** NASA. **18** Artist's conception of collision: NASA; remaining images by JB © JC. **19** Magnetic field: NASA; Hadean by JB © JC. **20** © JC. **21** Lava lamp: Kumar Jhuremalani (CC BY 2.0); Zircon: courtesy John W. Valley, University of Wisconsin-Madison; oldest rock (Acasta gneiss): Pedroalexandrado (CC BY SA 3.0); fossil courtesy Ken Sugitani; all other images by JB © JC. **22** Archean Earth by JB © JC. **23** Organic compounds by JB © JC; fossil images courtesy Ken Sugitani (Sugitani and others, 2015). **24** Prokaryote by JB © JC; archaea SEM image courtesy Anna-Louise Reysenbach; *E. coli* (B&W): NIAID; *S. aureus* and *E. coli* (colour): CDC/Matthew J. Arduino, DRPH (photo: Janice Haney Carr). **25** DNA © JC; ribosome: Korostelev, A., and others, 2006, Crystal structure of a 70S ribosome-tRNA complex reveals functional interactions and rearrangements. *Cell* 126, 1065-1077; haemoglobin: Richard Wheeler (Zephyris) (CC BY SA 3.0). **26** Seafloor: Elliot Lim, NOAA National Geophysical Data Center; oceanic ridge courtesy Ken MacDonald; black smoker: NOAA. **29** Shark Bay photo courtesy Nic Beukes; close-up photo of stromatolites courtesy Australian Centre for Astrobiology, University of New South Wales, Sydney; cyanobacteria sketch by JB © JC; fossil stromatolite outcrop courtesy Bruce Cairncross; stromatolite sliced section: James St. John (CC BY 2.0); fossil cyanobacteria courtesy J. William Schopf (Schopf and others, 2002). **30** Oxygen plot by JB © JC, adapted from Lyons and others (2014); mine and drill core photos © JC; rock face courtesy Nicholas Laidler. **31** and **32** by JB © JC. **34** Images courtesy Nicholas Butterfield (Butterfield, 2000); bacteria by JB © JC. **35** © JC. **36** Choanoflagellate SEM images courtesy Nicole King's lab (www.choano.org); sponge by JB © JC; fossil sponge: Donald Herd (Brain and others, 2012). **37** Cnidarian sketch by JB © JC; *Chamiodiscus* © The Museum Board of South Australia 2014 (photographer: Dr. J. Gehling; SAM P19690a); diorama © Smithsonian Institution; *Dickinsonia*: Verisimilus (CC BY SA 3.0). **38** *Cloudina* courtesy Stephen Bengtson (Bengtson and Zhao, 2002); Ediacaran fauna and Cambrian explosion adapted from Gehling, J., 2007, The Ediacaran diaspora: Diversity of the Ediacara biota in South Australia. In: Leicester's fossil celebrity: Charnia and the evolution of early life, seminar programme, Leicester Literary and Philosophical Society Section C (Geology). *Mawsonites*: Nordelch (CC BY 3.0); corals: Mark A. Wilson (wiki:Cladocora.jpg); sea pen: Nick Hobgood (CC BY SA 3.0); brachiopod fossil © JC; sea star: Bob Peterson (CC BY 2.0); ammonite: Tomomarusan (CC BY SA 3.0); trilobite: James St. John (CC BY 2.0); annelid worm: NOAA; chordate © Nobu Tamura (<http://spinops.blogspot.com>). **39** Vitruvian Man: Leonardo Da Vinci (photo by Luc Viatour, www.Lucnix.be); doughnut man by JB © JC. **40** *K. quadrata*: Aleksey Nagovitsyn (CC BY SA 4.0); rise in oxygen adapted from Sperling and others (2015). **42** and **43** artwork by JB © JC.

Chapter 2. **45** Cambrian diorama © John Sibbick; *Opabina* and *Hallucigenia* © Nobu Tamura (<http://spinops.blogspot.com>). **46** (refer to 38); beetle © Udo Schmidt; Darwin portrait by G. Richmond. **47** (refer to 38); black mussel (*C. meridionalis*) © JC. **48** Dragonfly © Ana Cotta (CC BY 2.0); flying fish: NOAA; bald eagle © Andy Morffew (CC BY ND 2.0); bat © Oren Peles (CC BY 2.5). **49** Darwin portrait by G. Richmond; coccyx by JB © JC. **50** Fancy pigeons *Illustrated London News* (23 Jan. 1864, p. 89). **51** © JC. **52** by JB © JC, adapted from Rohde and Muller (2005). **54** by JB © JC. **55** *M. fengjiao* fossil and reconstruction/interpretation courtesy Degan Shu (Shu and others, 1999); *P. gracilens* and *M. walcotti* © Royal Ontario Museum and Parks Canada (photo: Jean-Bernard Caron); reconstructions © Nobu Tamura (<http://spinops.blogspot.com>); comparison to amphioxus by JB © JC. **56** Gill arches by JB © JC; pinched nerve: Blausen.com staff. "Blausen gallery 2014". Wikiversity Journal of Medicine (DOI:10.15347/wjm/2014.010. ISSN 20018762). **57** Conodont drawing © Bill Parsons; apparatus from Purnell and Donoghue (1997); lamprey © Joanna Gilkeson (USFWS) (CC BY 2.0); hagfish © Linda Snook (NOAA/CBNMS). **58** Ordovician diorama © Redpath Museum/McGill University; ostracoderms courtesy Philippe Janvier. **59** First jaw by JB © JC; placoderm fossil: Mitternacht90. **60** (refer to 55 and 57); shark © Timothy Knepp (U.S. Fish and Wildlife Service); ray: Albert C.L.G. Günther; teleost fish: Francis de Laporte de Castelneau; lungfish © Joel Abroad (CC BY 2.0); coelacanth © Mark V. Erdmann. **61** *Cooksonia* courtesy Philippe Gerrienne (Gerrienne and others, 2006). **62** Eduard Riou. **62–63** Onto dry land by JB © JC. **64** Carboniferous diorama by Alan Singer courtesy of The Brooklyn Botanic Garden; palaeogeography © JC. **65** *Dimetrodon* © Bogdanov; all other reconstructions © Nobu Tamura (<http://spinops.blogspot.com>). **66** (refer to 65) *Morganucodon* © FunkMonk (Michael B. H.) (CC BY SA 3.0); Middle Triassic conodont: Mojcaj (CC BY SA 3.0); all other conodonts © Nobu Tamura. **67** Platypus: George Shaw (CC-BY-4.0) Wellcome/L0075037.html; echidna © John Harrison (CC BY SA 3.0); possum © Cody Pope (CC BY SA 2.5); kangaroo: <https://pixabay.com/en/kangaroo-marsupial-young-animal-218960/>. **68** Ear evolution © 2016 by The University

Illustration credits

of California Museum of Paleontology, Berkeley, and the Regents of the University of California; dinosaur diorama by JB © JC. **69** Cretaceous dioramas © Karen Carr. **70** Meteorite impact: NASA; palaeogeography © JC. **71** © JC, adapted from Luo (2007); impact: NASA. **72** Tree of mammals courtesy Dr. Frédéric Delsuc (CNRS, Université de Montpellier). **73** Carl Buell artist © Maureen O'Leary (O'Leary and others, 2013); hands and feet by JB © JC. **74** Images courtesy Xijun Ni (Ni and others, 2013). **75** (refer to 74); lemurs: David Dennis (CC BY SA 2.0); lorises: Dr. K.A.I. Nekaris (CC BY SA 4.0); tarsiers: mtoz (CC BY SA 2.0); New World monkeys: Mila Zinkova (CC BY SA 3.0); Old World monkeys: Dimitry B (CC BY 2.0); apes (gorilla): Beau B. (CC BY 2.0). **77** by JB © JC, adapted from Zhang and others (2014). **78** Baboons © JC; gibbons: John Harrison (CC BY SA 3.0); orang-utans: Robert Young (CC BY 2.0); gorillas: Kate (CC BY SA 2.0); Darwin portrait by G. Richmond; bonobos: Trisha Shears (CC BY SA 3.0); chimpanzees: Julie Larsen (Maher/Wildlife Conservation Society, USAID Africa Bureau).

Chapter 3. **79** University of the Witwatersrand Archives (Štrkalj and Kaszycka, 2012). **80** Ikiwaner (GFDL 1.2); Skulls by JB © JC. **81** (refer to 75 and 78); *A. ramidus*: T.M. Keesey; *K. platyops* from Leakey and others (2001); *H. erectus* (Eurasia) courtesy Christoph Zollikofer; all other image credits follow. **82** Ape comparison: Discott (CC BY SA 3.0); dinosaur to birds by JB © JC; ostrich © JC; gorilla: Colin M.L. Burnett (CC BY SA 3.0); man walking: colotype after Eadweard Muybridge (CC BY 4.0) Wellcome/V0048616.html. **83** Tanzanian rain forest © JC; Malawi Miombo woodland © Geoff Gallice. **84** Baboons © William Warby; Chad skull © Didier Descouens (CC BY SA 4.0); fossil leg bones courtesy Brigitte Senut (Senut and others, 2001). **85** Ard reconstruction © Jay Matternes; Lucy skeleton: https://en.wikipedia.org/wiki/File:Lucy_blackbg.jpg. **86** Skeleton of *Au. sediba* courtesy Lee Berger (University of the Witwatersrand); reconstruction of the Taung child skull: Cicero Moraes (CC BY SA 3.0); southern portion of the Laetoli trackway as it appeared during excavation in 1995 (Photo: Neville Agnew © 1995 The J. Paul Getty Trust and Tanzanian Antiquities Authority. All rights reserved.); skull of Little Foot courtesy Jason L. Heaton. **87** Chimps using stone tools courtesy Etsuko Nogami (springer.com/us/book/9784431539209). **88** Kunene River and environs © JC; Mekrou River: Marco Schmidt (CC BY SA 3.0). **89** Lomekwan stone tool courtesy Sonia Harmand © MPK-WTAP (Mission Préhistorique au Kenya - West Turkana Archaeological Project) (Harmand and others, 2015); cut marks on bone © Curtis W. Marean (McPherron and others, 2010). **90** Bjørn Christian Tørrissen (CC BY SA 3.0); *P. boisei* skull: Durova (CC BY SA 3.0); reconstruction: Cicero Moraes (CC BY SA 3.0). **91** Australopithecus *H. naledi* sketches by JB © JC; fossil images courtesy Lee Berger (Berger, and others, 2015; DOI: 10.7554/eLife.09560; CC BY 4.0); *H. habilis* skull: José Benito Álvarez; *H. habilis* reconstruction: Lillyundfrea (CC BY SA 3.0). **92** Oldowan stone tool © JC and from the western Sahara: José Benito Álvarez; Knapping by JB © JC. **94** by JB © JC. **95** Brain endocasts courtesy Lee Berger (Berger, and others, 2015; DOI: 10.7554/eLife.09560; CC BY 4.0). **96** Endocast courtesy Kristian Carlson. **97** Wildebeest herd: Bjørn Christian Tørrissen (CC BY SA 3.0); lions eating a Cape Buffalo: Luca Galuzzi (CC BY SA 2.5); African wild dogs: Charlesjshar (CC BY SA 4.0); 'Elephant butchery at Olorgesallie' by Karen Carr, Smithsonian National Museum of Natural History David H. Koch Hall of Human Origins © Smithsonian Institution. **98** Eric Dufresne (CC BY 2.0). **99** Photo of Turkana Boy Bone Clones® model by JC, used with permission (www.boneclones.com); African savannah © JC; habitat map © JC, adapted from Adams, J.M., Faure, H., 1997, QEN Members. Review and Atlas of Palaeovegetation: Preliminary Land Ecosystem Maps of the World since the Last Glacial Maximum. Oak Ridge National Laboratory, TN, USA (<http://www.esd.ornl.gov/projects/qen/adams1.html>). **100** Photos courtesy Casey Ryan. **101** Ibis foraging courtesy Adam Riley; burnt ant eater © Luiz Claudio Marigo (www.naturepl.com); burnt fynbos © JC. **102** © Mike Golby. **103** Wetland © JC; hippo photo courtesy Africa Green Media. **104** Lion © Marsel van Oosten (www.squiver.com); fire at will © JC, with permission Damara Living Museum. **105** Runners: John Hoey (CC BY 2.0); sweating © Rido (Shutterstock). **106** Photo by Sarah Leen © National Geographic; Map by JB © JC, adapted from Chaplin (2004). **107** Baby at birth: Ernest F (CC BY SA 3.0); newborn baby: Eduardo Merille (CC BY SA 2.0). **109** Upper photo: Ray Dumas (CC BY SA 2.0); lower photo: Robert Whitehead (CC BY 2.0). **111** 'Early humans sharing food at Geshert Benot Ya'aqov' by Karen Carr for Smithsonian National Museum of Natural History David H. Koch Hall of Human Origins © Smithsonian Institution. **113–116** Handaxe photos © JC. **114** Handaxe photo showing 3 different orientations: José Benito Álvarez. **116** Ethiopian handaxe © Gen Suwa (Konso Paleoanthropological Research Project) (Beyene and others, 2013); *H. erectus* skull: wiki:Homo_ergaster.jpg; *H. erectus* reconstruction: Lillyundfrea (CC BY SA 3.0); engraved shell photos courtesy Josephine C. A. Joordens (Joordens and others, 2015). **117** Maps © JC; Computer reconstruction of the five Dmanisi skulls courtesy Marcia Ponce de León and Christoph Zollikofer (University of Zurich, Switzerland); Google Earth, NASA. **118** Cave photo: Rosino (CC BY SA 2.0); skull photo: e_monk (CC BY-NC-SA 2.0, with permission); artwork by JB © JC. **119** *Australopithecus*: detail of artwork by Karen Carr © Human Origins Program, Smithsonian Institution; for all other image credits refer to above.

Chapter 4. **121** *H. erectus*: refer to 99; all other images © JC. **122** © JC, graph adapted from McHenry (1994); oxygen isotope curve: Lisiacki and Raymo (2005). **123–125** by JB © JC, adapted from various sources. **126** Ice sheet graphic © JC; ice core records of dust adapted from Lambert and others (2008); ice core records of CO₂ adapted from Lüthi and others (2008; and references therein); sea level records adapted from Bintanja and others (2005). **127** Peltier, W.R. (NOAA-NCEI). **128** Greenland ice core record adapted from Alley and others (2010) (and references therein); icebergs: Brocken Inagly (CC-SA-3.0); ENSO 1997–98: NASA/JPL-Caltech; ENSO graphic: Giorgiopp2 (CC-SA-3.0). **129** © JC, adapted from Adams and Faure (1997) (refer to 99). **130** Stone tool photos © Gen Suwa (Konso Paleoanthropological Research Project) (Beyene and others, 2013); sketches by JB © JC. **131** Graphic by JB © JC. **132** Ryan Somma (CC BY SA 2.0). **133** Nduu skull © Smithsonian Institution; Kabwe skull © JC; reconstruction: Cicero Moraes (CC-SA-3.0); blade courtesy Jayne Wilkins (Wilkins and Chazan, 2012); tortoise-shaped core courtesy Marta Lahr. **134** Graphic by JB © JC; blades and hafted stone tools: courtesy Jayne Wilkins (Wilkins and Chazan, 2012). **135** Points courtesy Jayne Wilkins (Wilkins and others, 2012); Graphic by JB © JC. **136** Amédée Forestier. **137** courtesy Aleix Martinez (The Ohio State University). **139** Graphics by JB © JC. **140** courtesy Javier Trueba / Madrid Scientific Films (Arsuaga and others, 2014). **141** Google Earth, NASA; monsoon graphic by JB © JC, adapted from Ziegler and others (2013). **142** © JC, adapted from Compton (2011). **143** Florisbad © JC; Laetoli © Smithsonian Institution; Jebel Irhoud © Natural History Museum London (Mohammed Ben Fatmi, 1961). **144** Ochre © JC; stone tools by JB, from Tryon and McBrearty (2002); Obsidian: Ji-Elle (CC BY SA 3.0). **145** Lancelolate point by JB, from Tryon and Faith (2013); obsidian tips courtesy Yonatan Sahle (Sahle and others, 2013). **146** Photo courtesy Neil Roach. **147** © JC. **148** Hafted stone tool courtesy Lyn Wadley; grinding ochre © JC. **149** © JC, adapted from Compton (2011).

HUMAN ORIGINS

Chapter 5. **151** Top left: courtesy Reigh LeBlanc (CC BY NC 2.0, with permission); top centre © Zurijeta (Shutterstock); Bottom centre © Ostill (Shutterstock); all other images © JC. **153** Omo by JB © JC; Herto fossil: National Museum of Ethiopia, photo © David L. Brill (humanoriginsphotos.com); Qafzeh 9 courtesy Desc/E (CC BY NC 2.0, with permission); Qafzeh 11 courtesy Anne-marie Tillier. **155–157** Graphics by JB © JC. **157** Zorse: Christine and David Schmitt (CC BY 2.0). **159** © JC, adapted from Adams and Faure (1997) (refer to 99). **160** www.ngdc.noaa.gov/mgg/image/2minrelief.html. **163** NASA; map adapted from Compton (2011). **164** Graphic © JC, adapted from Compton (2011); map adapted from www.ngdc.noaa.gov. **165** Liu, K.-K., Dittert, N., 2010, Web-based electronic supplements, Appendix C. In: Liu, K.-K., Atkinson, L., Quiñones, R.A., Talaue-McManus, L. (eds) *Carbon and nutrient fluxes in continental margins*. Springer, Berlin. <http://cmtt.pangaea.de/> [accessed June 2016]. **166** NASA; **167** © JC; NASA. **168** © JC. **169–170** © JC, adapted from Compton (2011). **171** Liu and Dittert (2010) (refer to 165). **172** Top left: <http://earth.imagico.de/view.php?site=rift2a> (CC BY SA 3.0); right: NASA; lower left: ESA. **173** wiki:Ethiopia_sat.png; highlands photo courtesy Harri Jarvelainen (CC BY 2.0); topography: Sadalmelk. **174** and **176** © JC, adapted from Compton (2011). **178** Population density: UNEP; wetlands: Namibia Nature Foundation; rainfall: NOAA.

Chapter 6. **183** Vitamin C by JB © JC; fruit © JC; scurvy: wiki:A_case_of_Scurvy_journal_of_Henry_Walsh_Mahon.jpg. **184** Satellite image: NASA; Okavango photo: Joachim Huber (CC BY SA 2.0); papyrus: wiki:Kew.gardens.papyrus.plant.arp.jpg; culms: courtesy Susan Mahr; catfish: wiki:Clarias_gariepinus.jpg. **186** Top left © JC; Intertidal graphic by JB © JC; seal © Grant Christie; graphic by JB © JC, adapted from Christensen LB., 2006, Marine mammal populations: reconstructing historical abundances at the global scale. Vancouver, BC Canada: Fisheries Centre, University of British Columbia; fur seal colony: Joachim Huber (CC BY SA 2.0). **187** © JC. **188** Croc gliding: MathKnight and Zachi Evenor (CC BY 4.0); croc attacking © Lee Kip (Solent News). **189** Hippos: Stuart Bassil (CC BY 2.0); salty snacks © JC. **190** Salt: Sandip Dey (CC BY 3.0); spilt salt: Jorge Royan (CC BY SA 3.0); Morton: www.motherearthnews.com. **191** Goitre: wiki:Cretinnen_aus_Steiermark,_1819_gez._Loder_gest._Leopold_M%3C3%BCller.jpg; graphic by JB © JC. **193** Limpets © JC; limpet underside: Tango22 (CC BY SA 3.0); shell midden © JC. **194** Cave photo courtesy Andy Herries; brown mussels courtesy George Brits; mussel interior: Rainer Zenz (CC BY SA 3.0). **195** Whale: Knordstrand (CC BY SA 3.0); barnacles: Aleria Jensen (NOAA/NMFS/AKFS); graphics © JC (Compton, 2011). **196** flickr/liddybits/2577255435. **197** Seal © Grant Christie; beached whale © Clare Lindeque. **201** Maghreb: Liu and Dittert (2010) (refer to 165); Tunisian coast: Eugenijus Radlinskas (CC BY 2.0); Graphic © JC (Compton, 2011). **202** © JC (Compton, 2011). **203** © Dominique de la Croix (www.photoworkshop.co.za). **205** Photos courtesy William Doherty. **206** Sketch by JB © JC. **207** Ochre courtesy Curtis Marean (Marean and others, 2007); heated tools courtesy Kyle Brown (Brown and others, 2009). **208** wiki:Lions_painting,_Chauvet_Cave_(museum_replica).jpg.

Chapter 7. **202** Signs by JB © JC; IMF: Stephen Jaffe; Goths: Grant Mitchell (CC BY 2.0); Mercedes: Garry Knight (CC BY 2.0). **213** Cave and profile courtesy Magnus Haaland; ochre tool kit: courtesy Christopher Henshilwood and Francesco d'Errico (photo: G. Moëll Pedersen) (Henshilwood and others, 2011); living abalone: Derek Keats (CC BY SA 2.0); shell © JC. **214** Tick shells © Marian Vanhaeren and Francesco d'Errico (Vanhaeren and others, 2006); Fossil *G. insubrica*: courtesy Daniella E. Bar-Yosef Mayer (Bar-Yosef Mayer and others, 2009); modern *G. insubrica* © Milan Korinek; Fossil *G. connollyi*: courtesy Curtis Marean (Jerardino and Marean, 2010); modern *G. connollyi* © JC. **215** Fossil helmet shell: courtesy Curtis Marean (Jerardino and Marean, 2010); modern helmet shell © Riaan Rossouw. **216** Satellite image: NASA; Blombos Cave shells: courtesy Christopher Henshilwood and Francesco d'Errico; Sibudu Cave shells: Francesco d'Errico and others (2008). **217** NASA. **218** Shells © JC; photos © JC. **219** Fossil brachiopod © JC; scallop © Charlie Griffiths; limpets: Jan Delsing. **220** Klein Kliphuis courtesy Alex Mackay (Mackay and Welz, 2008); Blombos courtesy Christopher Henshilwood (Henshilwood and others, 2009); Pinnacle Point courtesy Ian Watts (Watts, 2010); Klasies River courtesy Francesco d'Errico (d'Errico and others, 2012a). **221** Klasies River bone: courtesy Sarah Wurz (Wurz, 2016); Sibudu Cave bone: courtesy Lucinda Backwell (d'Errico and others, 2012b); Sibudu Cave photo: M. Ecker (doi:10.1371/journal.pone.0098359.g002); engraved eggshell courtesy Christopher Henshilwood (Henshilwood and others, 2014); Diepkloof: Vincent Mourre (CC BY SA 3.0). **222** © JC. **224** © Smithsonian Institution (photo by Chip Clark). **226** © JC (Compton, 2011). **229** Graphic by JB © JC, adapted from J.D. Clark: http://in-africa.org/wp-content/uploads/2012/12/Clark-MSA-map_2.jpg and Clark (1988). **230** Limpet point from Scerri (2013). **230** Map: courtesy Eleanor Scerri (Scerri, 2013); tanged points © Nick Barton (Institute of Archaeology, Oxford). **231** Still Bay points: courtesy Magnus Haaland; pressure flaking: courtesy Paola Villa and Vincent Mourre (Villa and others, 2009). **232** © JC. **233** Bone points: courtesy Christopher Henshilwood and Francesco d'Errico; bone tools: courtesy Lucinda Backwell (Backwell and others, 2008). **234** Klasies River: courtesy Sarah Wurz (Wurz, 2016); Sibudu: courtesy Marilze Lombard (Lombard and Phillipson, 2010); arrow graphic by JB © JC. **235** Photo: courtesy Curtis Marean; microliths courtesy Benjamin Schoville; map: www.ngdc.noaa.gov. **236** Photo courtesy Marilze Lombard. **237** © JC. **238** Bone arrows: courtesy Lucinda Backwell (Backwell and others, 2008); photos © JC. **239** National Library of South Africa: Portrait of a Bushman, playing on the Gorah from Burchell, W.J., 1822-4, Travels in the interior of Southern Africa. 2 vols. London: Longman, Hurst, Rees, Orme and Brown (vol. 1; Plate 9); musical bow: Iziko Museums of South Africa (Bohme, H.E., Some Nguni Crafts Part I Calabashes. Annals of the SA Museum Vol 70, part 1 (May 1976)). **241** Composite of previously credited images. **243** NASA.

Chapter 8. **245** NOAA (Amante, C., Eakins, B.W., 2009, ETOPO1 1 Arc-Minute Global Relief Model: Procedures, Data Sources and Analysis. NOAA Technical Memorandum NESDIS NGDC-24. National Geophysical Data Center, NOAA. doi:10.7289/V5C8276M [accessed June 2016]). **246** Oasis: Sivat; cave sketch by JB © JC, adapted from wiki:Tropfsteine.svg; cave photo: deror_avi (CC BY SA 3.0); spleothem: <http://highlyallochthonous.blogspot.co.za/2007/01/writing-in-cave-walls.html>; graphic by JB © JC, adapted from Grant and others (2012). **247** Graphics by JB © JC. **248** NASA. **249** Earth Snapshot (CC BY NC ND 3.0, with permission). **250** NASA (SeaWiFS); graphic by JB © JC. **251** Graphic by JB © JC, adapted from Jennings and others (2015). **253** Denisovan fossils: Thilo Parg (CC BY SA 3.0); map: NOAA (refer to 245). **254** Vera Salnitskaya (*Siberian Times*). **255** Map by JB © JC; map: NOAA (refer to 245). **257** Taurus Mountains: Zeynel Cebeci (CC BY SA 3.0); Coast photo © Michal Szymanski (Shutterstock); Google Earth, NASA. **259** Map by JB © JC, adapted from Oppenhiemer (2012). **260** Map by JB © JC; fish hooks: courtesy Sue O'Connor (www.sundatosahul.org). **261** Niah Cave: Starlightchild (CC BY SA 3.0). **262** Bird by JB © JC; lion © Nobu Tamura (<http://spinops.blogspot.com>); wombat: Dmitry Bogdanov (CC BY 3.0). **264** Google Earth, NASA. **265** Figurine and flute © University of Tübingen, Germany (photo: Hilde Jensen) (Conard, 2009); antler points and Fumane Cave art: courtesy Marco Peresani (University of Ferrara); lion man: photo Yvonne Mühies © Landesamt für Denkmalpflege im RP Stuttgart/ Ulmer Museum; El Castillo Cave: courtesy A.W. Pike (photo Marcos Diez). **266** Burin: Didier Descouens (CC BY SA 4.0); Solutrean tools/ harpoon/ horse sculpture: World Imaging (CC BY SA 3.0); fish hooks: José-Manuel Benito; cave painting: HTO. **267** Graphic by JB © JC. **268** Mal'ta Boy: Hermitage State

Illustration credits

Museum (*Siberian Times*); mammoth and mastodon: Danthem9758 (CC BY SA 3.0); graphics by JB © JC. **269** Graphic by JB © JC; map (modified) courtesy David Anderson (<http://pidba.utk.edu/maps.htm>); Clovis points courtesy David K. Thulman. **270** Sloth: Dmitry Bogdanov; ungulate: Kobrina Olga (CC BY 3.0); armadillo: Heinrich Harder. **271** Graphic by JB © JC, adapted from [wiki:Extinctions_Africa_Australia_NAmerica_Madagascar.gif](http://wiki.Extinctions_Africa_Australia_NAmerica_Madagascar.gif). **272** Map by JB © JC. **273** © Jihh-Jie Liou. **275** Courtesy Janette Deacon. **276** Land snail: Marcus Coltro (www.femorale.com); operculum and opercula courtesy Zelalem Assefa (Assefa and others, 2008); beads courtesy Francesco d'Errico (d'Errico, and others, 2012c); graphic by JB © JC, adapted from Alley and others (2010); and references therein). **277** Indonesian paintings: courtesy Maxime Aubert; satellite image: NASA; Apollo 11 rock art: courtesy State Museum of Namibia.

Chapter 9. **281** © JC, adapted from Alley and others (2010); and references therein). **282** Graphic by JB © JC; tundra: Andreas Hugentobler (CC BY 2.0); steppe: Ghilarovus (CC BY SA 4.0); woodland: Pravdaverita (CC BY SA 3.0). **283** Sickle: Wolfgang Sauber (CC BY SA 3.0); grinding © JC; spear throw by JB © JC; figurine: Petr Novák (CC BY SA 2.5). **284** Cermics by JB © JC; dog gaze: Bad Apple Photography (CC BY 2.0); wolf: Retron. **285** <http://www.freeworldmaps.net/>. **286** © JC. **287** Graphics by JB © JC, adapted from Adams and Faure (1997) (refer to 99); Göbekli Tepe: Teomancimit (CC BY SA 3.0). **288** © Peas: Bill Ebbesen (CC BY SA 3.0); lentils: Kurt Stüber (<http://www.biolib.de>); map by JB © JC; barley: Cliff (CC BY 2.0); wheat: Bluemoose (CC BY SA 3.0). **289** Maize: David Spender (CC BY 2.0); sheep: David Martyn Hunt (CC BY 2.0); horses: François Marchal (CC BY SA 3.0); cattle: Guido Gerding (CC BY SA 3.0); millet: STRONGIK7 (CC BY SA 3.0); pigs: Joshua Lutz; chickens: Philip Pikart (CC BY SA 4.0); rice: IRRI images (CC BY 2.0); taro: David Monniaux (CC BY SA 3.0); teff: Rasbak (CC BY SA 3.0); yams: Alan Levine (CC BY 2.0); sorghum: ABHJEET (CC BY SA 3.0); manioc: Amada44 (CC BY 3.0); potatoes: Scott Bauer (USDA/ARS); ant milking aphids: Friedrich Böhringer (CC BY 2.5). **290** © Eric Isselee (Shutterstock). **291** Teosinte and small cob: courtesy John Doebley; maize: USDA. **292** Topsoil © JC; erosion: Jack Dykinga (USDA). **294** Graphic by JB © JC. **295** Graphics by JB © JC, adapted from Maluciconi (CC BY 3.0), wiki:Migraciones_austronesias.png; Moa: George Edward Lodge; Inuit family: Edward S. Curtis; dialect map: Asybaris01 (CC BY SA 3.0). **296** Easter Island: Arian Zwegers; graphics by JB © JC, adapted from Ruddiman (2005). **297** Mohenjo-daro: Saqib Qayyum (CC BY SA 3.0); Ur: M. Lubinski (CC BY SA 2.0); pyramids: Daniel Mayer (CC BY SA 4.0). **298** Map by JB © JC, adapted from http://www.penn.museum/sites/iraq/wp-content/uploads/2009/09/NEO9_IAP_TE_Map_KQ.jpg. **301** Babylon: Edward G. Martens (US Navy); Hammurabi: Mbtz (CC BY 3.0); Ishtar Gate: Radomir Vrbovsky (CC BY SA 4.0); tablet: Marie-Lan Nguyen. **302** Maya panel: Authenticmaya (CC BY SA 2.5); hieroglyphics © Kokhanchikov (Shutterstock); Sumerian tablet and oracle bones: BabelStone (CC BY SA 3.0); statue: Ficatus (CC BY SA 3.0). **303** Bronze bowl: Mountain (CC BY SA 3.0); weapons: Zde (CC BY SA 4.0); map: adapted from wiki:AlterOrient2.png. **304** Map: Ali Zifan (CC BY SA 4.0); Cyrus the Great: Coyau (CC BY-SA 3.0); Parthenon © Anastasios71 (Shutterstock); Coliseum: David Iliff (CC BY SA 3.0); Great Wall: Severin Stalder (CC BY SA 3.0). **305** Cleopatra © Terterian; Genghis Khan: Ananghong (CC BY SA 3.0); Maya pyramid: Daniel Schwen (CC BY SA 4.0); map: adapted from Knyusser (CC BY SA 3.0); graphic adapted from Hodell and others (1995). **306** Graphic by JB © JC, adapted from various sources. **308** Graphic by JB © JC, adapted from various sources; Caravela de armada of João Serrão (1502); Chinese ships: wiki:ZhengHeShips.gif. **309** Cortez and Montezuma at Mexican Temple by Constantino Brumidi; Jan van Riebeeck arrives in Table Bay by Charles Davidson Bell. **310** Mosquito: Jim Gathany (CDC); parasite: Ute Frevert (false color by Margaret Shear) (CC BY 2.5). **311** Graphic by JB © JC; Jutten Island © JC. **312** Graphic by JB © JC, adapted from the 4th edition of Meyers Konversationslexikon (1885–90); Watt's steam engine © 2016 by Auction Team Breker (www.Breker.com); locomotive: Stephenson's 1830 locomotive Northumbrian (artist unknown). **313** Air pollution in Leeds: J.B. Cohen (1896); slave trade graphic by JB © JC, adapted from various sources; Stone Town slave monument © JC; diagram of a slave ship: author unknown. **314** New York city circa 1900: <http://digitalcollections.nypl.org/items/510d47e2-8e17-a3d9-e040-e00a18064a99>; wiki:NYC_Mulberry_Street_3g04637u.jpg; wiki:Looking_up_Broadway_from_Dey_Street,_New_York_City,_1900.jpg. **315** The Great War: Hermann Rex (wiki:Nach_Gasangriff_1917.jpg); Great Depression: Walter P. Reuther Library, Archives of Labor and Urban Affairs, Wayne State University; 1918 Flu: wiki:CampFunstonKS-InfluenzaHospital.jpg; WWII: Bundesarchiv; wiki:LondonBombedWWII_full.jpg (US Government); poster: U.S. National Archives and Records Administration (513498); nuclear weapon test Romeo: United States Department of Energy. **317** Leafcutter ants: Grey Wulf (CC BY 2.0); nest graphic by JB © JC, adapted from various sources. **318** Graphics by JB © JC. **319** NASA. **320** NASA/JPL. **321** NASA (Bill Anders).

Chapter 10. **323** NASA/JPL-Caltech/MSSS. **324** Kepler images: NASA Ames/SETI Institute/JPL-Caltech; radio telescope: CSIRO (CC BY 3.0). **325–326** Graphics by JB © JC. **327** Cod food web: adapted from Lavigne (2003); coral reef: Fascinating Universe (CC BY 3.0). **328** Global biosphere: SeaWiFS Project, NASA/Goddard Space Flight Center and ORBIMAGE. **329–330** Graphics by JB © JC; neocortex image: courtesy USC Laboratory of Neuro Imaging and Athinoula A. Martinos Center for Biomedical Imaging, Consortium of the Human Connectome Project (www.humanconnectomeproject.org); brain comparison © MPI for Evolutionary Anthropology/Philipp Gunz. **333** Graphics by JB © JC, adapted from various sources (Center on the Developing Child; C.A. Nelson, Harvard University). **335** Hand axe © JC; Still Bay point: courtesy Magnus Haaland; arrow graphic by JB © JC; Bombe computing device: National Security Agency; IBM XT computer: Ruben de Rijcke (CC BY 3.0); iPhone: Karlis Dambrans (CC BY 2.0). **336** Circuit board © Andrey VP (Shutterstock); Internet map: Matt Britt (CC BY SA 2.5); Facebook connections: Paul Butler. **338** Graphic by JB © JC, adapted from Gerland and others (2014); photo: Liz (CC BY 2.0). **340** Graphics by JB © JC, adapted from Millennium Ecosystem Assessment. **341** USA obesity and diabetes plots: CDC; Global obesity: WHO; Global diabetes: International Diabetes Federation, 2015 (www.diabetesatlas.org). **342** Carbon Cycle: U.S. DOE (wiki:Carbon_cycle.jpg); graphic by JB © JC, adapted from: CO₂ emissions (CDIAC, Boden and others (2015), atmospheric CO₂ content (https://scripps.ucsd.edu/programs/keelingcurve/wp-content/plugins/sio-blumoon/graphics/co2_800k_zoom.png) and global temperatures (Held, 2013); graphic by JB © JC, adapted from Model simulations of global warming © 2007 IPCC WG1 AR-4. **343** Projected change in annual mean surface air temperature from the late 20th century (1971–2000 average) to the middle 21st century (2051–2060 average): NOAA GFDL; Air pollution, Ningbo City China: courtesy John Kim (www.cargocycling.org). **344** Graphics by JB © JC, adapted from various sources; interior of the Alcatraz C-Mod tokamak: Mike Garrett (CC BY 3.0). **345** Graphics by JB © JC, adapted from www.uis.unesco.org/en/stats/statistics/literacy2000.htm; gender equality: adapted from Pew Research Center (<http://www.pewsocialtrends.org/2013/12/11/on-pay-gap-millennial-women-near-parity-for-now/>); air transport networks courtesy Dirk Brockmann; shipping networks courtesy Bernd Inlasius ("The complex network of global cargo ship movements" Pablo Kaluza, Andrea Kölzsch, Michael T. Gastner and Bernd Blasius, J. Royal Society Interface). **346** Benjamin D. Hennig (CC BY-NC-ND 3.0, with permission). **347** NASA. **348** Graphics by JB © JC. **350** Nuclear war © Razvan Ionut Dragomirescu (Shutterstock); graphic by JB © JC. **351** Graphic by JB © JC. **352** NickolayLamm.com. **353** © Ase (Shutterstock). **Inside back cover and back cover** Photo by Angelique Genemans; all other images © JC.