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References

Aktuell

Barkai 2020

Ran Barkai, *Lower Paleolithic bone handaxes and chopsticks, Tools and symbols?* PNAS **117** (2020), 30892–30893.

Corman 2020

Victor M. Corman et al., *Detection of 2019 novel coronavirus (2019-nCoV) by real-time RT-PCR.* EuroSurveillance **25** (2020), 2000045, 23–30. DOI:10.2807/1560-7917.ES.2020.25.3.2000045.

Background: The ongoing outbreak of the recently emerged novel coronavirus (2019-nCoV) poses a challenge for public health laboratories as virus isolates are unavailable while there is growing evidence that the outbreak is more widespread than initially thought, and international spread through travellers does already occur. Aim: We aimed to develop and deploy robust diagnostic methodology for use in public health laboratory settings without having virus material available.

Methods: Here we present a validated diagnostic workflow for 2019-nCoV, its design relying on close genetic relatedness of 2019-nCoV with SARS coronavirus, making use of synthetic nucleic acid technology.

Results: The workflow reliably detects 2019-nCoV, and further discriminates 2019-nCoV from SARS-CoV. Through coordination between academic and public laboratories, we confirmed assay exclusivity based on 297 original clinical specimens containing a full spectrum of human respiratory viruses. Control material is made available through European Virus Archive – Global (EVAg), a European Union infrastructure project.

Conclusion: The present study demonstrates the enormous response capacity achieved through coordination of academic and public laboratories in national and European research networks.

Ng 2020

Kevin W. Ng et al., *Preexisting and de novo humoral immunity to SARS-CoV-2 in humans.* science **370** (2020), 1339–1343. DOI:10.1126/science.abe1107.

s370-1339-Supplement.pdf

Zoonotic introduction of novel coronaviruses may encounter preexisting immunity in humans. Using diverse assays for antibodies recognizing SARS-CoV-2 proteins, we detected preexisting humoral immunity. SARS-CoV-2 spike glycoprotein (S)–reactive antibodies were detectable using a flow cytometry–based method in SARS-CoV-2–uninfected individuals and were particularly prevalent in children and adolescents. They were predominantly of the immunoglobulin G (IgG) class and targeted the S2 subunit. By contrast, SARS-CoV-2 infection induced higher titers of SARS-CoV-2 S–reactive IgG antibodies targeting both the S1 and S2 subunits, and concomitant IgM and IgA antibodies, lasting throughout the observation period. SARS-CoV-2–uninfected donor sera exhibited specific neutralizing activity against SARS-CoV-2 and SARS-CoV-2 S pseudotypes. Distinguishing preexisting and de novo immunity will be critical for our understanding of susceptibility to and the natural course of SARS-CoV-2 infection.

Kevin W. Ng, Nikhil Faulkner, Georgina H. Cornish, Annachiara Rosa, Ruth Harvey, Saira Hussain, Rachel Ulferts, Christopher Earl, Antoni G. Wrobel, Donald J. Benton, Chloe Roustan, William Bolland, Rachael Thompson, Ana Agua-Doce, Philip Hobson, Judith Heaney, Hannah Rickman, Stavroula Paraskevopoulou, Catherine F. Houlihan, Kirsty Thomson, Emilie Sanchez, Gee Yen Shin, Moira J. Spyer, Dhira Joshi, Nicola O'Reilly, Philip A. Walker, Svend Kjaer, Andrew Riddell, Catherine Moore, Bethany R. Jebson, Meredyth Wilkinson, Lucy R. Marshall, Elizabeth C. Rosser, Anna Radziszewska, Hannah Peckham, Coziana Ciurtin, Lucy R. Wedderburn, Rupert Beale, Charles Swanton, Sonia Gandhi, Brigitta Stockinger, John McCauley, Steve J. Gamblin, Laura E. McCoy, Peter Cherepanov, Eleni Nastouli & George Kassiotis

Patton 2020

Austin H. Patton & Andrew Storfer et al., *A transmissible cancer shifts from emergence to endemism in Tasmanian devils*. science **370** (2020), 1293.

s370-1293-Supplement1.pdf, s370-1293-Supplement2.mp4

Emerging infectious diseases pose one of the greatest threats to human health and biodiversity. Phylodynamics is often used to infer epidemiological parameters essential for guiding intervention strategies for human viruses such as severe acute respiratory syndrome coronavirus 2 (SARS-Cov-2). Here, we applied phylodynamics to elucidate the epidemiological dynamics of Tasmanian devil facial tumor disease (DFTD), a fatal, transmissible cancer with a genome thousands of times larger than that of any virus. Despite prior predictions of devil extinction, transmission rates have declined precipitously from ≈3.5 secondary infections per infected individual to ≈1 at present. Thus, DFTD appears to be transitioning from emergence to endemism, lending hope for the continued survival of the endangered Tasmanian devil. More generally, our study demonstrates a new phylodynamic analytical framework that can be applied to virtually any pathogen.

Austin H. Patton, Matthew F. Lawrance, Mark J. Margres, Christopher P. Kozakiewicz, Rodrigo Hamede, Manuel Ruiz-Aravena, David G. Hamilton, Sebastien Comte, Lauren E. Ricci, Robyn L. Taylor, Tanja Stadler, Adam Leaché, Hamish McCallum, Menna E. Jones, Paul A. Hohenlohe & Andrew Storfer

Pennisi 2020

Elizabeth Pennisi, *Tasmanian devils claw their way back from extinction*. science **370** (2020), 1257.

Suwa 2020

Gen Suwa, Berhane Asfaw, Katsuhiro Sano & Yonas Beyene, *Implications of the Konso bone handaxe, Reply to Barkai*. PNAS **117** (2020), 30894–30895.

The emerging hierarchical complexity of the pre-1.0 Mya Acheulean technology suggests that coevolution of tool technology, social learning, and some form of verbal or vocal communication might have extended well back into the Early Pleistocene, and formed a key component of the brainbehavior culture coevolutionary "helical cycle" that characterizes both Pleistocene Homo and extant humans. It is quite striking that a clear, early manifestation of this cycle is represented by the earliest Acheulean at ≈1.75 Mya and the near-coeval transition to a hominin morphology that we recognize as Homo erectus.

Wang 2020

Siwen Wang, Hang Su & Yafang Cheng et al., *Natural gas shortages during the "coal-to-gas" transition in China have caused a large redistribution of air pollution in winter 2017.* PNAS **117** (2020), 31018–31025.

pnas117-31018-Supplement.pdf

The Chinese "coal-to-gas" and "coal-to-electricity" strategies aim at reducing dispersed coal consumption and related air pollution by promoting the use of clean and low-carbon fuels in northern China. Here, we show that on top of meteorological influences, the effective emission mitigation measures achieved an average decrease of fine particulate matter (PM2.5) concentrations of ≈14 % in Beijing and surrounding areas (the "2+26" pilot cities) in winter 2017 compared to the same period of 2016, where the dispersed coal control measures contributed ≈60 % of the total PM2.5 reductions. However, the localized air quality improvement was accompanied by a contemporaneous ≈15 % upsurge of PM2.5 concentrations over large areas in southern China. We find that the pollution transfer that resulted from a shift in emissions was of a high likelihood caused by a natural gas shortage in the south due to the coal-to-gas transition in the north. The overall shortage of natural gas greatly jeopardized the air quality benefits of the coal-to-gas strategy in winter 2017 and reflects structural challenges and potential threats in China's clean-energy transition.

Keywords: coal-to-gas action | PM2.5 | natural gas shortage | air pollution redistribution | environmental justice

Siwen Wang, Hang Su, Chuchu Chen, Wei Tao, David G. Streets, Zifeng Lu, Bo Zheng, Gregory R. Carmichael, Jos Lelieveld, Ulrich Pschl & Yafang Cheng

Significance: Improving air quality is an important driving force for China's move toward clean energy and the extensive implementation of the "coal-to-gas" policy. Our analysis shows, however, that a shortage of natural gas during the implementation of the action in northern China has led to the transfer of pollution emissions and deterioration of air quality for large areas and populations in southern China during winter 2017. Our finding Highlights the importance and necessity of synergy between environmental and energy policymaking to address the grand challenge of an actionable future to achieve the cobenefits of air quality, human health, and climate.

Zeng 2020

Hong-Li Zeng, Vito Dichio, Edwin Rodríguez Horta, Kaisa Thorell & Erik Aurell, *Global analysis of more than 50,000 SARS-CoV-2 genomes reveals epistasis between eight viral genes.* PNAS **117** (2020), 31519–31526. DOI:10.1073/pnas.2012331117.

pnas117-31519-Supplement.pdf

Genome-wide epistasis analysis is a powerful tool to infer gene interactions, which can guide drug and vaccine development and lead to deeper understanding of microbial pathogenesis. We have considered all complete severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) genomes deposited in the Global Initiative on Sharing All Influenza Data (GISAID) repository until four different cutoff dates, and used direct coupling analysis together with an assumption of quasi-linkage equilibrium to infer epistatic contributions to fitness from polymorphic loci. We find eight interactions, of which three are between pairs where one locus lies in gene ORF3a, both loci holding nonsynonymous mutations. We also find interactions between two loci in gene nsp13, both holding nonsynonymous mutations, and four interactions involving one locus holding a synonymous mutation. Altogether,

we infer interactions between loci in viral genes ORF3a and nsp2, nsp12, and nsp6, between ORF8 and nsp4, and between loci in genes nsp2, nsp13, and nsp14. The paper opens the prospect to use prominent epistatically linked pairs as a starting point to search for combinatorial weaknesses of recombinant viral pathogens.

Keywords: SARS-CoV-2 | epistasis | recombination | direct coupling analysis

Significance: The COVID-19 pandemic is a worldwide public health emergency caused by the b-coronavirus SARS-CoV-2. A very large and continuouslyincreasing number of high-quality whole-genome sequences are available. We have investigated whether these sequences show effects of epistatic contributions to fitness. In a population evolving under a high rate of recombination, such effects of natural selection can be detected by direct coupling analysis, a global model learning technique. The paper opens up the prospect to leverage very large collections of genome sequences to find combinatorial weaknesses of highly recombinant pathogens.

Bibel

Michel 2003

Andreas Michel, *Gott und Gewalt gegen Kinder im Alten Testament*. Forschungen zum Alten Testament 37 (Tübingen 2019).

Klima

Ai 2020

Xuyuan E. Ai & Daniel M. Sigman et al., *Southern Ocean upwelling, Earth's obliquity, and glacial-interglacial atmospheric CO2 change*. science **370** (2020), 1348–1352.

s370-1348-Supplement.pdf

Previous studies have suggested that during the late Pleistocene ice ages, surface-deep exchange was somehow weakened in the Southern Ocean's Antarctic Zone, which reduced the leakage of deeply sequestered carbon dioxide and thus contributed to the lower atmospheric carbon dioxide levels of the ice ages. Here, high-resolution diatom-bound nitrogen isotope measurements from the Indian sector of the Antarctic Zone reveal three modes of change in Southern Westerly Wind–driven upwelling, each affecting atmospheric carbon dioxide. Two modes, related to global climate and the bipolar seesaw, have been proposed previously. The third mode—which arises from the meridional temperature gradient as affected by Earth's obliquity (axial tilt)—can explain the lag of atmospheric carbon dioxide behind climate during glacial inception and deglaciation. This obliquity-induced lag, in turn, makes carbon dioxide a delayed climate amplifier in the late Pleistocene glacial cycles.

Xuyuan E. Ai, Anja S. Studer, Daniel M. Sigman, Alfredo Martínez-García, François Fripiat, Lena M. Thöle, Elisabeth Michel, Julia Gottschalk, Laura Arnold, Simone Moretti, Mareike Schmitt, Sergey Oleynik, Samuel L. Jaccard & Gerald H. Haug

Wang 2020

Songhan Wang et al., *Recent global decline of CO2 fertilization effects on vegetation photosynthesis*. science **370** (2020), 1295–1300.

s370-1295-Supplement.pdf

The enhanced vegetation productivity driven by increased concentrations of carbon dioxide (CO2) [i.e., the CO2 fertilization effect (CFE)] sustains an important negative feedback on climate warming, but the temporal dynamics of CFE remain unclear. Using multiple long-term satellite- and ground-based datasets, we showed that global CFE has declined across most terrestrial regions of the globe from 1982 to 2015, correlating well with changing nutrient concentrations and availability of soil water. Current carbon cycle models also demonstrate a declining CFE trend, albeit one substantially weaker than that from the global observations. This declining trend in the forcing of terrestrial carbon sinks by increasing amounts of atmospheric CO2 implies a weakening negative feedback on the climatic system and increased societal dependence on future strategies to mitigate climate warming.

Songhan Wang, Yongguang Zhang,Weimin Ju, Jing M. Chen, Philippe Ciais, Alessandro Cescatti, Jordi Sardans, Ivan A. Janssens, MousongWu, Joseph A. Berry, Elliott Campbell, Marcos Fernández-Martínez, Ramdane Alkama, Stephen Sitch, Pierre Friedlingstein,William K. Smith,Wenping Yuan,Wei He, Danica Lombardozzi, Markus Kautz, Dan Zhu, Sebastian Lienert, Etsushi Kato, Benjamin Poulter, Tanja G. M. Sanders, Inken Krüger, Rong Wang, Ning Zeng, Hanqin Tian, Nicolas Vuichard, Atul K. Jain, Andy Wiltshire, Vanessa Haverd, Daniel S.Goll & Josep Peñuelas

Zhang 2020

Jianping Zhang, Houyuan Lu & Caiming Shen et al., *Seasonal drought events in tropical East Asia over the last 60,000 y*. PNAS **117** (2020), 30988–30992.

pnas117-30988-Supplement.pdf

The cause of seasonal hydrologic changes in tropical East Asia during interstadial/stadial oscillations of the last glaciation remains controversial. Here, we show seven seasonal drought events that occurred during the relatively warm interstadials by phytolith and pollen records. These events are significantly manifested as high percentages of bilobate phytoliths and are consistent with the large zonal sea-surface temperature (SST) gradient from the western to eastern tropical Pacific, suggesting that the reduction in seasonal precipitation could be interpreted by westward shifts of the western Pacific subtropical high triggered by changes of zonal SST gradient over the tropical Pacific and Hadley circulation in the Northern Hemisphere. Our findings highlight that both zonal and meridional ocean–atmosphere circulations, rather than solely the Intertropical Convergence Zone or El Niño-Southern Oscillation, controlled the hydrologic changes in tropical East Asia during the last glaciation.

Keywords: phytolith | pollen | interstadial/stadial | tropical SST gradient | Walker and Hadley circulation

Jianping Zhang, Houyuan Lu, Jiwei Jia, Caiming Shen, Shuyun Wang, Guoqiang Chu, Luo Wang, Anning Cui, Jiaqi Liu, Naiqin Wu & Fengjiang Li

Significance: The characters and mechanisms of seasonal precipitation changes during the last glaciation in tropical East Asia are enduring and important issues of debate for researchers from many disciplines. Sensitive indicators for annual/seasonal hydrological changes are keys to understanding the issues. Here, we use successive phytolith and pollen records to reconstruct the changes of precipitation in the catchment of the Huguangyan Maar Lake, an important site at northern tropical East Asia that could simultaneously receive climate signals from higherlatitude continent and tropical ocean. We then identify seven seasonal drought events during interstadials. The results indicate that both zonal and meridional circulations control seasonal hydrologic changes, which is of great

significance to understand tropical atmospheric–ocean interactions under global changes.

Kultur

Krenn-Leeb 2010

Alexandra Krenn-Leeb, *Ressource versus Ritual, Deponierungsstrategien der Frühbronzezeit in Österreich.* In: Harald Meller & François Bertemes (Hrsg.), *Der Griff nach den Sternen, Internationales Symposium in Halle (Saale) 16.–21. Februar 2005.* Tagungen des Landesmuseums für Vorgeschichte Halle 5 (Halle 2010), 281–315.

The beginning of the Early Bronze Age at around 23oo/225o BC is closely associated with the appearance of the hoard phenomenon in Central Europe. This hoard phenomenon represents the first "pan-European communication link" as it was established and cultivated for the elites in a close connection between metallurgy, the distribution of bronze, related rituals and religious ideas.

In clear contrast to the usual inventories of settlement pits or graves these usually are carefully stacked or piled deposits of various copper and bronze objects in different stages (i. e. raw, semi-finished and finished products), less frequently gold or amber, and also ceramic vessels. They clearly indicate a purposeful intent in their depositing, with different motivations. The deposit complexes are usually situated in direct proximity to, or even within, the contemporaneous settlements and thus directly within the communication sphere of the Early Bronze Age societies. At times, it seems as if there existed actual areas of deposition.

Till 2oo7 there are 137 known deposit find complexes dating from the Early Bronze Age in Austria, comprising over 3,ooo metal and ceramic objects from all cultural groups dating from the 23rd to the 16th centuries BC. Based on the composition of the depositions, a number of categories could be established: ceramic vessels; ring ingots; mixed ring ingots; axes; bar ingots; deposits of tools. The latter consist of three varieties: tool deposits with costume elements, deposits with prestige objects, and deposits with only one single type. The find complexes show a ritual and intentionally irretrievable deposition of defined objects, the combinations of which are subject to changes in time and space. We can distinguish three concepts and strategies of deposition.

The ceramic deposits could be an expression of a strongly agrarian-orientated society at the beginning of the Early Bronze Age. It has been noted that offerings of food and drink were often associated with agrarian and seasonal activities or social events to do with the life stages within the societies. They represent certain economic traditions. The motivations for the deposition of metal objects can probably be attributed to the increase in metallurgy, the influence of which reached into many aspects of life and represented a social and technological innovation. In many cases, this involved high metal values, which were almost standardized and assembled in units. The ring, mixed ring and bar ingot as well as the multiple axe deposits clearly belong to such metal value deposits. Most important, it seems, was a long-term deposition with a pre-monetary character.

The necessity to legitimize oneself was apparently accomplished by the rulers by the ritual deposition of prestige and representative objects in the form of equipment deposits. These were deliberately assembled to be similar to the composition of princely furnishings. In order to express the even greater power and sway that could legitimize the elite, an escalation of such equipping was necessary. This could only function successfully with objects, insignias and symbols, which were already well-known and which did not need any further legitimization of unlimited power.

Keywords: deposit finds | hoards | ritual practices

Metallzeiten

Metzner-Nebelsick 2019

Carola Metzner-Nebelsick, *Bestattung als Privileg und soziale Distinktion, Bemerkungen zum Bestattungswesen der Aunjetitzer Kultur in Mitteldeutschland.* In: Harald Meller & François Bertemes (Hrsg.), *Der Aufbruch zu neuen Horizonten – Neue Sichtweisen zur europäischen Frühbronzezeit, Abschlusstagung der Forschergruppe FOR550 vom 26. bis 29. November 2010 in Halle (Saale).* Tagungen des Landesmuseums für Vorgeschichte Halle 19 (Halle 2019), 215–224.

This article begins with a brief discussion about intentions and aims of project A4/1 “Kontinuitäten und Wechselwirkungen des Bestattungsverhaltens in Gräberfeldern und Siedlungen des 3. bis 2. Jahrtausends v. Chr. im südlichen SachsenAnhalt und angrenzenden Gebieten anhand der Funde seit 199o (Continuity and interdependency of burial practices in cemeteries and settlements of the 3rd and 2nd millennium B.C. in southern Saxony-Anhalt and adjacent areas – based on finds since 199o)” within DFG Research Unit FOR55o. It was lead by the author and has now successfully been finished. Main argument of this contribution is the proposition that the funeral behavior of the Central German Únìtice Culture was highly selective. On the basis of the known number of grave finds as well as the inner structure of the cemeteries, which usually include only small groups of scattered burials, a funeral custom is postulated that granted only certain members of society the right to be buried. The comparison of thousands of grave finds of the Lower Austrian Unterwölblinger Group with the approximately 45oo known graves of the Central German Únìtice Culture within a much larger territory suggests that this pattern mirrors a normative social practice. For the communities of the Únìtice Culture, a burial even without any grave goods or dress accessories can be regarded as privilege and feature of social distinction. The majority of the population is unrepresented in the context of funerary rituals. The high percentage of deviant burials and the diversity of the burial practices of the Únìtice Culture as a whole can be interpreted as reflection of great social differences. Below the level of chieftains, i. e. regional rulers being heroised after death, or a small group of specialists like craftsmen, the social rank of the buried individual is not emphasised by means of dress accessories or other goods. Thus, women in particular remain largely invisible in grave contexts. In contrast, different social status groups find limited reflection in contemporary hoard finds.

Der vorliegende Beitrag stellt zunächst Intention und Ziele des von der Verfasserin geleiteten und unterdessen abgeschlossenen Teilprojekts A4/1 innerhalb der FOR55o “Kontinuitäten und Wechselwirkungen des Bestattungsverhaltens in Gräberfeldern und Siedlungen des 3. bis 2. Jahrtausends v. Chr. im südlichen Sachsen-Anhalt und angrenzenden Gebieten anhand der Funde seit 199o” vor. Als Kernthese postuliert der Beitrag ein selektives Bestattungsverhalten der mitteldeutschen Aunjetitzer Kultur. Aufgrund der bekannten Grabfunde sowie vor allem aufgrund der Struktur der Gräberfelder mit in der Regel kleinen Grabgruppen mit einzelnen Bestattungen in lockerer Streuung wird ein selektives Bestattungsverhalten der Aunjetitzer Kultur angenommen, das heißt, dass nur ausgewählten Mitgliedern der Gesellschaft das Anrecht auf eine Bestattung zustand. Der Vergleich von tausenden bekannten Grabfunden der zeitgleichen niederösterreichischen

Unterwölblinger Gruppe mit den rund 45oo bekannten Gräbern der Aunjetitzer Kultur Mitteldeutschlands innerhalb eines größeren Territoriums legt den Schluss nahe, hinter diesem Muster ein bewusstes Verhalten zu sehen. Für die Gemeinschaften der Aunjetitzer Kultur kann bereits die Anlage eines beigabenlosen Grabes als Privileg und soziales Distinktionsmerkmal verstanden werden. Ein Großteil der Bevölkerung wird im Bestattungskult nicht sichtbar. Der hohe Anteil an Sonderbestattungen und die Vielfalt des Bestattungsverhaltens der Aunjetitzer Kultur insgesamt können als Ausdruck großer sozialer Unterschiede gelesen werden. In Gräbern unterhalb der Ebene von Häuptlingen bzw. im Tod heroisierter regionaler Herrscher oder ausgewählter Spezialisten wird auf die Abbildung sozialen Ranges im Grab anhand von Trachtattributen verzichtet. Frauen bleiben so im Grabkult weitgehend unsichtbar. Unterschiedliche soziale Statusgruppen finden hingegen in begrenztem Umfang Niederschlag in den zeitgleichen Horten.

Religion

Robinson 2020

David W. Robinson et al., *Datura quids at Pinwheel Cave, California, provide unambiguous confirmation of the ingestion of hallucinogens at a rock art site.* PNAS **117** (2020), 31026–31037.

pnas117-31026-Supplement1.pdf, pnas117-31026-Supplement2.mp4

While debates have raged over the relationship between trance and rock art, unambiguous evidence of the consumption of hallucinogens has not been reported from any rock art site in the world. A painting possibly representing the flowers of Datura on the ceiling of a Californian rock art site called Pinwheel Cave was discovered alongside fibrous quids in the same ceiling. Even though Native Californians are historically documented to have used Datura to enter trance states, little evidence exists to associate it with rock art. A multianalytical approach to the rock art, the quids, and the archaeological context of this site was undertaken. Liquid chromatographymass spectrometry (LC-MS) results found hallucinogenic alkaloids scopolamine and atropine in the quids, while scanning electron microscope analysis confirms most to be Datura wrightii. Three-dimensional (3D) analyses of the quids indicate the quids were likely masticated and thus consumed in the cave under the paintings. Archaeological evidence and chronological dating shows the site was well utilized as a temporary residence for a range of activities from Late Prehistory through Colonial Periods. This indicates that Datura was ingested in the cave and that the rock painting represents the plant itself, serving to codify communal rituals involving this powerful entheogen. These results confirm the use of hallucinogens at a rock art site while calling into question previous assumptions concerning trance and rock art imagery.

Keywords: hallucinogens | rock art | Datura | quids | Native California

David W. Robinson, Kelly Brown, Moira McMenemy, Lynn Dennany, Matthew J. Baker, Pamela Allan, Caroline Cartwright, Julienne Bernard, Fraser Sturt, Elena Kotoula, Christopher Jazwa, Kristina M. Gill, Patrick Randolph-Quinney, Thomas Ash, Clare Bedford, Devlin Gandy, Matthew Armstrong, James Miles & David Haviland

Significance: Proponents of the altered states of consciousness (ASC) model have argued that hallucinogens have influenced the prehistoric making of images in caves and rock shelters. However, the lack of direct evidence for the consumption of hallucinogens at any global rock art site has undermined the ASC model. We present the first clear evidence for the ingestion of hallucinogens at a rock art site, in this case, from Pinwheel Cave, California. Quids in the cave ceiling are

shown to be Datura wrightii, a Native Californian entheogen, indicating that, rather than illustrating visual phenomena caused by the Datura, the rock paintings instead likely represent the plant and its pollinator, calling into question longheld assumptions about rock art and the ASC model.