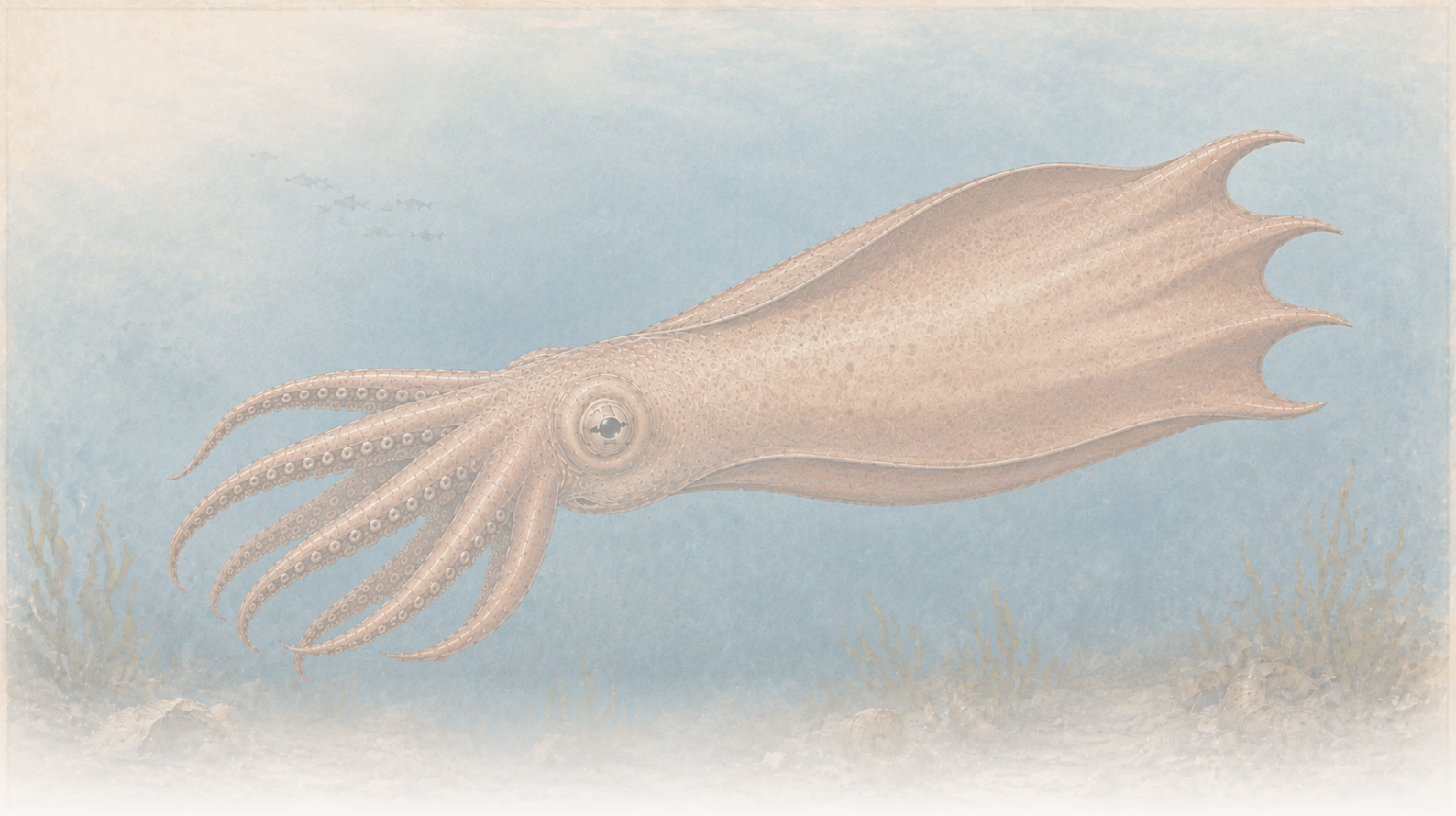




The CLEAN PAPER

WHAT THE PAPER SAYS · WHAT IT DOESN'T · WHY IT MATTERS

Giant Cretaceous octopuses top predators ta'uu malan — garuu evidence'n jaws irraa jalqaba, sea monsters irraa miti

Science paper tokko huge Cretaceous cephalopod jaws irra deebi'ee qoratee species Nanaimoteuthis lama early finned octopuses ta'uu isaanii argue godha; body-size estimates meters hedduu, possible hanga 18.6 m. Heavy jaw wear hard-prey crushing agarsiisa; asymmetric wear lateralized behavior irratti hint ta'uu mala. Fossil story spectacular dha, garuu clean version 'kraken dhugaa ture' miti: jaws, wear patterns, taxonomy fi scaling irraa reconstruction dha.

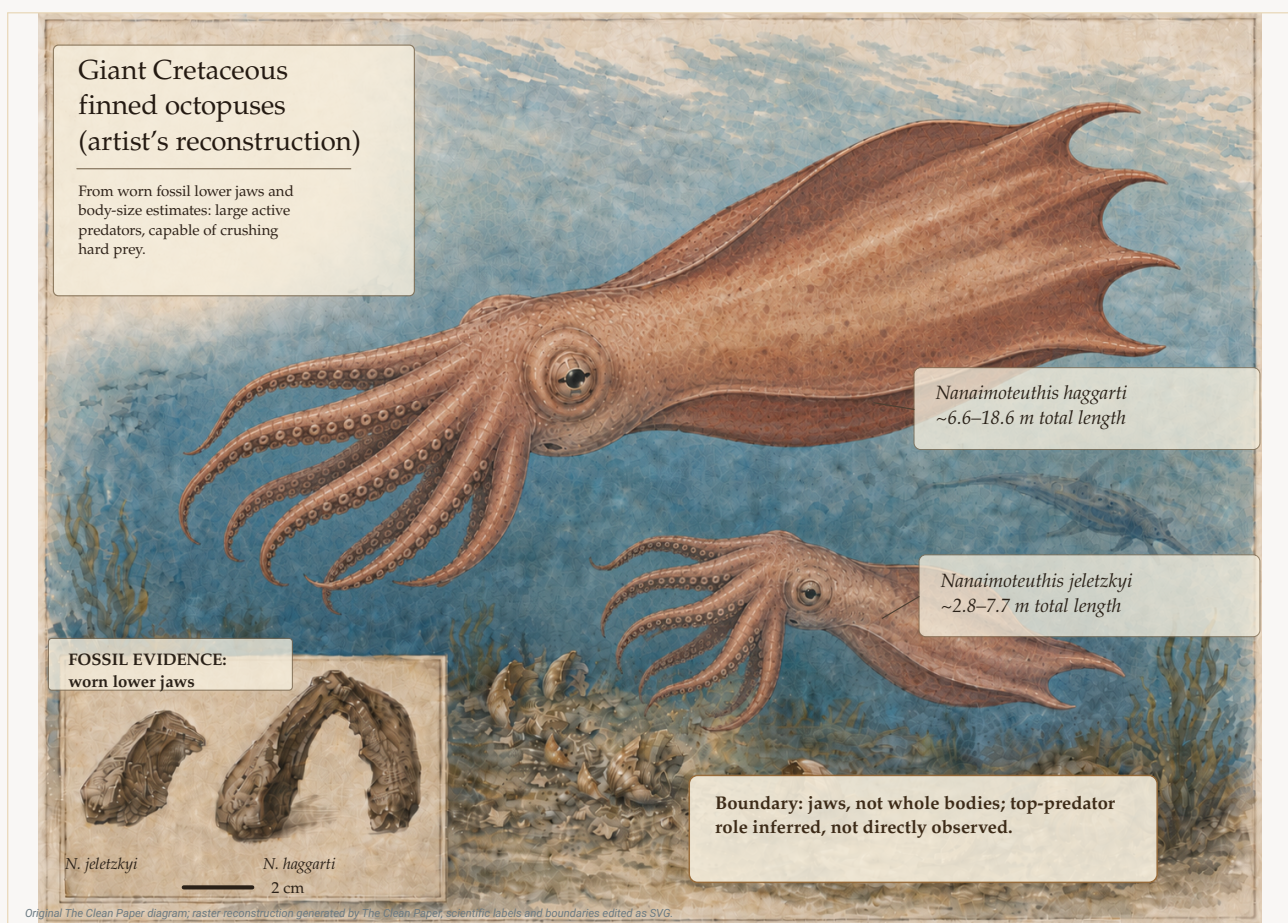
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Paper: *Earliest octopuses were giant top predators in Cretaceous oceans*, Shin Ikegami, Jörg Mutterlose, Kanta Sugiura, Yusuke Takeda, Mehmet Oguz Derin, Aya Kubota, Kazuki Tainaka, Takahiro Harada, Harufumi Nishida, and Yasuhiro Iba, *Science* 392, 406–410 (2026) · DOI: [10.1126/science.aea6285](https://doi.org/10.1126/science.aea6285)

Seenaa kraken, fossil ragaa qofatti deebifamee

Jaw fossil tokko bineensa guutuu miti. Inni qaama lallaafaa keessaa kutaa jabaa hafe qofa; paleontologists anatomy, amala fi ecology isaa irraa deebisanii tilmaamuu, akka bineensa lubbuun arganitti fakkeessuu malee. Kanaaf barruu kun nama hawwata, yeroo wal-fakkaatutti oversimplify gochuun salphaa. mata-duree nama hawwatu: giant kraken-like octopuses Cretaceous oceans bulchan. Gosa of-eeggannoo qabu caalaatti gaarii: fossil jaws haala addaa keessatti eegamanii hafan irraa, finned octopuses durii keessaa tokko tokko carnivores baay'ee guguddoo, prey jabaa irra deddeebi'anii caccabsan, Late Cretaceous marine food webs keessatti top tier ga'uu malan.

Kun ammallee spectacular dha. Sea-monster seenaa akka hin taane, jaws, wear akkaataawwan, taxonomy fi body-size scaling irraa reconstruction akka ta'etti dubbifamuu qaba.



Artist's reconstruction species **Nanaimoteuthis** lama barruu keessatti ibsame, fossil gadi-aanaa jaws kallattii ragaa body-size reconstruction duuba jiran waliin. Suuraan kun reconstruction dha, fossil photograph miti: ragaa preserved jaws dha; body length fi top-predator gahee scaling, wear akkaataawwan fi ecology irraa irraa tilmaamamu.

Original hybrid diagram — The Clean Paper CC BY 4.0

Barreessitoonni maal godhan

Barreessitoonni fossil jaws Cretaceous octobrachian cephalopods — garee bal’aa octopuses fi firoota isaanii of keessaa qabu — irra deebi’anii qoratan. Jaws fossil guguddoo 15 Japan fi Vancouver Island irraa kanaan dura gabaasa ta’anii turan. Gareen digital fossil-Albuuda baasuun fayyadamuun concretions carbonate shan Japan keessaa jaws 12 dabalataa argate.

Mala’n high-resolution, full-color grinding tomography fi zero-shot learning AI moodeela walitti fide; jechuun moodeela fossils kana irratti addatti leenjifame hin turre. Concretion tokkoon tokkoon isaa **50-micrometer intervals** irratti grinder’n muranii, fuula haaraa tokkoon tokkoon isaa photograph godhanii color images sequence guddaa ijaaran. Segmentation moodeela DEVA image tokkoon tokkoon keessatti jaw outline/mask digital uume. Qorattoonni masks jalqabaa images waliin qoratan, achiis wal irratti stack fi join godhanii minimally smoothed, original-color 3D moodeelota uuman. Kun jaws dhagaa keessa dhokatan arguufi chips, scratches fi wear amaloota fine fuula isaanii qorachuuf dandeessise. Grinding tomography dhagaa saamudawwan shan balleesse, garuu image daataa, masks fi 3D moodeelota kuusaa ragaa godhaman.

Achiis wantoota walitti hidhatan afur godhan.

Tokkoffaa, taxonomy haaromsan. Fossil jaws kanaan dura species shan keessatti ramadaman species lama keessatti qindeessan: **Nanaimoteuthis jeletzkyi** fi **Nanaimoteuthis haggarti**. Genus kun kanaan dura vampire-squid walbira qabamee jedhamee ilaallamaa ture, barruu kana keessatti **Cirrata**, finned octopuses, keessa kaa’ame.

Lammaffaa, timeline dheeressan. Maateriyaalii haaraan **N. jeletzkyi** earliest Cenomanian, naannoo **waggaa miliyoona 100 dura**, geessa; galmee finned octopuses naannoo waggaa miliyoona 15, octopuses bal’inaan naannoo waggaa miliyoona 5 duubatti dheeressa.

Sadaffaa, jaw hammamtaa irraa body hammamtaa tilmaaman. Ammayyaa long-bodied finned octopuses allometric relationships fayyadamuun maantilii length, achiis total length tilmaaman. Daangaa bal’aa dha: **N. jeletzkyi** total length naannoo **2.8 hanga 7.7 meters**, **N. haggarti** immoo **6.6 hanga 18.6 meters**. Gubbaa daangaa irraa “kraken” afaan dhufa.

Supplementary malleen scaling chain kana ifatti agarsiisa. Worn/weathered jaw outlines bakka barbaachisutti reconstruct godhan; achiis lower-jaw hood length fi maantilii length gidduu **gosa sanaaf addaa relationships 12** fayyadaman. Ammayyaa specimens barbaachisoo keessatti giddugaleessa **39% fixation shrinkage** herrega keessa galchan; maantilii length gara total lengthtti reeshiyoo **4.2** long-bodied living finned octopuses irraa argameen jijjiiran. Filannoowwan kun daangaa uumu; fossil body kallattii safartuu miti.

Afurffaa, wear qoratan. Jaws guguddoo bakka juveniles sharp jaw elements qabaatanitti blunt fi rounded turan. Chips, scratches, polished fuulota, cracks fi asymmetric dhabamuu jaw edges agarsiisan. Barreessitoonni kana repeated hard-prey crushing ragaa fi tarii lateralized amala jechuun hiiku.

Maal argatan

Kanneen jalqabaa finned octopuses ta’uu malu, vampire squids miti. Supplementary taxonomy tarkaanfiiwwan lama adda baasa. Bridge tokko jaw maateriyaalii strip hood fi lateral wall walitti hidhu dha. **Nanaimoteuthis** keessatti bridges kun inner fi outer jaw plates jalatti guutumaan dhokatu; akkaataa kun genus *Cirrata* keessatti kaa’u deeggara. Broad jaw wings isaa immoo long-bodied finned octopus garee keessatti ramadu deeggara. Kun barruun “guddaa cephalopod” qofa jechuu miti; fossils kun seenaa octopus keessatti bakka isaanii jijjiirama.

Baay’ee durii turan. Haaraa specimens finned octopuses naannoo **waggaa miliyoona 100 dura**, Cretaceous keessatti, kaa’u. Isaan octopus-line animals beekamoo durii keessaa tokko ta’u.

Baay’ee guguddoo ta’uu danda’u. Body-size tilmaamota preserved bodies irraa tokko safartuuwwan miti; jaws irraa shallaggiwwan dha. Garuu lakkoofsota of-eeggannoodhaan illee guguddoo dha. Species xiqqaan *N. jeletzkyi* meters hedduu total length. Kan guddaan *N. haggarti* hanga **18.6 meters** tilmaamame, marine predators guddoo yeroo sanaa fi living cephalopods guddoo waliin safartuu wal-fakkaatu.

Jaws baay’ee worn turan. Specimens guddoo keessatti jaw maateriyaalii bade total jaw length keessaa naannoo **10%** ga’e. barruun wear kun preparation damage yookaan transport abrasion miti jechuun falma: specimens low-energy outer-shelf deposits irraa, chips/scratches fayyadama waliin wal-simu ta’een preserved, co-occurring fossil squid jaws akkaataa wal-fakkaatu hin qaban. Wear ammayyaa durophagous cephalopods — prey jabaa nyaatan — waliin wal bira qabu.

Wear asymmetric ture. Species lamaan keessatti mirga jaw edge bitaa caalaa worn ture. Barreessitoonni danda’amaa amalaa lateralization — side tokko caalaatti fayyadamu preference — jechuun hiiku. Lateralized amala ammayyaa animals keessatti walxaxaa nervous sirnoota waliin wal-qabatu waan ta’eef, jalqabaa octopuses kun advanced intelligence qabaachuu malan jedhu.

Kun maal jechuu akka malu

Ecological hiika cimaa: Late Cretaceous finned octopuses hundi xiqqaa duubbee animals ecosystems guddaa vertebrates’n dominated keessatti miti. Top-predator haala barreessitoonni argannoowwan lama walitti fida: gigantic tilmaamame body hammamtaa fi durophagous carnivory — hard animal prey irra deddeebi’anii adeemsa gochuu — jaw wear irraa inferred. Waliin, invertebrate lineage food web top tier mosasaurs, plesiosaurs, guddaa fish fi sharks waliin associated keessatti hirmaachuu mala jedhu deeggara.

Evolutionary seenaa illee interesting dha. Vertebrate marine predators fi octopus-line cephalopods predationtti routes baay’ee adda hordofan. Vertebrates jaws, streamlined bodies argatan, yeroo baay’ee alaa armor hir’isan. Octopus relatives shells hir’isan yookaan internalize godhan, soft-bodied fi mobile ta’an, powerful jaws fi flexible arms eeganii. Barruu kun guddaa, intelligent marine predators irratti convergent path jechuun frame godha.

Amala kutaa speculative caalaa. Extensive wear hard-prey feeding deeggara. Guddaa hammamtaa

ecological barbaachisummaa deeggara. Asymmetric wear danda'amaa lateralized amala deeggara. Garuu “advanced intelligence” inference dha, fossil kallattii safartuu miti. Octopus baayoloojii haala keessatti amansiisaa dha, garuu ragaa caalaa jabeessuun sirrii miti.

Kun maal *hin* mirkaneessu

- Whole giant octopus body **hin preserve**. Reconstruction irra caalaa jaws irratti, body hammamtaa ammayyaa finned-octopus scaling irraa inferred.
- Stomach contents yookaan kallattii prey remains **hin agarsiisu**. Hard-prey feeding jaw wear irraa inferred, fossilized meal irraa miti.
- **Authored research article** mosasaurs, plesiosaurs yookaan guddaa marine reptiles biroo akka prey ta'an **hin propose**. Research text keessatti isaan body hammamtaa/ecological position wal-bira qabuwwan qofa.
- Sirrii body length hin kennu. Tilmaamota ranges dha, isa guddaa himannaa gubbaa tilmaama dha.
- Intelligence kallattii hin measure. Lateralized jaw wear danda'amaa amalaa lateralization jechuun interpreted; kun animal maal dandeessu beekuu irraa inferential tarkaanfiiwwan hedduu fagaata.
- Jalqabaa octopuses hundi giants turan jechuu miti. Himannaa species Nanaimoteuthis kana, keessumaa N. haggarti, irratti.

Ragaan hammam cimaa dha?

Very guddaa Cretaceous octopus-line jaws jiraachuu irratti ragaa cimaa dha: described specimens, digital moodeelota, stratigraphic haala fi ammayyaa/fossil cephalopod jaws walbira qabuwwan jiru.

Hard-prey feeding irratti ragaa reasonably cimaa dha. Wear akkaataawwan bal'aa — chips, scratches, polish, cracks, asymmetric dhabamuu — fi barreessitoonni preparation damage/transport abrasion keessaa baasuuf tattaaffii godhan. Ammayyaa durophagous cephalopods walbira qabuu amansiisaa bridge dha.

Sirrii body hammamtaa fi top-predator status irratti amanamummaa medium caalaa. Hammamtaa tilmaamota living long-bodied finned octopuses allometric scaling irratti hirkatu. Ecological ga-hee tilmaamame hammamtaa + durophagous carnivory walitti qabuu irraa inferred, kallattii hin mul'anne. Argument coherent dha, garuu ecological reconstruction dha, food web kallattii census miti.

Maaliif barbaachisaa dha

Barruu kun paleontology partial ragaa irraa cimaa himannoowwan akkamitti godhu — magic malee — fakkeenya gaarii dha. Jaw object dha. Wear amalaa trace dha. Scaling qaxxaamura fossil jabaa irraa soft bodytti bridge dha. Tarkaanfii tokkoon tokkoon humna dabalata, shakkii illee dabalata. Lesson kun eegamuu qaba.

Picture beekamaa tokko illee sirreessa. Cretaceous oceans yeroo baay’ee guddaa vertebrate predators fi xiqqaa shelled prey addunyaa akka ta’etti yaadama. Fossils kun soft-bodied invertebrates tokko tokko food web jala dhokachaa qofa hin turre; gubbaa sadarkaalee keessatti dorgomaa turuu malu jedhu.

Bu’aa visually nama hawwata, garuu ifaa seenaa “kraken dhugaa ture” miti. Guddaa, jalqabaa finned octopuses jaws dhiisan; irraa researchers gigantic bodies fi repeated hard-prey feeding reconstruct godhan — combination kun age marine reptiles keessatti invertebrate top predators jiraachuu irratti serious, garuu inferential haala uuma.

Cuunfaa gabaabaa

Qorattoonni Cretaceous fossil cephalopod jaws Japan fi Vancouver Island irraa irraa deebi’anii qoratan; full-color grinding tomography + zero-shot AI segmentation fayyadamuun Japanese dhagaa keessa jaws dhokatan bal’aa 3D specimens ta’anii reconstruct godhan. Fossil taxa hedduu species lama **Nanaimoteuthis** keessatti reorganize godhan; asitti jalqabaa finned octopuses jechuun interpreted. Fossils galmee finned octopuses gara **waggaa miliyoona 100 dura** geessu. Jaw-size scaling irraa, **N. jeletzkyi** total length **2.8–7.7 m**, **N. haggarti** **6.6–18.6 m** tilmaaman. Heavy jaw wear — chips, scratches, polish, cracks fi asymmetric edge dhabamuu — repeated hard-prey crushing fi danda’amaa lateralized amala agarsiisa. Gigantic tilmaamame hammamta + durophagous carnivory animals kun marine food webs top tier keessa turuu malu deeggara. Ragaa guutuu bodies, sirrii lengths, identified prey, yookaan kallattii intelligence safartuu hin qabu. Authored research article guddaa marine reptiles prey ta’an jechuun hin jedhu.

Sakatta’a ifaa

barruun maal agarsiisa: Guddaa Cretaceous octopus-line jaws species Nanaimoteuthis lama jechuun haaromfamee fi finned octopuses keessatti placed; Cirrata galmee duraa; body-size tilmaamota meters hedduu, danda’amaa 18.6 m; adult jaw wear hard-prey feeding waliin wal-simu; asymmetric wear danda’amaa lateralized amala waliin wal-simu.

Waan amansiisaa ta’e garuu hin mirkanoofne: N. haggarti invertebrates beekamoo guddoo keessaa tokko ta’uu; true top-predator gaheewwan qabaachuu; asymmetric wear amalaa lateralization fi advanced cognition agarsiisuu.

Waan hin agarsiifne: Whole-body fossils; kallattii prey yookaan stomach contents; sirrii body lengths; predation guddaa marine reptiles irratti; kallattii intelligence ragaa; jalqabaa octopuses hundi giants ta'uu.

Daangaawwan ijoo: Body hammamtaa multi-step jaw→maantilii→total-length scaling moodeela irraa inferred; top-predator status tilmaamame hammamtaa + durophagous carnivory irraa inferred; amala asymmetric wear irraa; fossils jaws preserve malee guutuu animals/prey miti.

Dubbisaan waliigalaa amanamummaa hammam qabaachuu qaba? Very guddaa jalqabaa finned-octopus jaws fi wear ragaa cimaa irratti amanamummaa guddaa. Isa guddaa animals 6.6–18.6 m daangaa gubbaa end ga'uu irratti medium. True top predators ta'uu irratti medium, very guddaa hard-prey carnivores ta'uu caalaa shakkii qaba. Intelligence addaa irratti gadi-aanaa. Stance sirrii: fossil seenaa spectacular, garuu jaws fi inference irraa ijaarame — guutuu sea monster irraa miti.

Fooyya'iinsa maxxansa boodaa

- **Sirreeffama · 2026-07-26**

Corresponding author Yasuhiro Iba irraa feedback booda, authored research article large marine reptiles akka comparisons qofa ilaalu malee prey akka hin taane ifatti ibsine; authored research article fi Science Editor's Summary prey attribution irratti adda baafne. Digital fossil-mining method fi top-predator evidence illee bal'isnee, supplementary package guutuu check goone.

Maddoota

Science 392, 406–410 (2026)

<https://doi.org/10.1126/science.aea6285>

Supplementary methods, text, figures S1–S6, and references

https://www.science.org/doi/suppl/10.1126/science.aea6285/suppl_file/science.aea6285_sm.pdf

Supplementary tables S1–S6

https://www.science.org/doi/suppl/10.1126/science.aea6285/suppl_file/science.aea6285_tables_s1_to_s6.zip

MDAR reproducibility checklist

https://www.science.org/doi/suppl/10.1126/science.aea6285/suppl_file/science.aea6285_mdar_reproducibility_checklist.pdf

Fossil lower jaws dataset — Figshare

<https://doi.org/10.6084/m9.figshare.27933759>

Tomographic animations — Figshare

<https://doi.org/10.6084/m9.figshare.27935904>

CPU-enabled AI segmentation code — Zenodo

<https://doi.org/10.5281/zenodo.15176344>