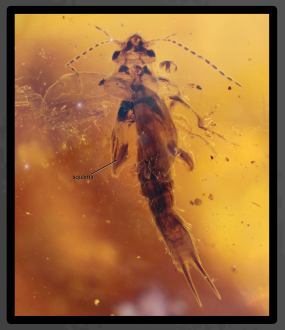
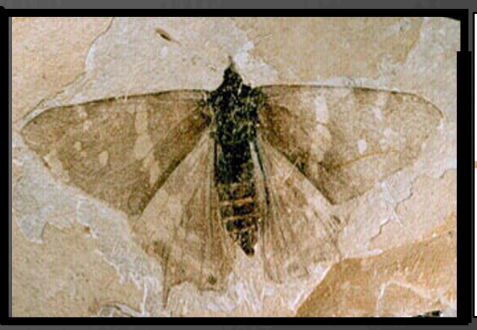
fossil insect COLLABORATIVE





NSF

Using digitized fossil Coleoptera (beetles) to study ecological and evolutionary response to global climate change

DM Smith, LJ Walker, CR Nufio, HM Sexson
University of Colorado Museum of Natural History, Boulder, CO 80308

dena@colorado.edu

fossilinsects.colorado.edu

fossil insect COLLABORATIVE

HARVARD UNIVERSITY
Museum of Comparative Zoology

The Field Museum

Yale PEABODY MUSEUM OF NATURAL HISTORY

ILLINOIS NATURAL HISTORY SURVEY
PRAIRIE RESEARCH INSTITUTE

Virginia Museum of NATURAL HISTORY
IN ASSOCIATION WITH THE SMITHSONIAN INSTITUTION

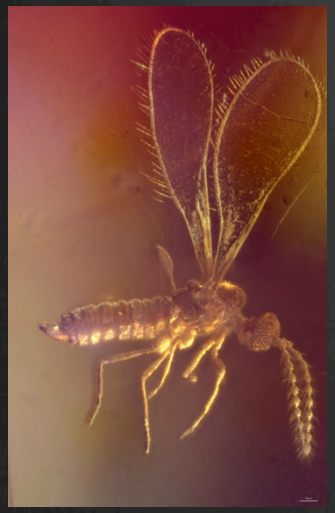
University of California Museum of Paleontology

Smithsonian

Boulder

American Museum of Natural History

KU BIODIVERSITY INSTITUTE & NATURAL HISTORY MUSEUM
The University of Kansas



Digitize and make available all the major collections of fossil insect specimens in the United States

fossil insect COLLABORATIVE

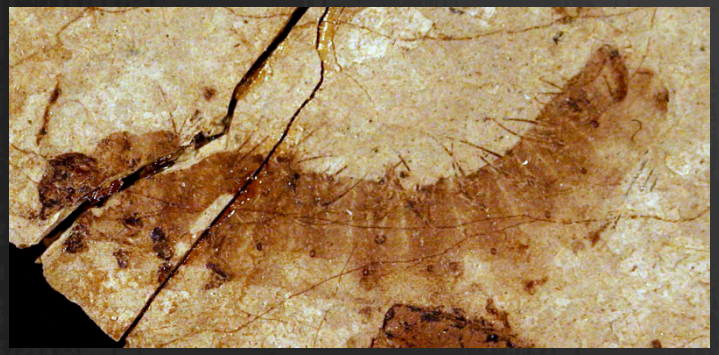
Digitization Goals

- Database ~500,000 specimens
- ~77,000 digital images
- Data sharing
- iDigPaleo development

YPM-IP.1002 *Dunbaria fasciipennis* Holotype

fossil insect COLLABORATIVE

Research Goals



- Examine insect response to environmental change in deep time
- Examine evolutionary history of fossil insect groups and patterns of diversity in deep time

How do beetles respond to global cooling during the middle Eocene?

Grande (2013); Lawrence & Britton (1994)

Locality

Eocene lake system
- UT – CO – WY

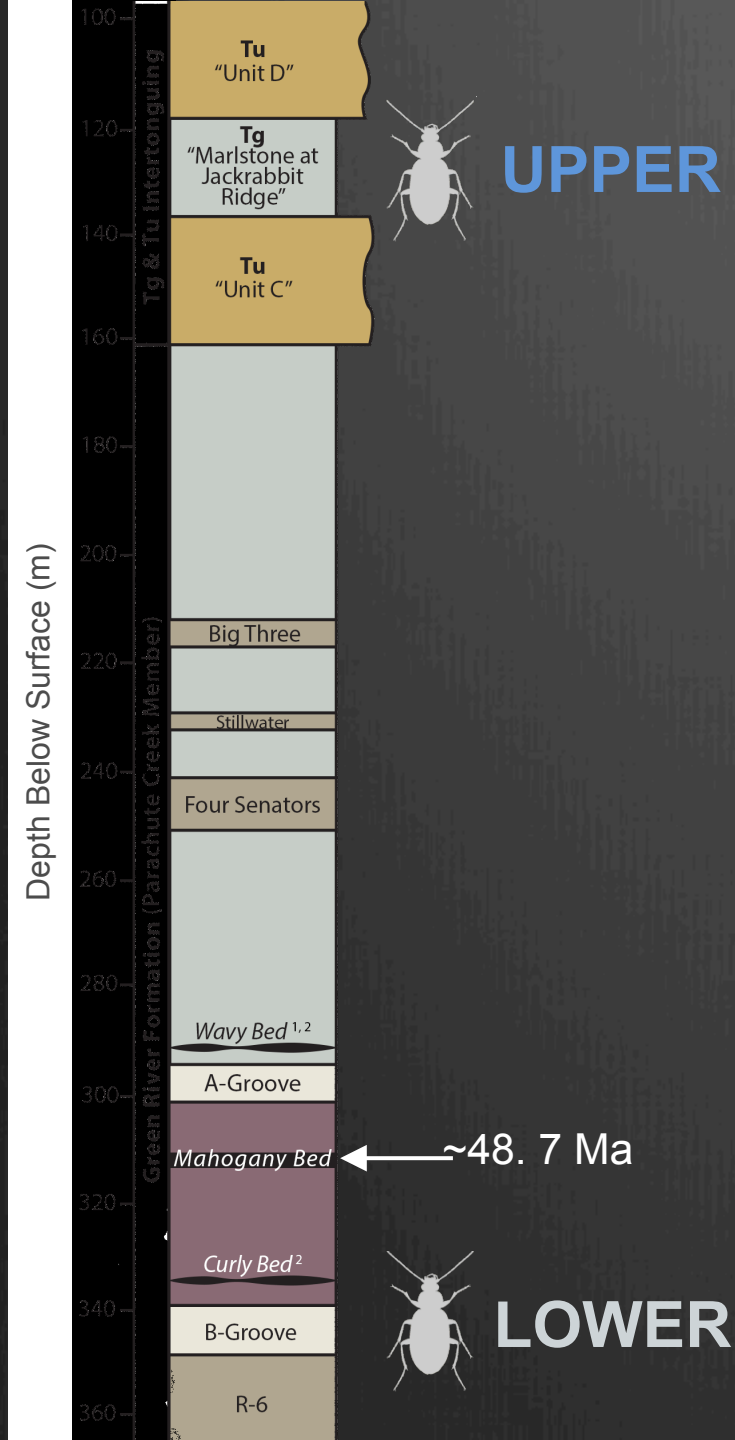
Piceance Creek Basin

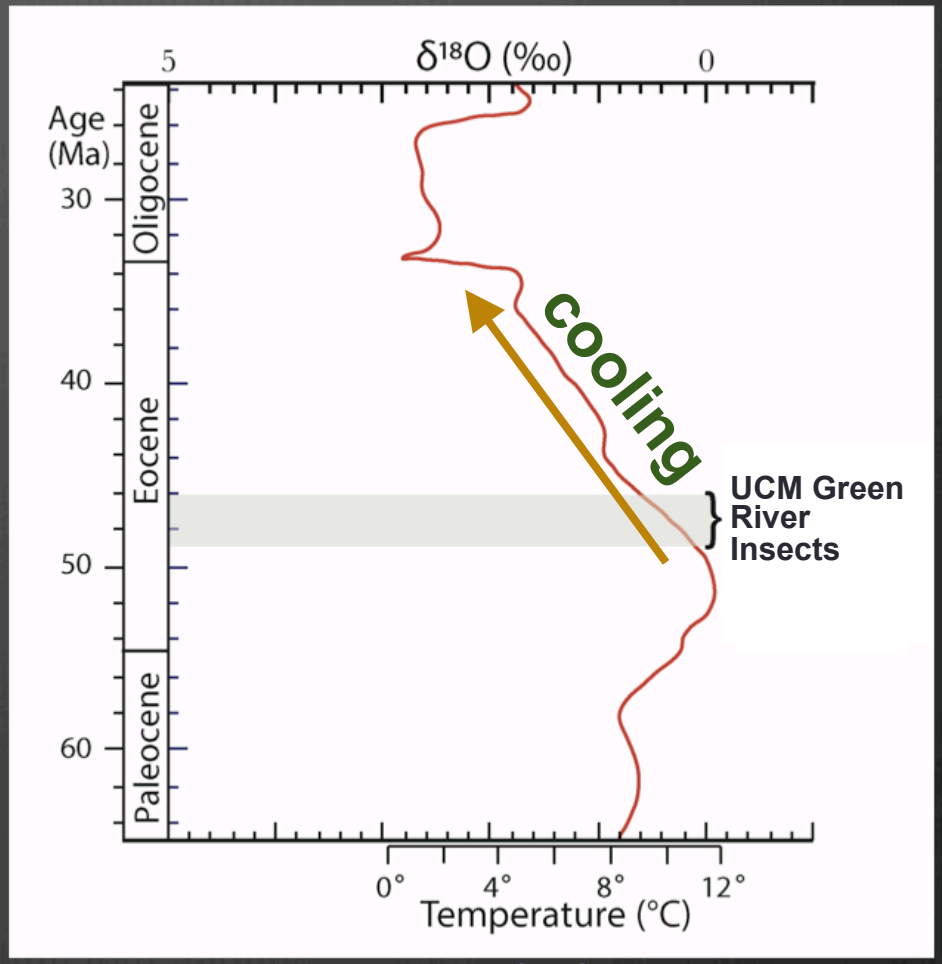
All major insect orders
- Diptera
- Coleoptera
- Hymenoptera

Ron Blakey, Colorado Plateau Geosystems, Arizona, USA
Inset map modified from Johnson (2014)

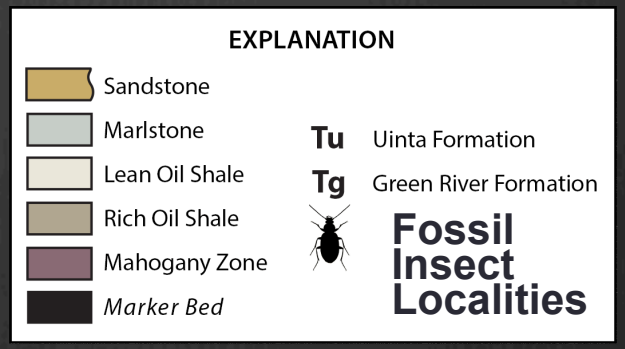

CLAUDIA'S PLACE


B GROOVE
SITE 5





Modified from Zachos et al. (2001)



Cashion & Donnell (1972); Donnell (2010); Duncan (1997); O'Sullivan & Hail (1987); Smith et al. (2008)

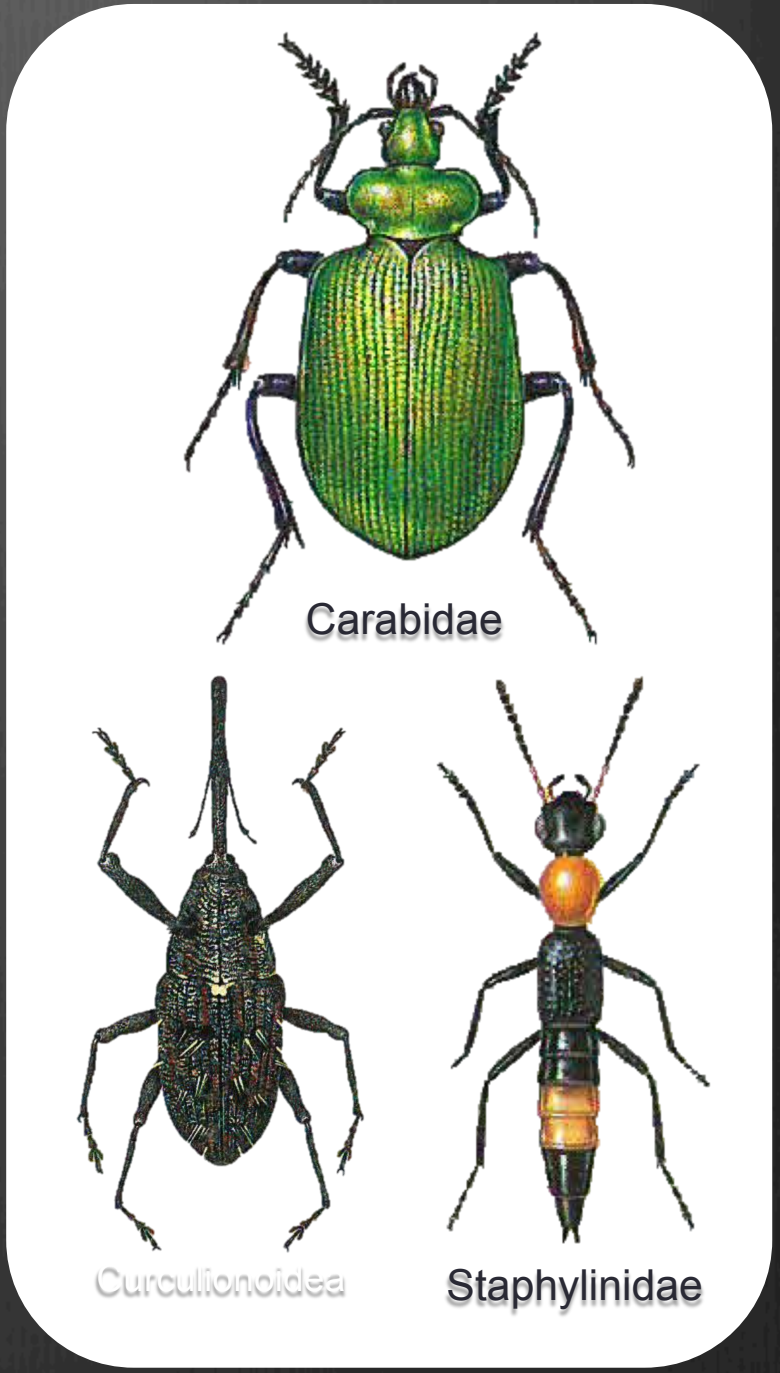
Focal Taxa

Order Coleoptera

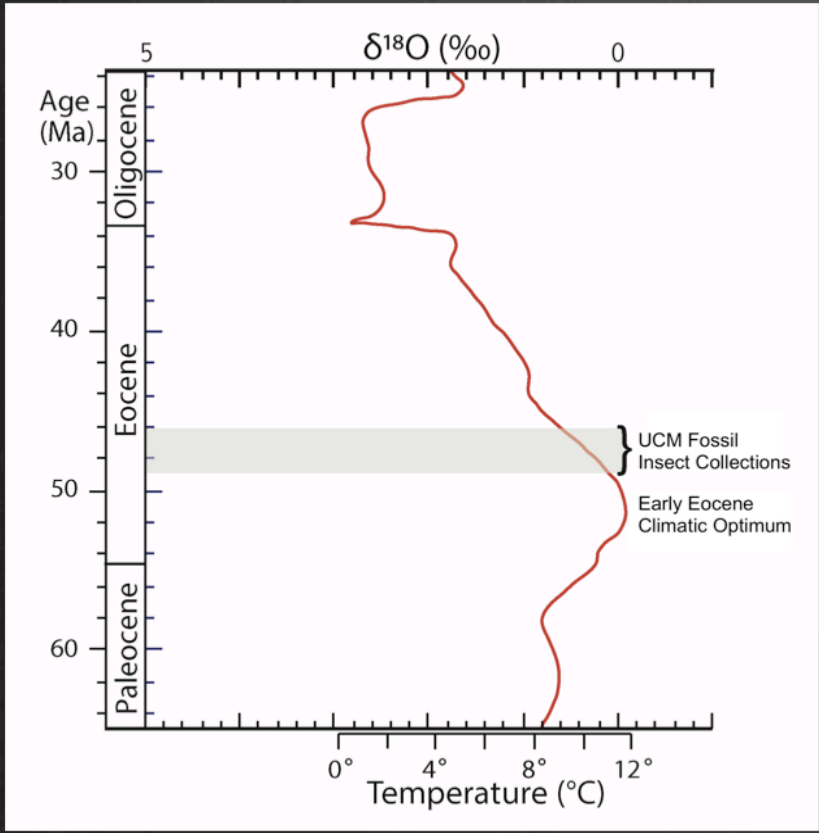
- Carabidae (ground beetles)
- Staphylinidae (rove beetles)
- Curculionoidea (weevils)

Chosen for

- taxonomic diversity
- ecological affinities
- relative abundance
- dispersal potential



Predictions



Decrease in species richness

Shifts in relative abundance

Compositional changes (turnover)

Imaging & Analysis

Results Summary

Imaged Specimens

Locality	Samples	Coleoptera Imaged	ID'ed to morphospp.
Upper	51	737	191
Lower	39	1356	389
Total	90	2093	580

Observed Morphospecies

Locality	Carabids	Staphylinids	Weevils	Total S_{obs}
Upper	16	16	27	59
Lower	24	22	34	80

Sampling Effort

Observed species

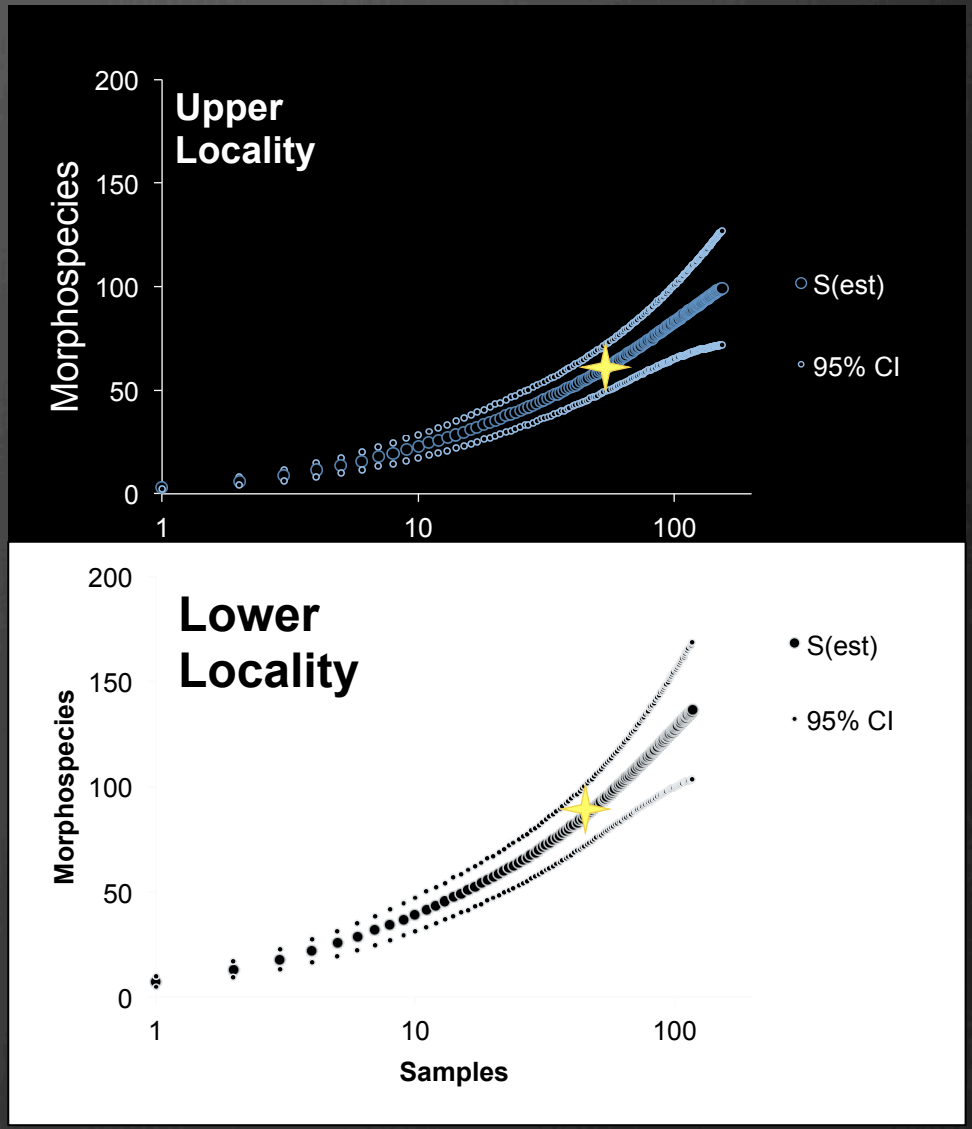
UPPER: 51 samples/59 spp

LOWER: 39 samples/80 spp

How complete is sampling for each locality?

Estimated species

Sample-based rarefaction: S(est)

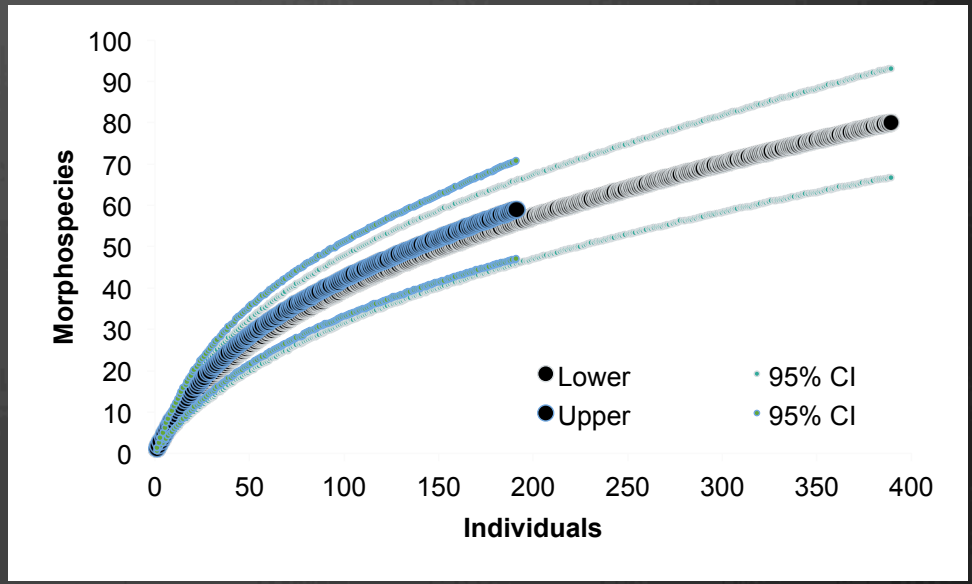


Colwell (2013); Colwell et al. (2012); Colwell & Coddington (1994)

Richness

As global climate cooled,did the # of spp. change?

- All beetles pooled by locality
- Individual-based rarefaction



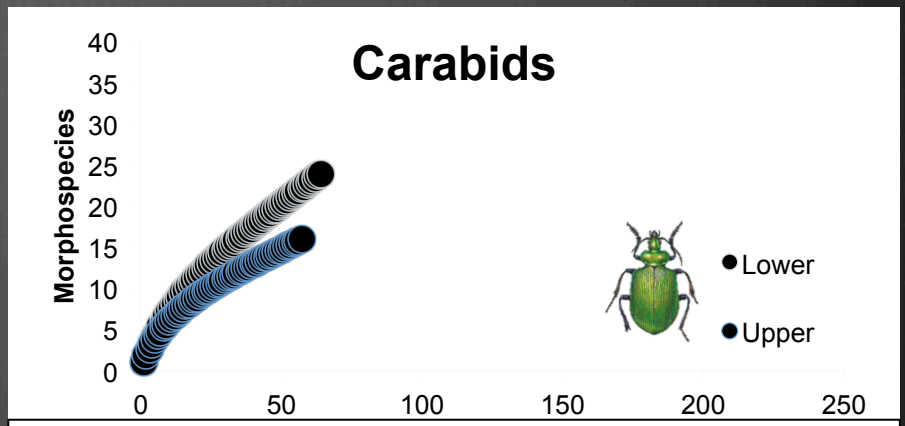
Total richness did not decrease.

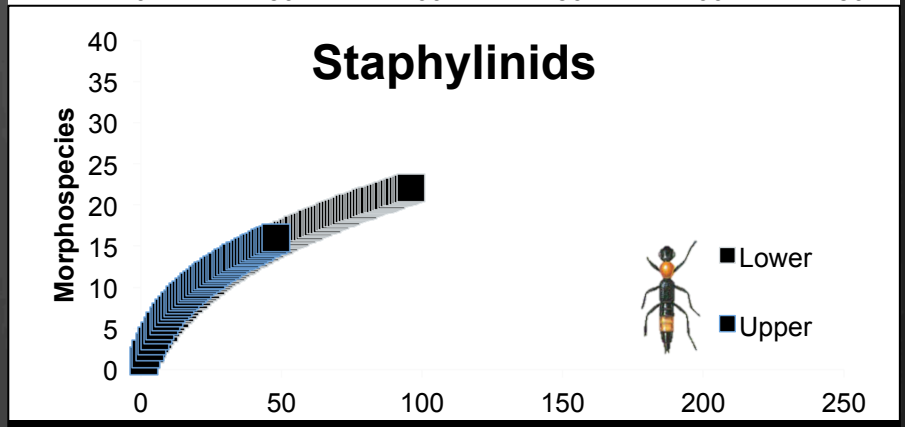
Colwell (2013); Gotelli & Colwell (2001)

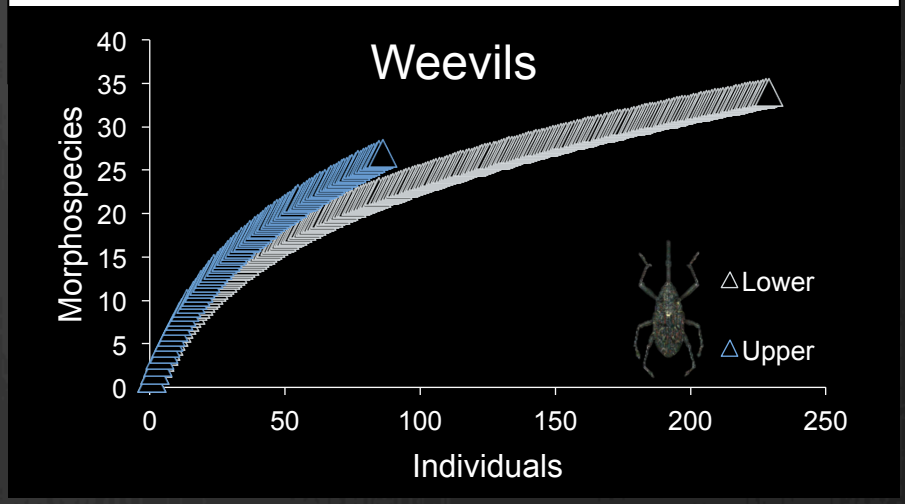
Focal Taxa

Carabidae, Staphylinidae, & Curculionoidea

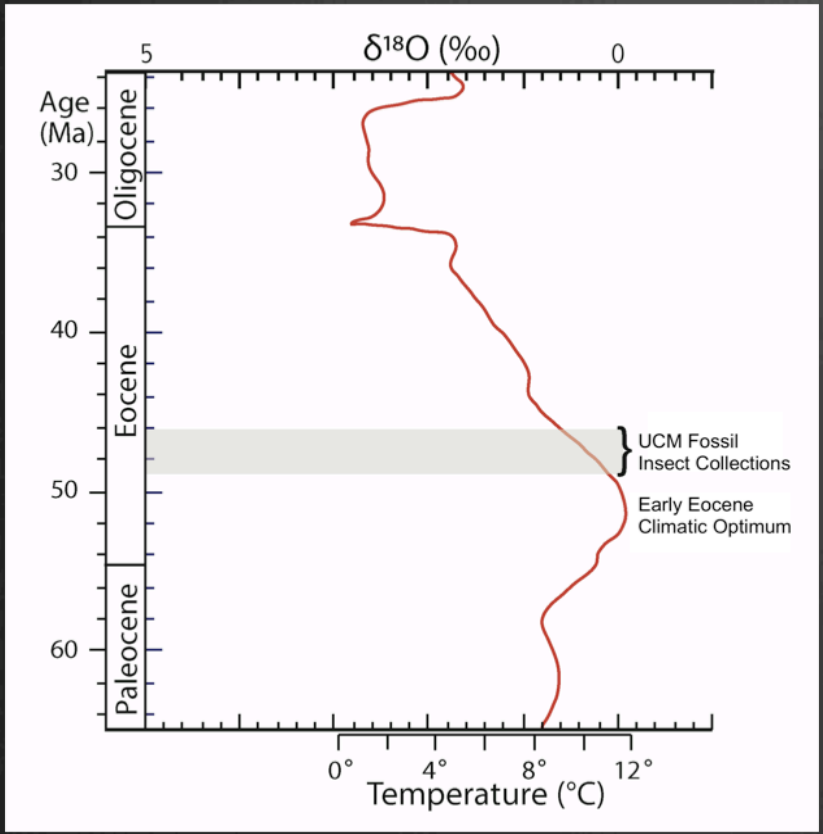
- Some taxon-specific directionality
- Compositional shifts
- Do predators shift more quickly than herbivores?



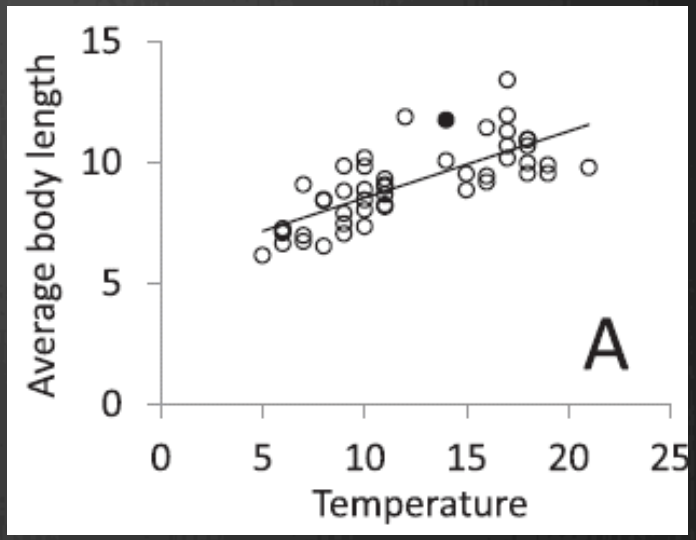




Predictions



Decrease in body size.



Original article

Latitudinal trends in body length distributions of European darkling beetles (Tenebrionidae)

Simone Fattorini [a,b], Roberto Lo Monaco [c], Andrea Di Giulio [c], Werner Ulrich [d,*]

[a] Water Ecology Team, Department of Biotechnology and Biosciences, University of Milano Bicocca, Piazza della Scienza 2, 20126 Milan, Italy
[b] Azorean Biodiversity Group (CITA-A) and Platform for Enhancing Ecological Research & Sustainability (PEERS), Universidade dos Açores, Dep. Ciências Agrárias, Angra do Heroísmo, Terceira, Açores, Portugal
[c] Dipartimento di Biologia Ambientale, Università degli Studi Roma Tre, Viale G. Marconi 446, 00146 Rome, Italy
[d] Chair of Ecology and Biogeography, Nicolaus Copernicus University in Toruń, Lwowska 1, 87-100 Toruń, Poland

Body Size

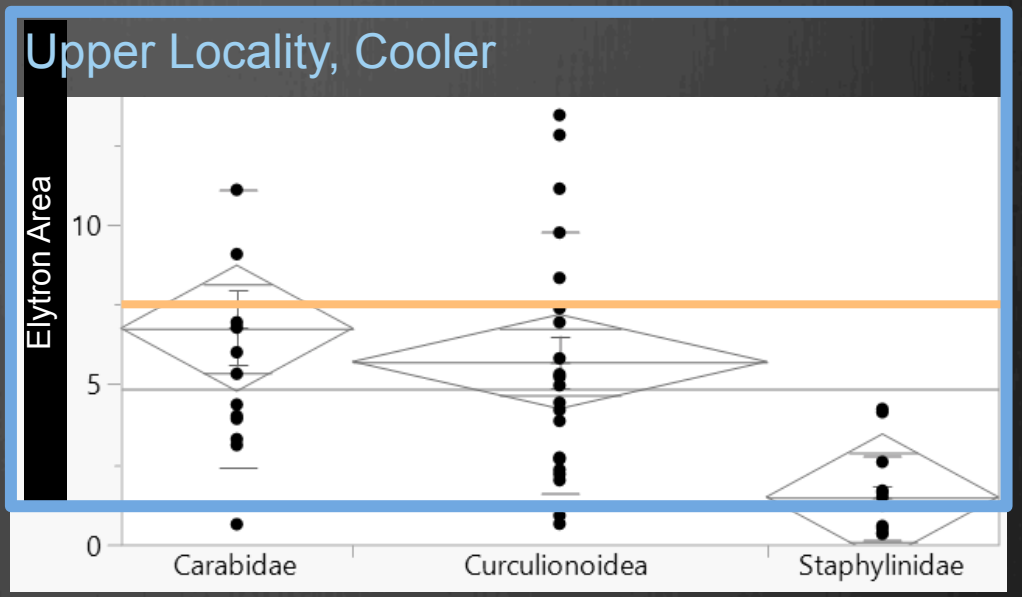
- Image J
- Elytron area

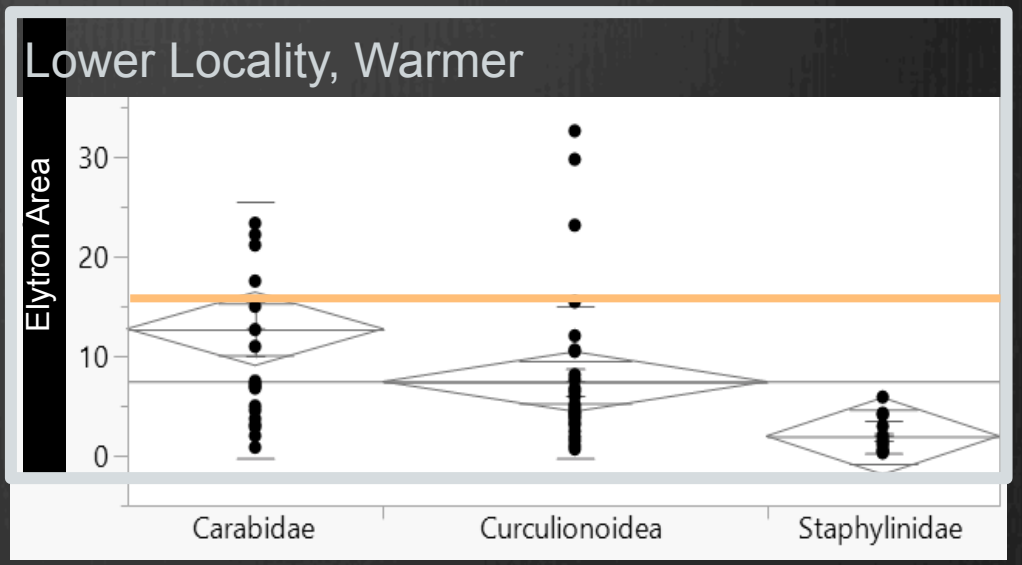
e.g. Gardiner et al. (2011); Hunt & Roy (2006); Fattorini et al (2013)

Body Size

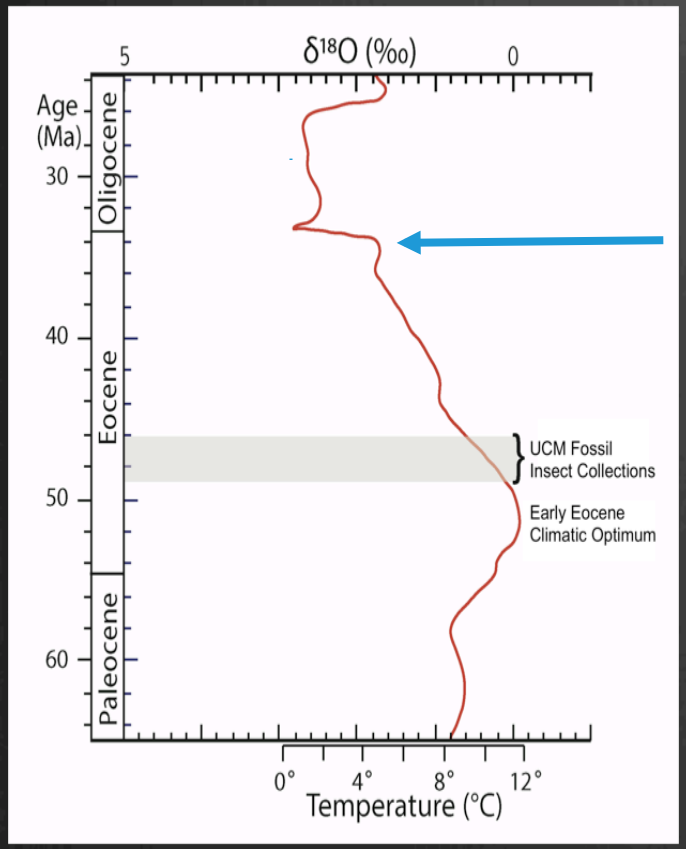
- **Elytron (wing) measurements**
  Mean body size ↓ 30%

- **ANOVA**
  site P = 0.0408
  family P < .0001



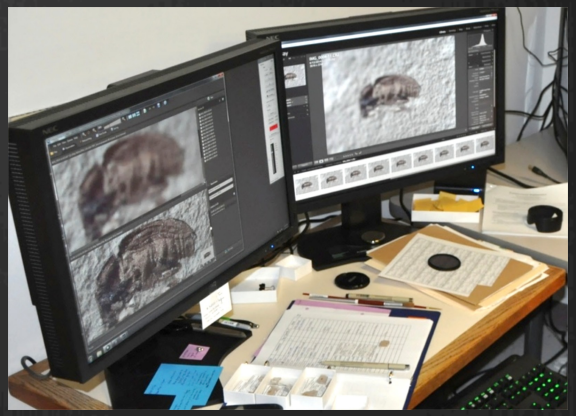


Body Size



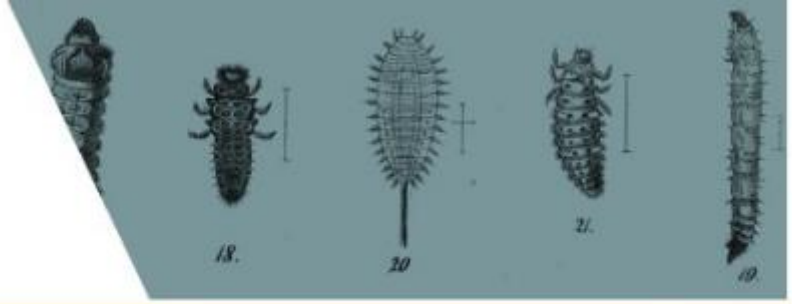
Now working to digitize Florissant specimens

Prediction: body size will continue to decline



fossil insect COLLABORATIVE

Making data and images of millions of insect specimens available on the web



ABOUT NEWS BROWSE JOIN EDUCATION

Search

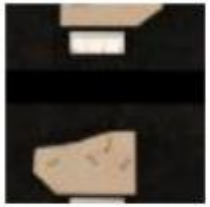
News

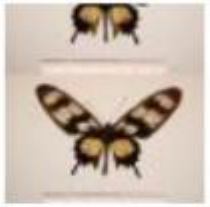
Society for the Preservation of Natural History Collections Annual Meeting

More

undet. Hexapoda (YPM IP 584656).

Featured Fossils





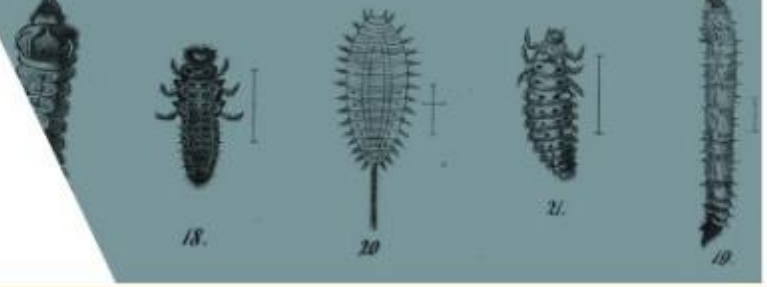
YPM IP 585232

Latest Comments

Featured Institution

fossil insect COLLABORATIVE

Making data and images of millions of insect specimens available on the web



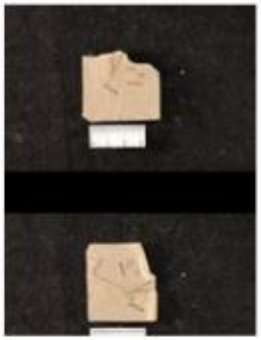
ABOUT NEWS BROWSE JOIN EDUCATION

Search

6292 SPECIMEN RESULTS

SOURCE: YALE PEABODY MUSEUM OF NATURAL HISTORY FOSSIL/MODERN: FOSSILS HAS MEDIA: HAS MEDIA

YPM IP 223880
Urogomphus eximius



YPM IP 454216
undet. Zygoptera

YPM IP 794004
undet. Zygoptera

YPM IP 793713
undet. Vespidae

YPM IP 793298
undet. Vespidae

YPM IP 454356
undet. Trichoptera

YPM IP 454362
undet. Trichoptera

FILTER BY

COMMON NAME
Ants
Ants, bees, and wasps
Ants, bees, narrow-waisted hymenopterans, and true wasps
Aphids
Arthropods
Bee fly
Beetles
and 57 more

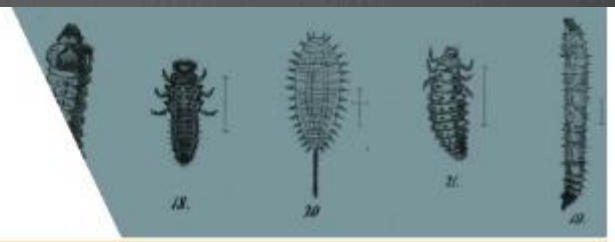
GENUS
Acrocera
Actea
Anthracothremma
Anthrakoris
Aphaenogaster

CONTINENT
Europe

BROWSE

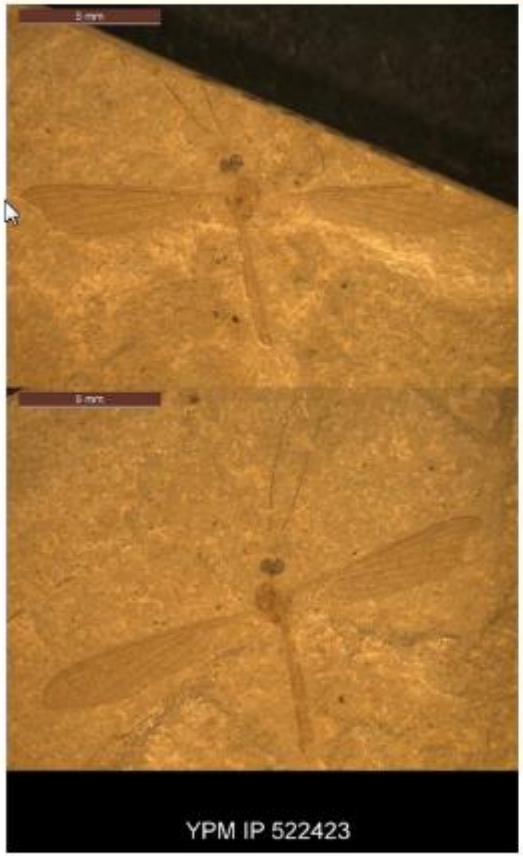
fossil insect COLLABORATIVE

Making data and images of millions of insect specimens available on the web



ABOUT NEWS BROWSE JOIN EDUCATION

Search



undet. Tipulidae; feather on slab with

True flies, Mosquitoes and Gnats

YPM IP 522423

Yale Peabody Museum of Natural History

TAXONOMY

Animalia > Arthropoda > Insecta > Diptera > Tipulidae > Family

LOCALITY

North America > USA > Colorado > Garfield County > N end of Radar Dome

ADD TO ASSIGNMENT

COMMENTS (0)

SHARE

DigPaleo

MAP

MEASURE

COMMENT

fossilinsects.colorado.edu