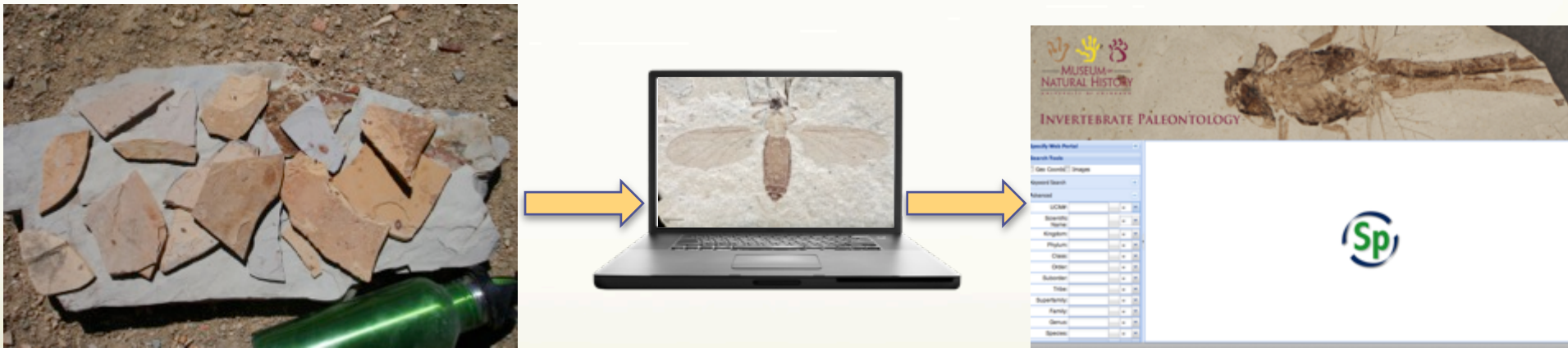


OPTIMIZING A COMPRESSION FOSSIL DIGITIZATION WORKFLOW AT THE UNIVERSITY OF COLORADO



Talia Karim and Lindsay Walker
University of Colorado Museum of Natural History

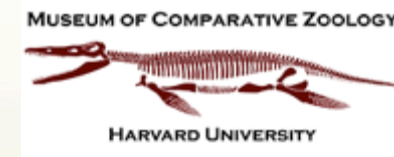


Core Funded Institutions



University
of Colorado
Boulder

Yale
PEABODY
MUSEUM



You?



TCN Goals



- ~500,000 specimen records
- ~77,000 images
- Publish- iDigPaleo, iDigBio, GBIF



CUMNH Goals



- Database 76,000 new specimens (~100,000 total records)
- Capture 25,000 digital images
- Georeference 172 localities
- Publish data!



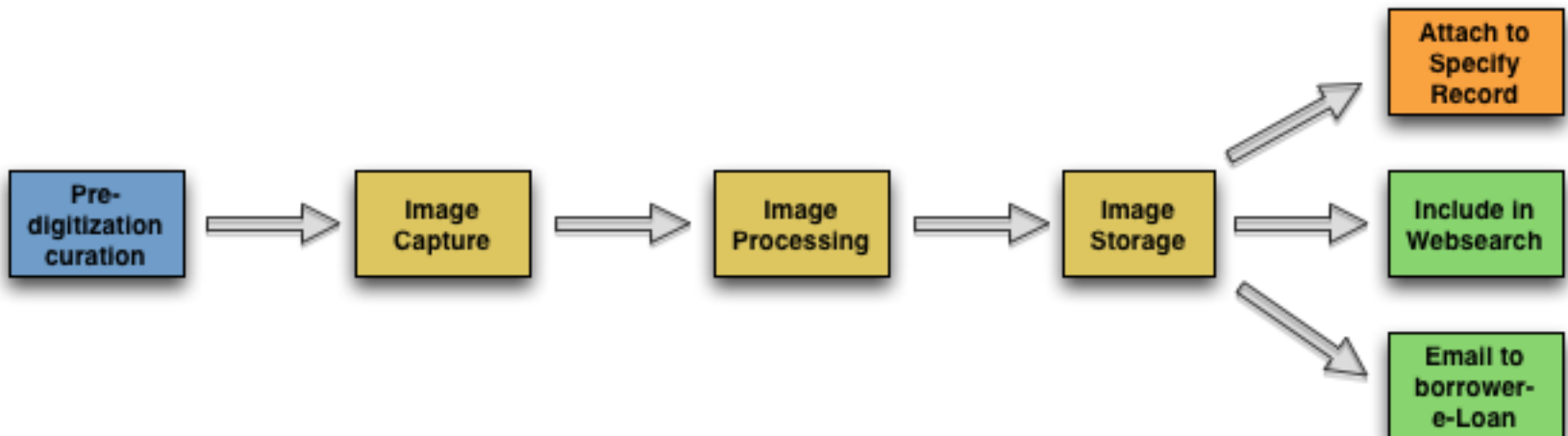
Digitization Status:

- 50,224 insect & spider records
- 6,004 records with image(s)
- 9,450 images attached
- CU Museum websearch,



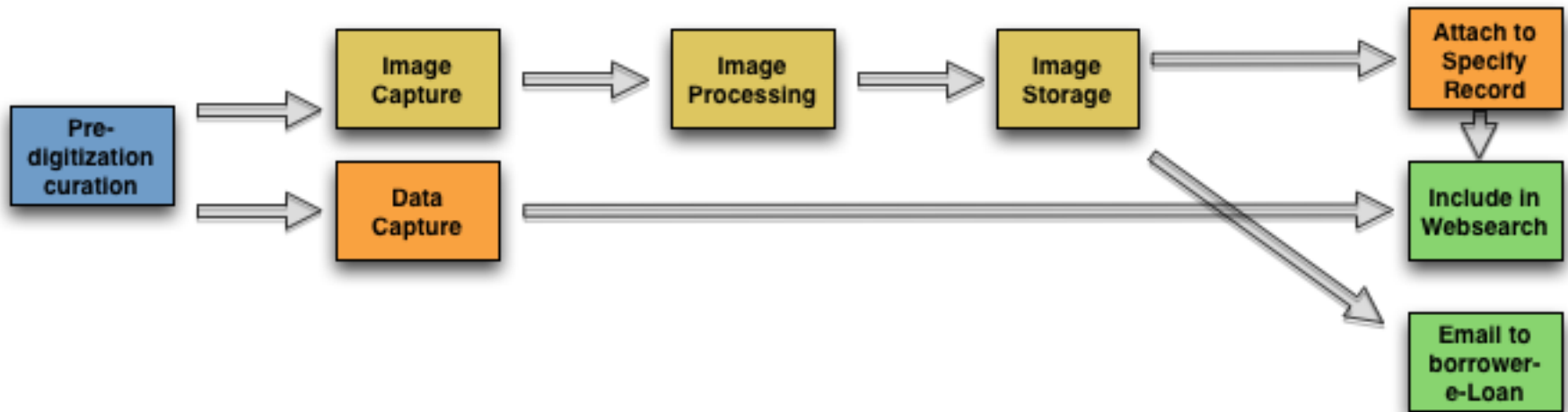
The Workflow

DROID Workshop 2012

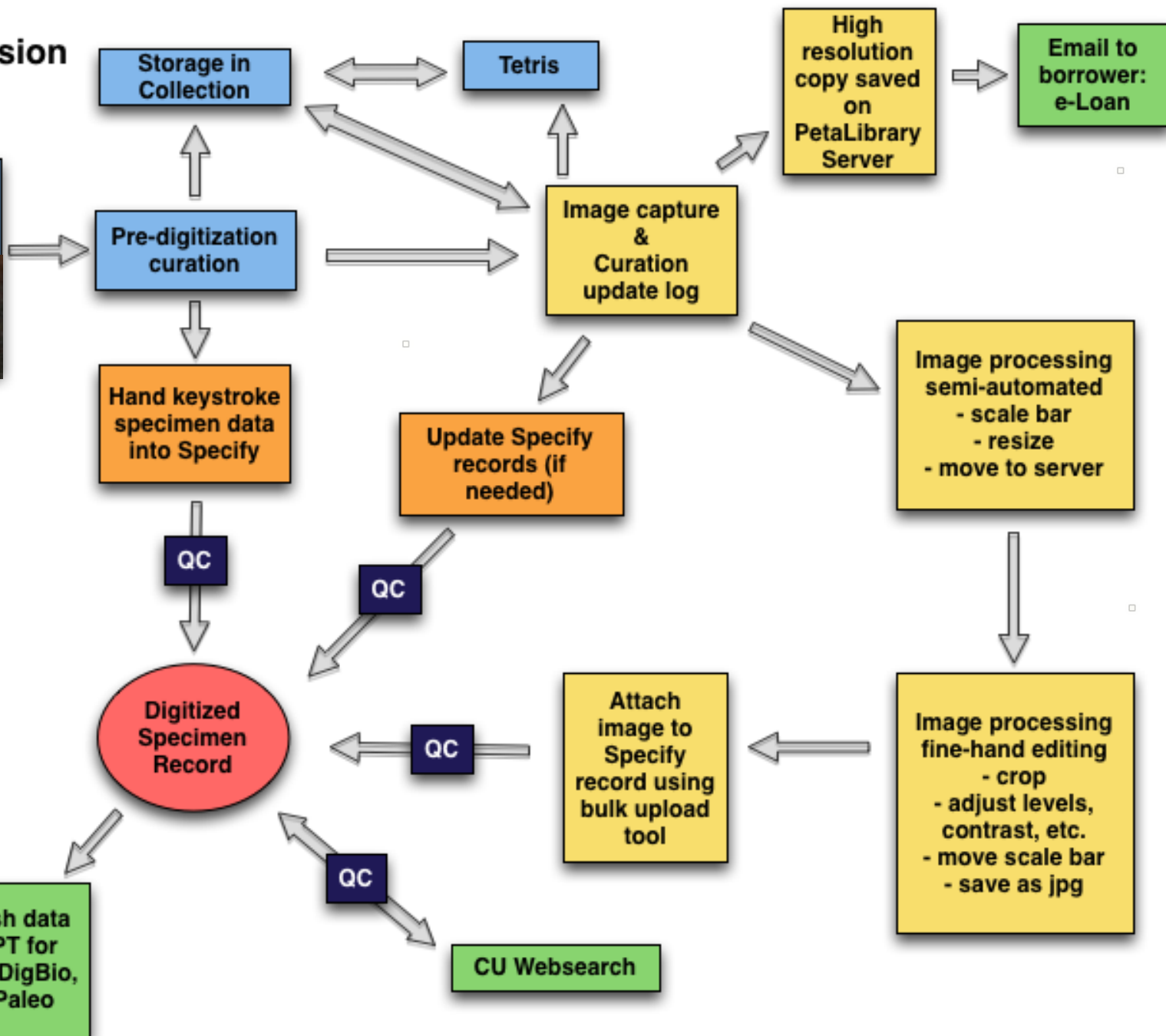
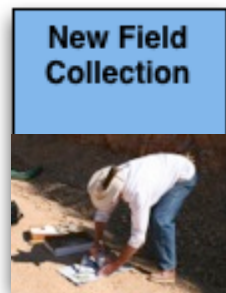


The Workflow

Post-DROID Workshop 2012



Compression Fossils



Predigitization Curation



Unpack new collections

Predigitization Curation

Utilize volunteers for cataloging



Predigitization Curation

Determinations-streamline



All the other
orders



Databasing- new material

Custom specify query for QC data entry

	Not	Operator	Criteria	Sort	Show	Prompt	Always	
	☐	Between	79451 and 79500		☒	☒	☐	
	☐	Contains			☒	☒	☐	
	☐	Contains			☒	☒	☐	
	☐	Contains			☒	☒	☐	
	☐	Contains			☒	☒	☐	
	☐	Contains			☒	☒	☐	
	☐	Contains			☒	☒	☐	
	☐	Contains			☒	☒	☐	
	☐	Contains			☒	☒	☐	
	☐	Contains			☒	☒	☐	
	☐	Contains			☒	☒	☒	
	☐	Contains			☒	☒	☐	
	☐	Contains			☒	☒	☐	
	☐	=			☒	☒	☐	

Databasing- new material

Query output mimics catalog sheet

▼ Search Results – 50													
UCM#	Suffix	Accession #	Last Name	CollDate	Description	Preferred Taxon/Full Name	Comments	Field Number	Locality #	Entered By Date	Chrono Strat/Full Name	Litho Strat/Full Name	# of Spec
79451	a+b	000770	Kohls, D	2009Jul13	body	Tipulidae		CP 090713	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79452	a+b	000770	Kohls, D	2009Jul13	winged body	Tipulidae	Assoc. UCM #s: 79452–79453	CP 090713	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79453	a+b	000770	Kohls, D	2009Jul13	body	Nematocera	Assoc. UCM#s: 79452–79453	CP 090713	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79454	a+b	000770	Kohls, D	2009Jul13	winged body	Mycetophilidae?		CP 090713	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79455	a+b	000770	Kohls, D	2009Jul13	winged body	Lauxaniodea?		CP 090713	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79456	a+b	000770	Kohls, D	2009Jul13	winged body	Ceratopogonidae		CP 090713	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79457	a+b	000770	Kohls, D	2009Jul13	body	Muscomorpha		CP 090713	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79458		000770	Kohls, D	2009Jul13	winged body	Tephritoidea		CP 090713	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79459		000770	Kohls, D	2009Jul13	body w/o abdomen	Brachycera		CP 090713	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79460		000770	Kohls, D	2009Jul13	headless, winged body	Brachycera		CP 090713	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79461		000770	Kohls, D	2009Jul13	body	Ceratopogonidae		CP 090713	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79462		000770	Kohls, D	2009Jul13	body	Chironomidae		CP 090713	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79463		000770	Kohls, D	2009Jul13	winged body	Mycetophilidae		CP 090713	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79464		000770	Kohls, D	2009Jul13	winged, headless body	Mycetophilidae		CP 090713	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79465		000770	Kohls, D	2009Jul13	body	Hymenoptera	Assoc. UCM #s: 79465–79467	CP 090713	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79466		000770	Kohls, D	2009Jul13	winged body	Coleoptera	Assoc. UCM #s: 79465–79467	CP 090713	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79467		000770	Kohls, D	2009Jul13	winged body	Tipulidae	Assoc. UCM #s: 79465–79467	CP 090713	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79468		000770	Kohls, D	2009Jul13	body	Tipulidae		CP 090713	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79469		000770	Kohls, D	2009Jul13	winged body	Tipulidae		CP 090713	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79470		000770	Kohls, D	2009Jul13	winged body	Tipulidae		CP 090713	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79471		000770	Kohls, D	2009Jul13	body	Tipulidae		CP 090713	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79472		000770	Kohls, D	2009Jul13	wing	Tipulidae		CP 090713	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79473		000770	Kohls, D	2009Jul13	winged body	Nematocera		CP 090713	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79474	a+b	000770	Kohls, D	2009Jul16	winged body	Auchenorrhyncha		CP 090716	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79475		000770	Kohls, D	2009Jul16	wing	Auchenorrhyncha		CP 090716	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79476		000770	Kohls, D	2009Jul16	body	Auchenorrhyncha		CP 090716	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79477		000770	Kohls, D	2009Jul16	wing & partial body	Auchenorrhyncha		CP 090716	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79478		000770	Kohls, D	2009Jul16	body	Heteroptera		CP 090716	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79479		000770	Kohls, D	2009Jul16	body	Heteroptera		CP 090716	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79480		000770	Kohls, D	2009Jul16	body	Heteroptera		CP 090716	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79481	a+b	000770	Kohls, D	2009Jul16	body	Heteroptera		CP 090716	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79482	a+b	000770	Kohls, D	2009Jul16	winged body	Heteroptera		CP 090716	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79483		000770	Kohls, D	2009Jul16	body	Chrysomelidae		CP 090716	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79484		000770	Kohls, D	2009Jul16	partial body	Coleoptera	Assoc. UCM #s: 79484–79485	CP 090716	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79485		000770	Kohls, D	2009Jul16	body	Mordellidae	Assoc. UCM #s: 79484–79485	CP 090716	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79486		000770	Kohls, D	2009Jul16	body	Mordellidae		CP 090716	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79487	a+b	000770	Kohls, D	2009Jul16	body	Carabidae		CP 090716	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79488	a+b	000770	Kohls, D	2009Jul16	body	Curculionidae		CP 090716	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79489		000770	Kohls, D	2009Jul16	body	Curculionidae		CP 090716	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79490	a+b	000770	Kohls, D	2009Jul16	elytra	Coleoptera		CP 090716	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79491		000770	Kohls, D	2009Jul16	body	Coleoptera		CP 090716	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79492	a+b	000770	Kohls, D	2009Jul16	body	Coleoptera		CP 090716	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79493	a+b	000770	Kohls, D	2009Jul16	body	Coleoptera		CP 090716	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79494	a+b	000770	Kohls, D	2009Jul16	body	Hymenoptera		CP 090716	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79495	a+b	000770	Kohls, D	2009Jul16	winged body	Hymenoptera		CP 090716	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79496	a+b	000770	Kohls, D	2009Jul16	body	Muscomorpha		CP 090716	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79497	a+b	000770	Kohls, D	2009Jul16	winged body	Ephydroidea		CP 090716	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79498	a+b	000770	Kohls, D	2009Jul16	winged body	Tipulidae		CP 090716	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1
79499	a+b	000770	Kohls, D	2009Jul16	body	Chironomidae		CP 090716	2009063	NMR 2014Aug28	Eocene M	Green River Formation	1

Imaging Capture Timeline

Imaging System Setup– December 2013

2014:

January	February	March	April	May	June
S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S
5 6 7	16 17 18 19 20 21 22	16 17 18 19 20 21 22	4 5	1 2 3	1 2 3 4 5 6 7
12 13 14	23 24 25 26 27 28	23 24 25 26 27 28 29	11 12	4 5 6 7 8 9 10	8 9 10 11 12 13 14
19 20 21 22 23 24 25		30 31	18 19	11 12 13 14 15 16 17	15 16 17 18 19 20 21
26 27 28 29 30 31			20 21 22 23 24 25 26	18 19 20 21 22 23 24	22 23 24 25 26 27 28
			27 28 29 30	25 26 27 28 29 30 31	29 30
July	August	September	October	November	December
S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S
1 2 3 4 5	1 2	1 2 3 4 5 6	1 2 3 4	1	1 2 3 4 5 6
6 7 8 9 10 11 12	3 4 5 6 7 8 9	7 8 9 10 11 12 13	5 6 7 8 9 10 11	2 3 4 5 6 7 8	7 8 9 10 11 12 13
13 14 15 16 17 18 19	10 11 12 13 14 15 16	14 15 16 17 18 19 20	12 13 14 15 16 17 18	9 10 11 12 13 14 15	14 15 16 17 18 19 20
20 21 22 23 24 25 26	17 18 19 20 21 22 23	21 22 23 24 25 26 27	19 20 21 22 23 24 25	16 17 18 19 20 21 22	21 22 23 24 25 26 27
27 28 29 30 31	24 25 26 27 28 29 30	28 29 30	26 27 28 29 30 31	23 24 25 26 27 28 29	28 29 30 31

2015:

January	February	March	April	May	June
S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S
1 2 3	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4	1 2	1 2 3 4 5 6
4 5 6 7 8 9 10	8 9 10 11 12 13 14	8 9 10 11 12 13 14	5 6 7 8 9 10 11	3 4 5 6 7 8 9	7 8 9 10 11 12 13
11 12 13 14 15 16 17	15 16 17 18 19 20 21	15 16 17 18 19 20 21	12 13 14 15 16 17 18	10 11 12 13 14 15 16	14 15 16 17 18 19 20
18 19 20 21 22 23 24	22 23 24 25 26 27 28	22 23 24 25 26 27 28	19 20 21 22 23 24 25	17 18 19 20 21 22 23	21 22 23 24 25 26 27
25 26 27 28 29 30 31		29 30 31	26 27 28 29 30	24 25 26 27 28 29 30	28 29 30

Image Capture



Image Capture

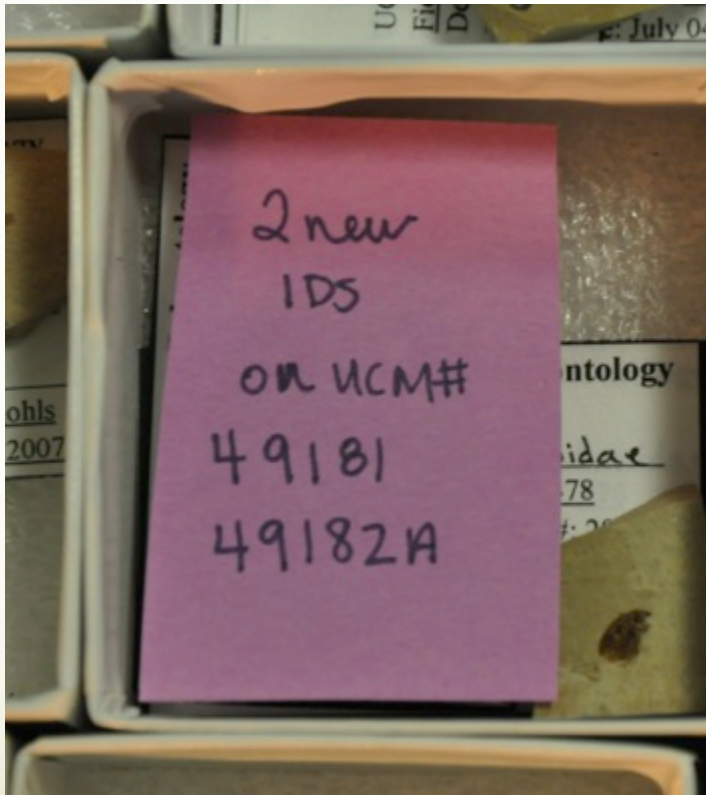


Image Capture



- Rolling cabinet of drawers
- Shoot specimens by size
- Save into folder by magnification
- Tag development

Image Capture



New catalog # required or old number illegible



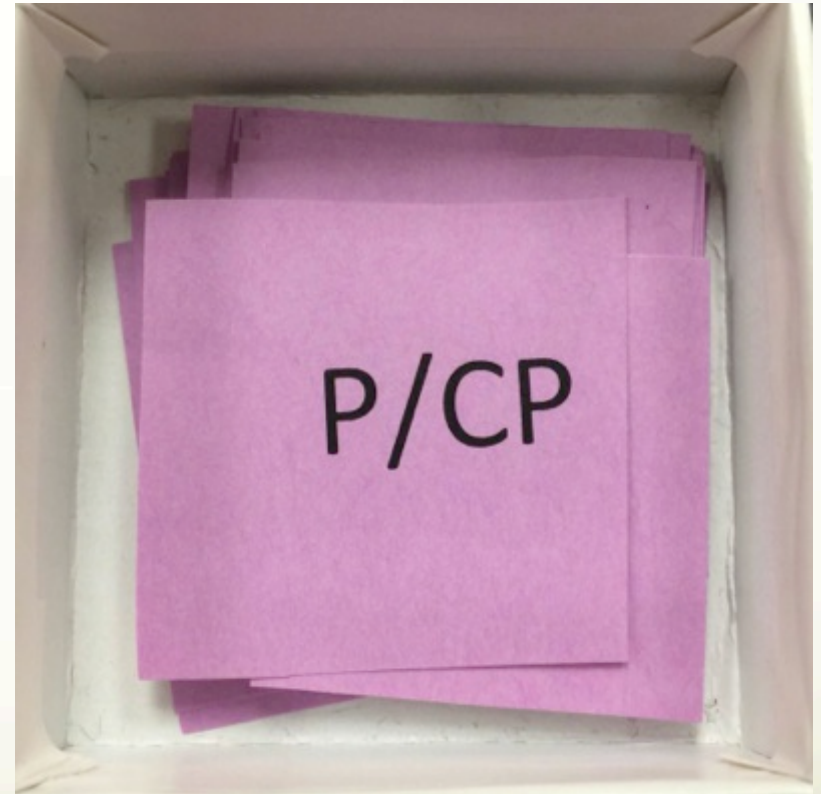
New catalog # required and specimen needs to be imaged afterward

Image Capture



Habitus image needed when >1
specimens per shale piece

Image Capture



Specimens were cataloged separately, but are actually Part and Counterpart

Curation & Specify Updates

UCM	Updated ID	Tag ✓	Specify ✓	Notes
41469	Staphylinidae	✓		
40425	Carabidae	✓		
39347	" "	✓		
58147	Elatridae?	✓		
56816	Blattodea	✓		
58134	Erotylidae	✓		
44431	Elatridae	✓		

Update Determination

UCM	Updated ID	Tag ✓	Specify ✓	Notes
41469	Staphylinidae	✓		
40425	Carabidae	✓		

53636	Coleoptera	✓		
44529	Chrysomelidae	✓		
55645	Carabidae	✓		
53401	Nitidulidae	✓		
40638	Carabidae	✓		
46656ab	"	✓		
37614ab	Mantodea	✓		
45980ab	Dermaptera	✓		
45905ab	Erotylidae	✓		
46048ab				
39602ab	"	✓		
37136ab	Carabidae	✓		
assoc UCM#s:	37134 - 37139			

Associated Cat. #s

assoc UCM#s: 37134 - 37139

Image Capture & Curation

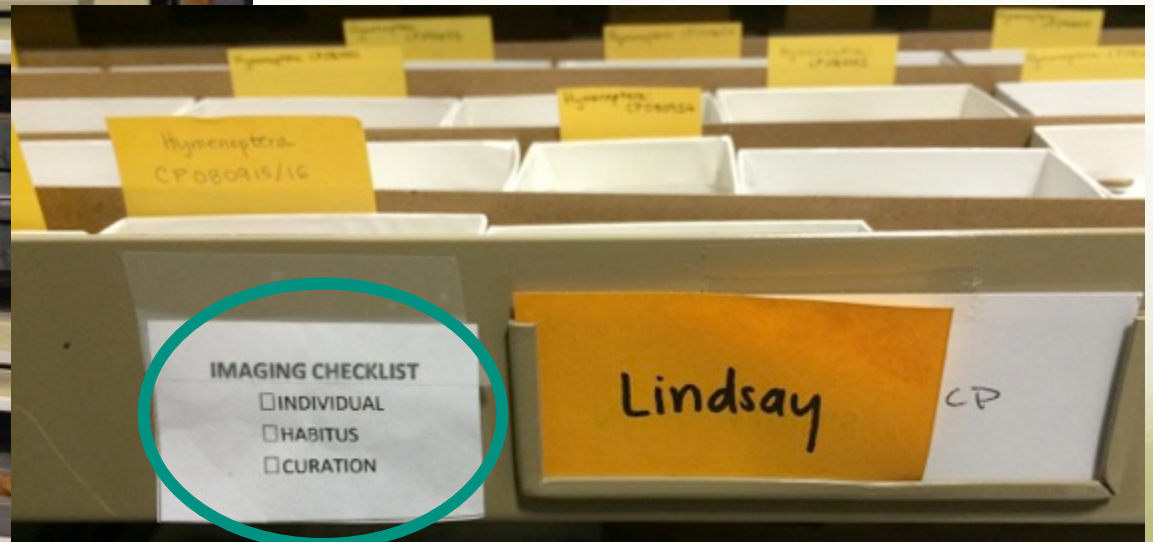
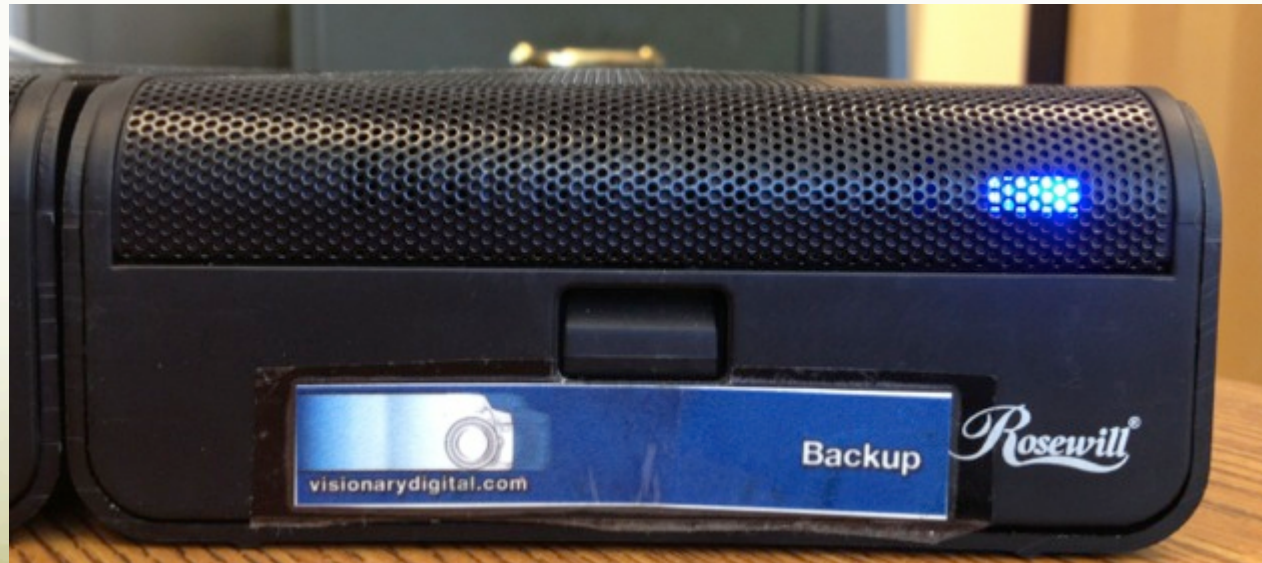


Image Archive

- Daily backup to external hard drive
- Backup to CU PetaLibrary
 - Unaltered TIFF
- Issues
 - Retrieval
 - Sharing
 - Backup
 - CU Libraries?



Imaging Capture Timeline

Imaging System Setup– December 2013

2014:

January	February	March	April	May	June
S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S
5 6 7	16 17 18 19 20 21 22	16 17 18 19 20 21 22	4 5 11 12	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7
12 13 14	23 24 25 26 27 28	23 24 25 26 27 28 29	18 19	11 12 13 14 15 16 17	8 9 10 11 12 13 14
19 20 21 22 23 24 25		30 31	20 21 22 23 24 25 26	18 19 20 21 22 23 24	15 16 17 18 19 20 21
26 27 28 29 30 31			27 28 29 30	25 26 27 28 29 30 31	22 23 24 25 26 27 28
					29 30
July	August	September	October	November	December
S M T W T F S	S M T W T F S	S M T	T F S	S M T W T F S	S M T W T F S
1 2 3 4 5	1 2	1 2	2 3 4	1	1 2 3 4 5 6
6 7 8 9 10 11 12	3 4 5 6 7 8 9	7 8 9	9 10 11	2 3 4 5 6 7 8	7 8 9 10 11 12 13
13 14 15 16 17 18 19	10 11 12 13 14 15 16	14 15 16 17 18 19 20	12 13 14 15 16 17 18	9 10 11 12 13 14 15	14 15 16 17 18 19 20
20 21 22 23 24 25 26	17 18 19 20 21 22 23	21 22 23 24 25 26 27	19 20 21 22 23 24 25	16 17 18 19 20 21 22	21 22 23 24 25 26 27
27 28 29 30 31	24 25 26 27 28 29 30	28 29 30	26 27 28 29 30 31	23 24 25 26 27 28 29	28 29 30 31
	31			30	

← major learning curves →

Repairs

2015:

January	February	March	April	May	June
S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S
1 2 3	1 2 3 4 5 6 7	1 2 3 4 5 6 7		1 2	1 2 3 4 5 6
4 5 6 7 8 9 10	8 9 10 11 12 13 14	8 9 10 11 12 13 14	5 6 7	7 8 9	7 8 9 10 11 12 13
11 12 13 14 15 16 17	15 16 17 18 19 20 21	15 16 17 18 19 20 21	12 13 14	14 15 16	14 15 16 17 18 19 20
18 19 20 21 22 23 24	22 23 24 25 26 27 28	22 23 24 25 26 27 28	19 20 21 22 23 24 25	17 18 19 20 21 22 23	21 22 23 24 25 26 27
25 26 27 28 29 30 31		29 30 31	26 27 28 29 30	24 25 26 27 28 29 30	28 29 30
				31	

Repairs

Tetris and Put Away



Pre-tetris (re)organization:

- Locality
 - Taxon (now updated)
 - Field Collection Date



Completed tetris

Image Processing



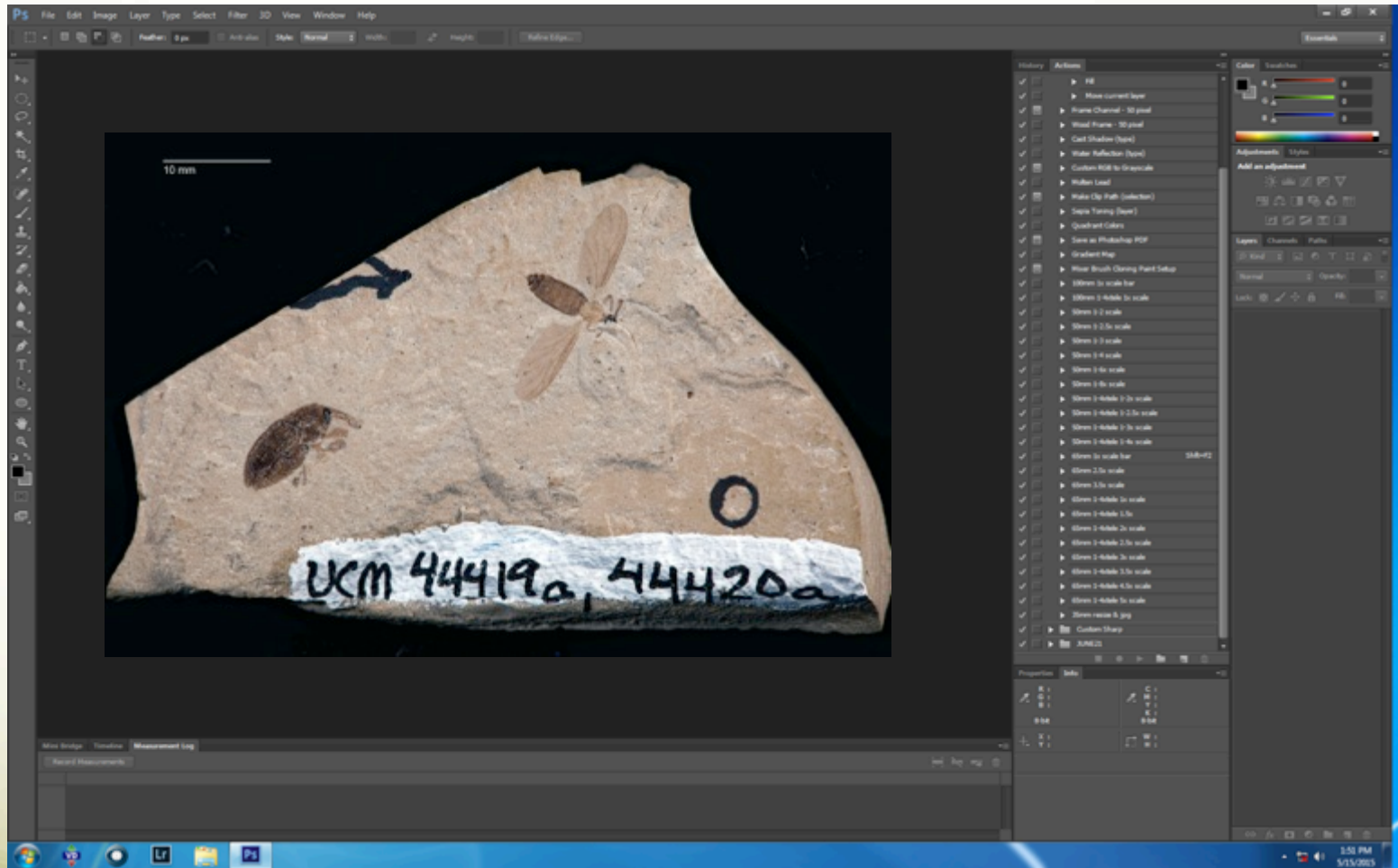
Part 1- Semi-automated

- Insert scale bars
- Resize
- Save temp copy to server

Part 2- Hand Editing

- Scale bar placement
- Cropping
- Color balance
- Levels
- Etc.

Rethinking Image Processing



Written Protocol

Fossil Insect Digitization: File Naming 101

Naming images:

catalognumber**a/b**_UCM_habitus[space]1-4xtele[space]lens[space]magnification[space]suffix(es)

- **Bold** fields indicate required information.
- Colored fields should be added only when applicable.
- Grey text indicates a space (*never* a period, which may be confused for a file extension and cause errors).
- The tables in the following pages indicate the preferred formatting for different magnifications in file and folder names. These pages are included as pictorial guide to each lens and its magnification options.
- The lowest catalog number associated with a given habitus shot will be the UCM # used in the file name.
- Suffixes can be appended to file names if multiple images of a specimen (or habitus versions) are saved.

Examples:

- "reverse" = specimens on both sides of one piece of shale
- "alt" = alternative view
- "diffuser" = diffuser applied

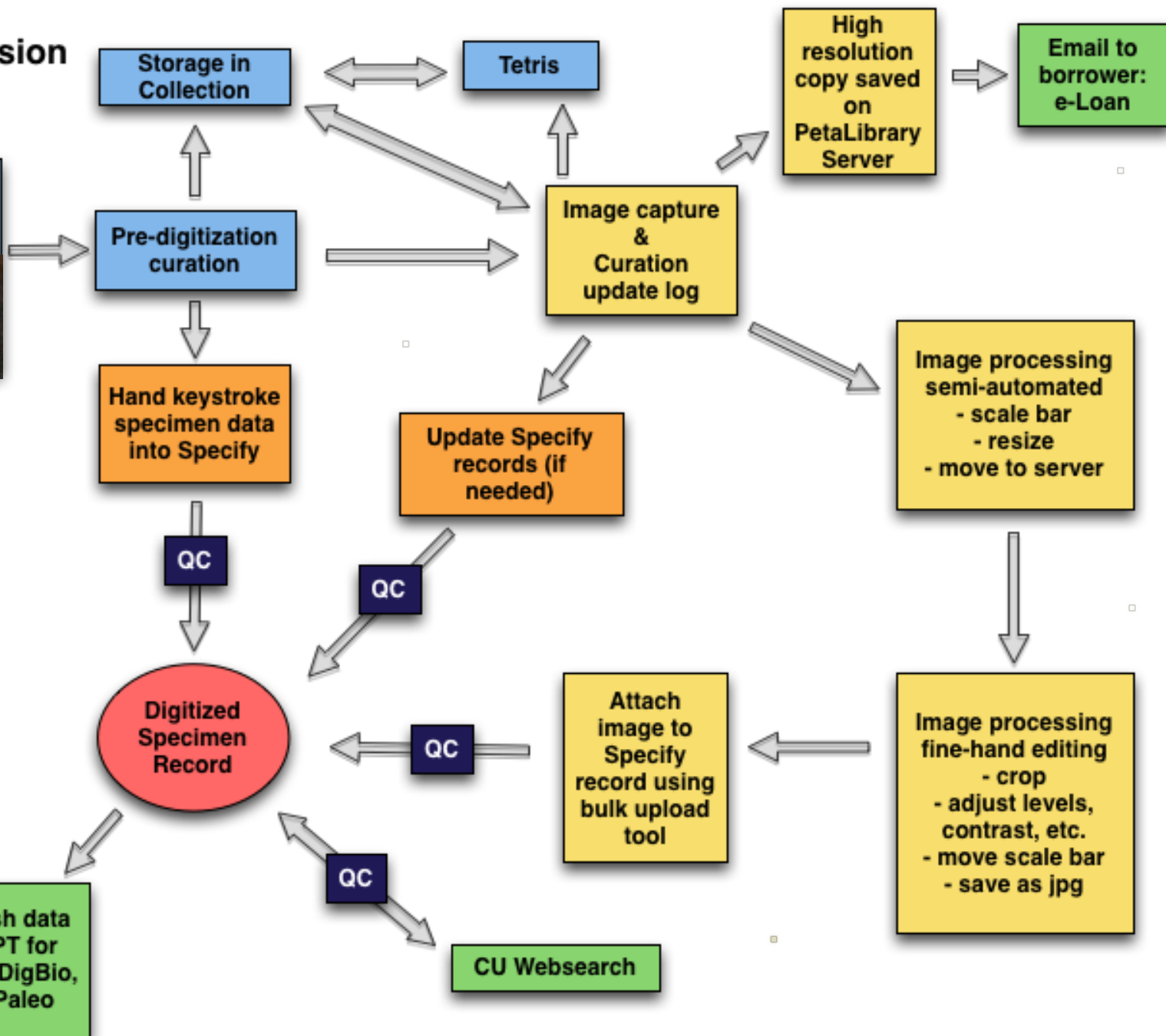
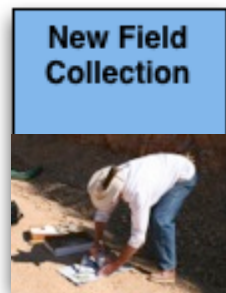
Example: 65 mm lens with 1x magnification

- Basic format: 12345_UCM 65mm 1x
- **Part/Counterpart:** 12345**a**_UCM 65mm 1x
- **Habitus:** 12345a_UCM_habitus 65 mm 1x
- **Teleconverter in use:** 12345a_UCM_habitus 1-4xtele 65mm 1x
- **Multiple orientations or lighting options:** 12345a_UCM_habitus 1-4xtele 65mm 1x alt
- **Reverse sides** (e.g. shale has specimens on both sides): 12345a_UCM_habitus 1-4xtele 65mm 1x alt reverse

Naming folders:

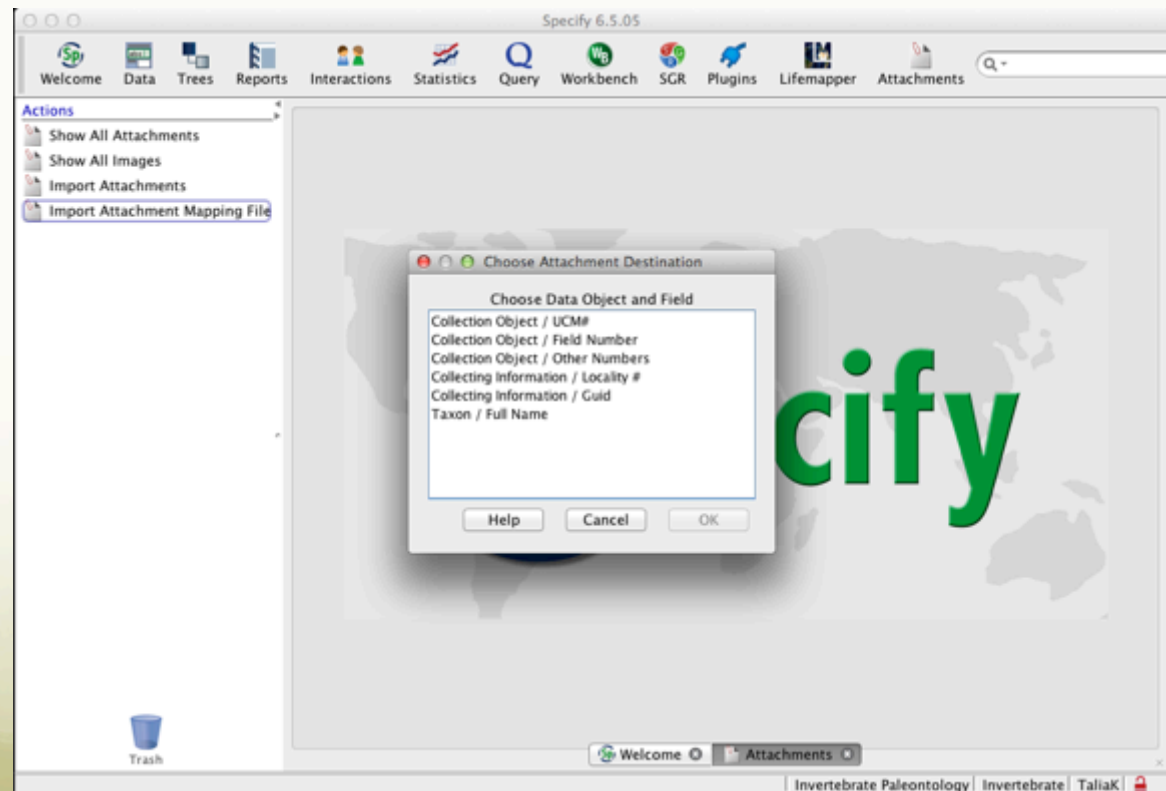


Compression Fossils



Attach to Specify

- Specify Bulk uploader- Mapping file
- SAVE the mapping files!



Publishing- CU Websearch

MUSEUM of NATURAL HISTORY
UNIVERSITY OF COLORADO

INVERTEBRATE PALEONTOLOGY

Specify Web Portal

Search Tools

☐ Geo Coords ☒ Images

Keyword Search

Advanced

Name:

Kingdom:

Phylum:

Class:

Order:

Suborder:

Tribe:

Superfamily:

Family:

Genus:

Species:

Collectors:

Collection Date:

UCM Locality #:

Locality Name:

Country:

County:

State:

Records Images Map

Preview (page 1 of 1)

10 mm

2 mm

2 mm

10 mm

2 mm

10 mm

2 mm

QC

invertpaleosearch.colorado.edu

Publishing- GBIF & iDigBio

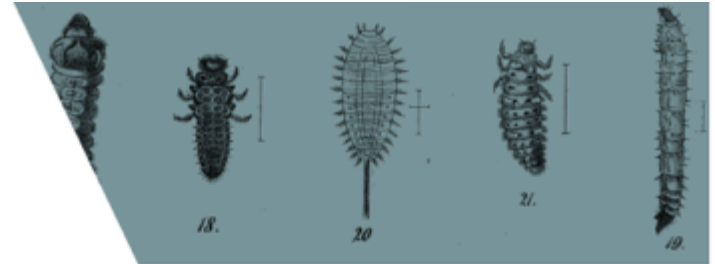
- IPT Server
- Monthly updates
- Automate?
- Data cleanup
 - Dates- add fields to Specify
 - DC mapping



Publishing- iDigPaleo



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



ABOUT NEWS **BROWSE** JOIN EDUCATION

Search



440 SPECIMEN RESULTS ⚙



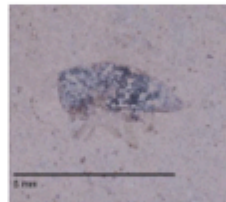
SOURCE: UNIVERSITY OF COLORADO MUSEUM OF PALEONTOLOGY

SERIES: EOCENE M

HAS MEDIA: HAS MEDIA



CUMNH UCM 37044
Curculionidae



CUMNH UCM 37048
Curculionidae



CUMNH UCM 37064
Coleoptera



CUMNH UCM 37078
Coleoptera

FILTER BY

CONTINENT
North America

SYSTEM
Paleogene

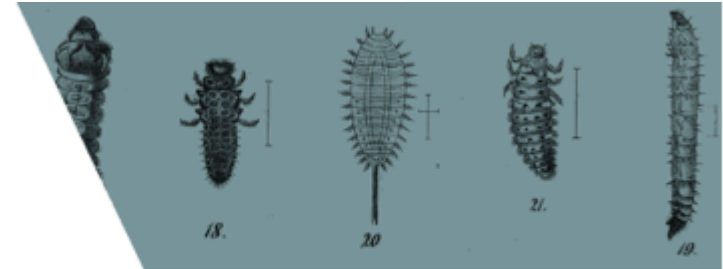
PERSON
Anderson, Evan
Clarke, Laura
Hollis, Kathy
Karim, Talia
Levy, Rick
Walker, Lindsay



Publishing- iDigPaleo



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



ABOUT NEWS BROWSE JOIN EDUCATION

Search



«
BACK



COMMENTS (0)

SHARE

Curculionidae

CUMNH UCM 37044

University of Colorado Museum of Paleontology

Identifier: Levy, Rick

TAXONOMY

Invertebrates > Arthropoda > Insecta > Coleoptera > Curculionidae

STRATIGRAPHY

Chronostratigraphy

Paleogene, Eocene M

Lithostratigraphy

Green River Formation, Parachute Creek?

LOCALITY

North America > USA > CO > Garfield > DON - Donnell Site

>
NEXT

Conclusions

- Small adjustments = big time savings
- Share the QC work
- Don't be afraid to stop and reassess
- Downtime can be productive too

