

RESTORATION AND THREE-DIMENSIONAL ASSEMBLY OF A NEARLY COMPLETE, ARTICULATED EOCENE PROTOCETID WHALE SKELETON FROM PAKISTAN



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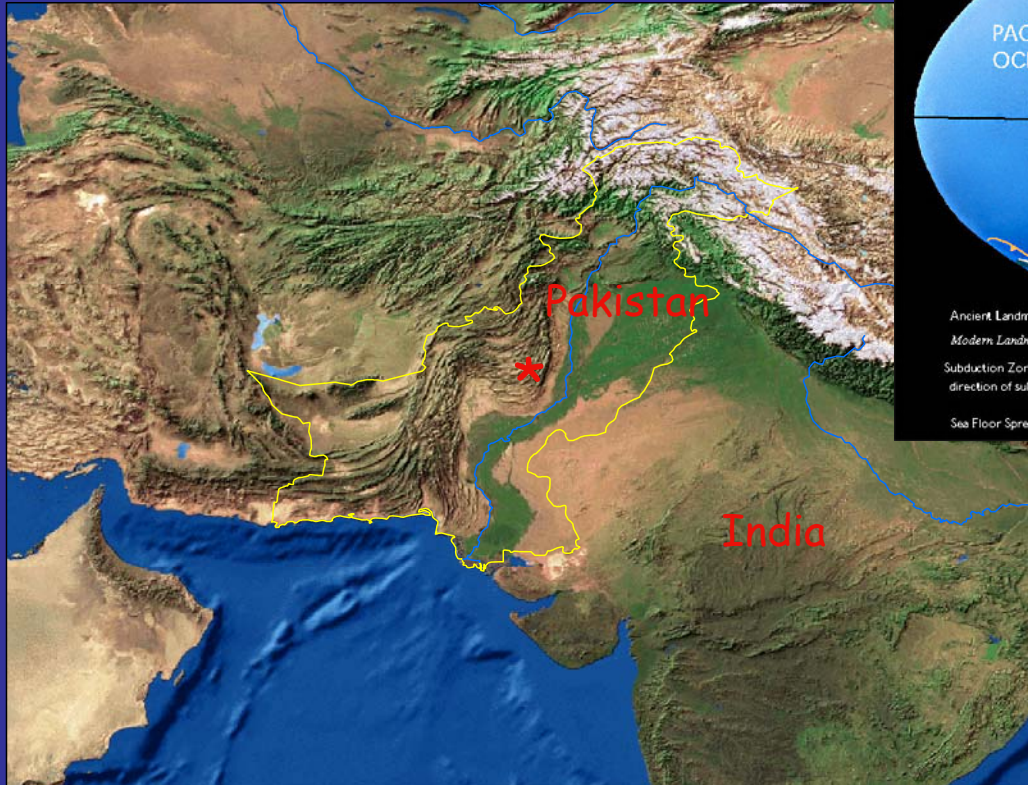
*University of Michigan Museum of Paleontology and
the Geological Survey of Pakistan*

Paleobiological Reconstruction

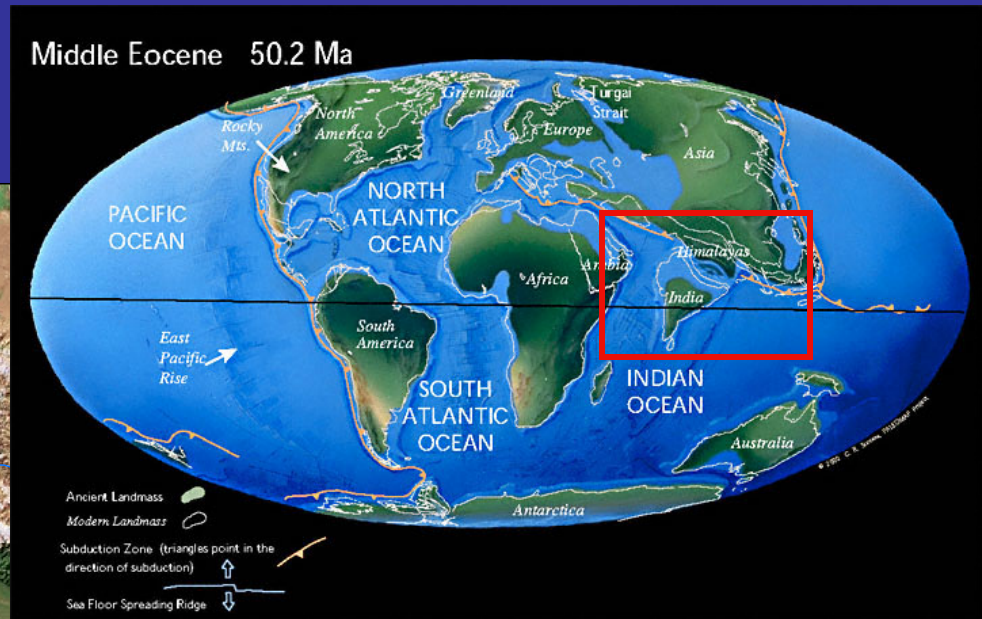
--Paleobiological reconstruction of fossil vertebrates is enhanced by recovery of associated skeletal elements and accuracy of restoration and assembly



Geographic and Geologic Context



0 125 250 500 750 1,000 Miles

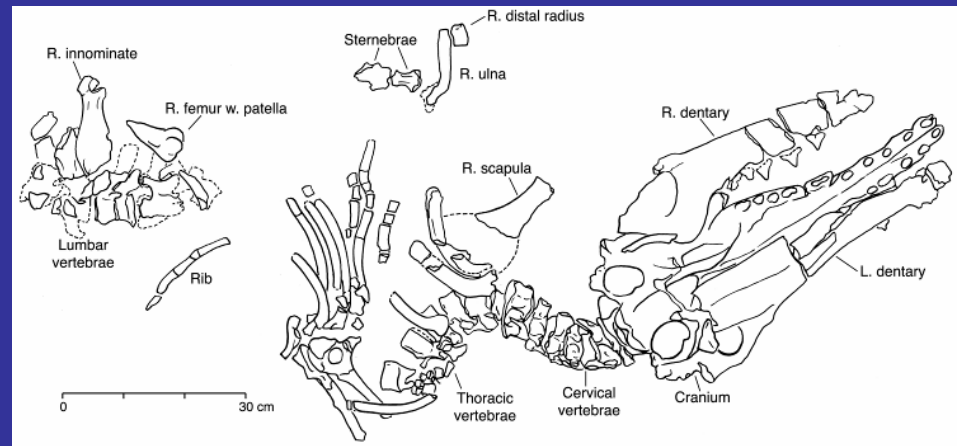
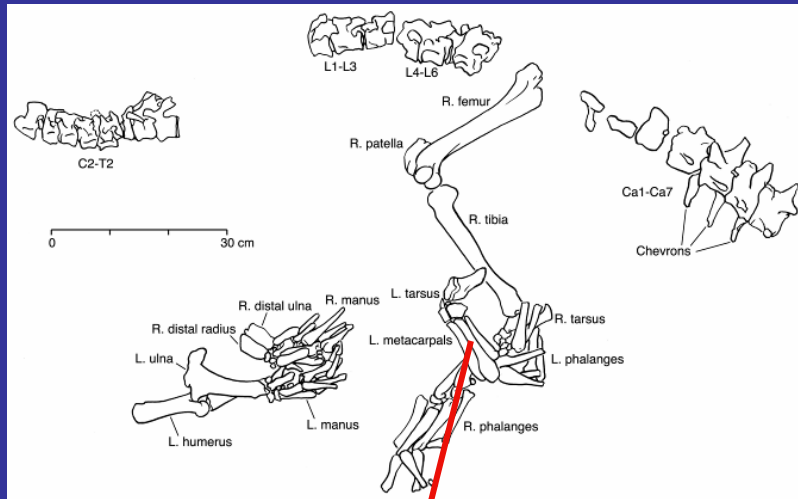


Habib Rahi Formation,
early middle Eocene, ca.
48 myr (nearshore
sediments of the Tethys
Sea)

Kunvit area, near Rakhni, in the Sulaiman
Range, eastern Balochistan

Productivity of Habib Rahi Formation in the Kunvit Area, Lakha Kach syncline, eastern Balochistan

Partial skeleton of *Rodhocetus balochistanensis*



Partial skeleton of *Artiocetus clavis*

Locality of new skeleton, GSP-UM 3551

Near-shore marine sediments;
platy marl and limestone of
the Habib Rahi Formation



Excavation of GSP-UM 3551



Removing overburden the old-fashioned way

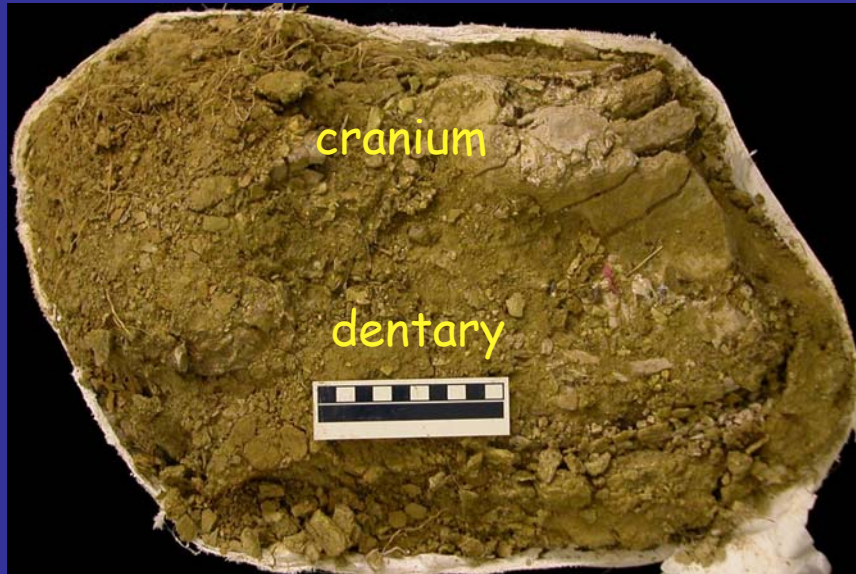
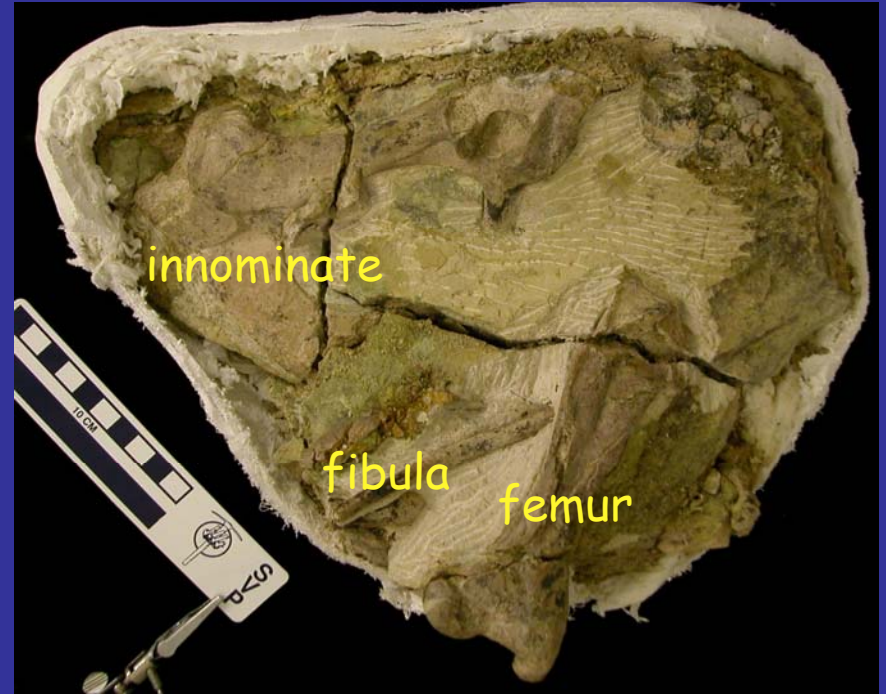


Cranial fragments on surface

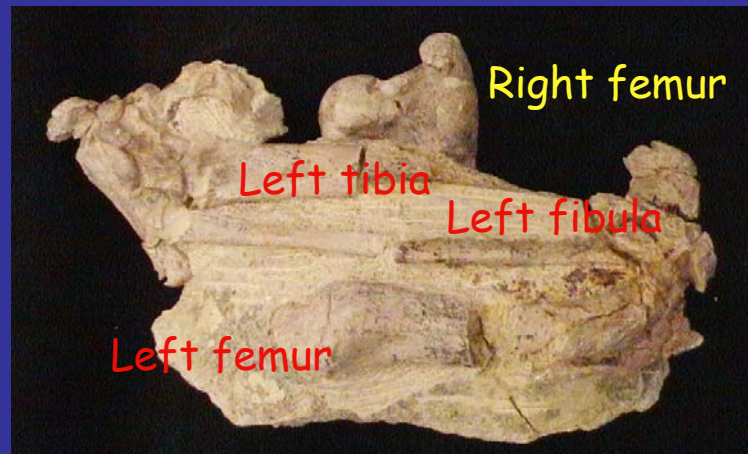


Long bones exposed and consolidated with PVAc

Jacketing and removal

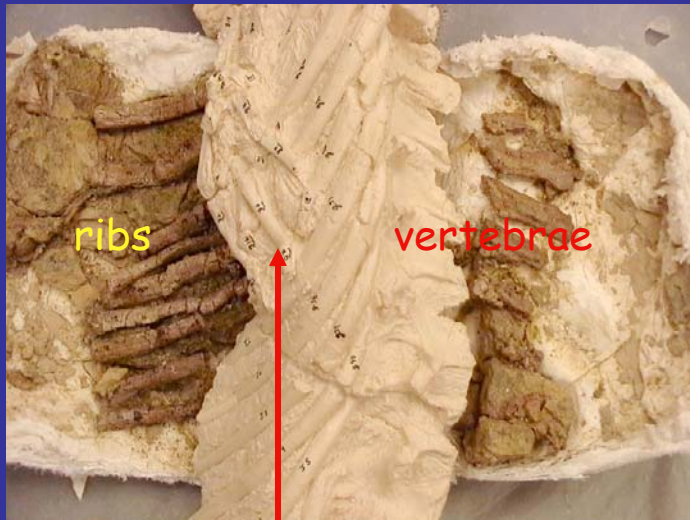


Preparation phase I: manual preparation of blocks within jackets



- consolidate
- airscribe
- minor reconstruction
- leave in association

Preparation phase II: silicone molding, polyester casting, and assembly of bone blocks

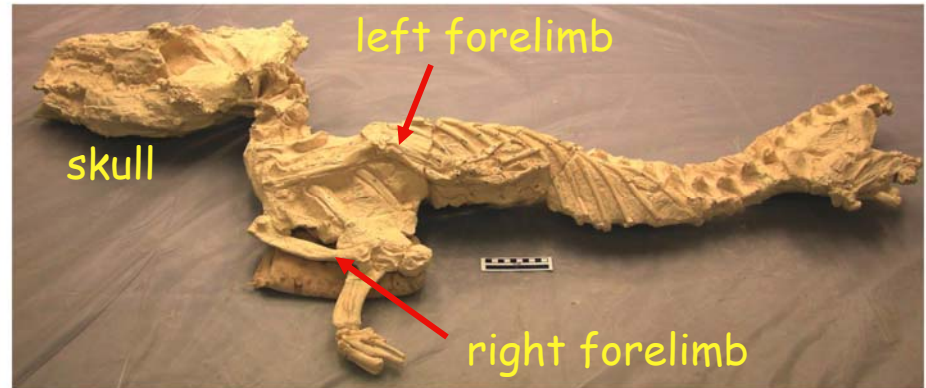


ribs

vertebrae

manus

Assembled blocks (minus posterior caudals)



skull

left forelimb

right forelimb

GSP-UM 3551: all blocks from field jackets cast and assembled



Preparation phase III: extraction of skeletal elements from blocks, re-molding, casting



Skull set in clay for part I of mold



Original bones set in clay, laminated with silicone rubber, and mother molded with polyester + fiberglass

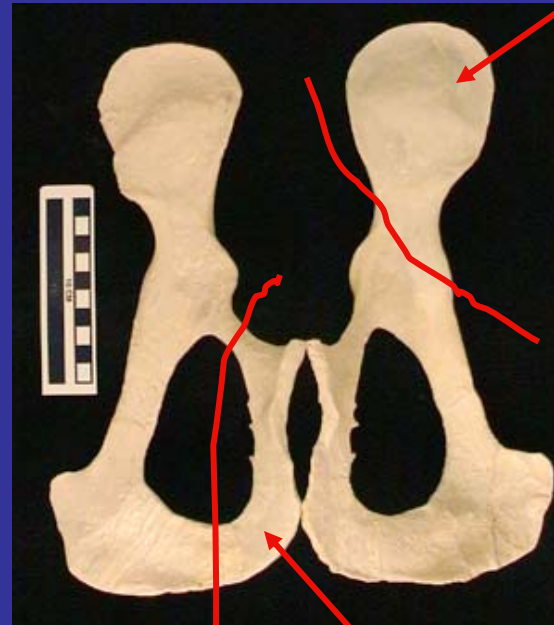


Originals and casts of lumbar vertebrae L1-L6

Preparation phase IV: restoration on casts, re-molding, casting model skeletal elements for mount



Left innominate,
GSP-UM 3551



reconstructed area

reconstructed area

Cast models, left and right
innominates, GSP-UM 3551

Phase IV: dentary restoration from cut cast pieces and "scaffolded" anterior reconstruction



Restored mandible, GSP-UM 3551



Scaffolded anterior dentaries built on inverted cranium with teeth spaced accordingly



Cast model skull, GSP-UM 3551

Phase IV: restoration of vertebral series



Cervical vertebral series restoration



Thoracic vertebral series restoration

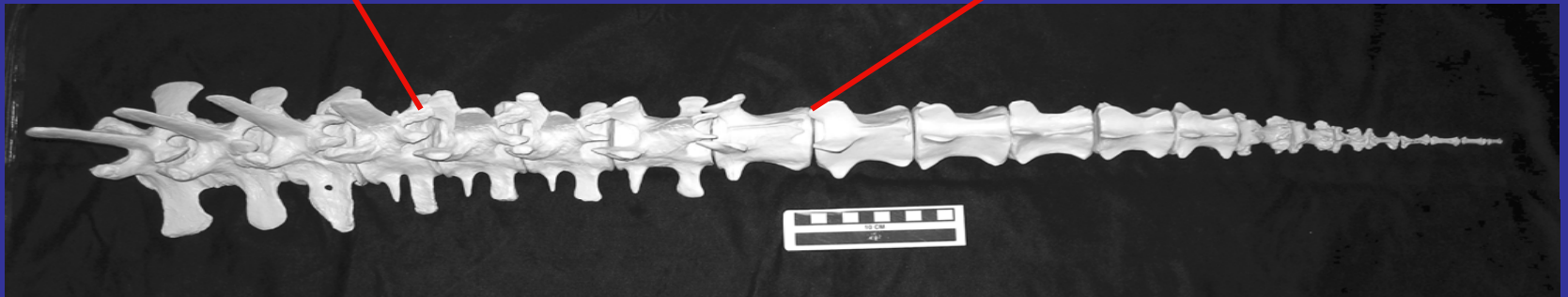


Lumbar vertebral series restoration

Phase IV: restoration of vertebral series



Original caudal
vertebrae, Ca5-Ca8



Cast model, caudal vertebral series GSP-UM 3551

Molding, casting restored model elements for final mounting (Phase V)



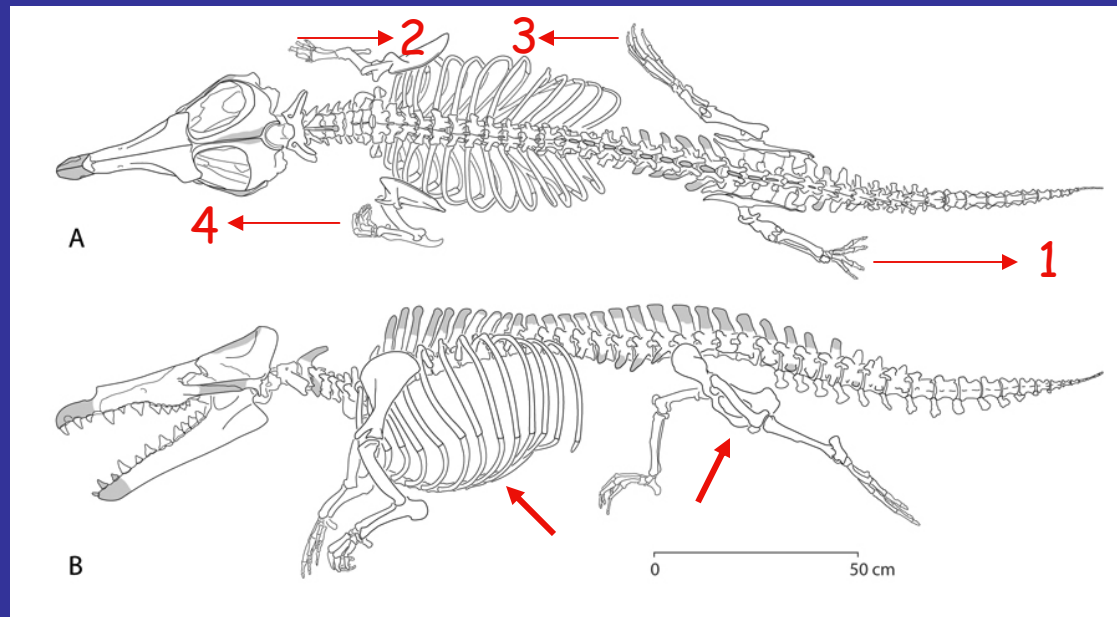
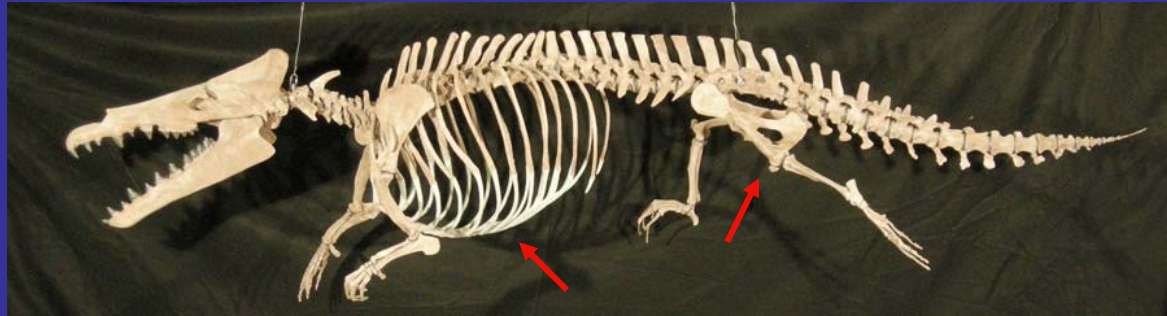
Restored model series of thoracic vertebrae T7-T10 set in clay for molding

Restored model of left dentary with i1-m3 in completed silicone mold and fiberglass + resin mothermold, side I



Working mount assembly of skeleton of GSP-UM 3551

GSP-UM
3551



Reconstructed in hindlimb-dominated, forelimb-assisted swimming mode



THE END!

Acknowledgements

- National Geographic, NSF, and The University of Michigan for funding
- The Geological Survey of Pakistan and people of Pakistan for collegial interaction and kind hospitality
- Dan Erickson, Mike Cherney, and John Klausmeyer for help with reconstruction and mounting

- Numerous students for their hard work and diligence, notably Aaron Wood, Carly Manz, Amber Heard, Darcy Shapiro, Isabel Wiesenfeld, Ian Winklestern, Kristina Galdes, Michael Adams, and Katie Slivensky
- Special thanks to Bonnie Miljour for her superb illustrations
- Kudos to the Society of Vertebrate Paleontology for creating a permanent Preparators Session
- Dedicated to the memory of the late Karl Sanders, who would have enjoyed seeing this whale brought "back to life."