

| Abbreviation | Institution |
|---------------------|---|
| CGM | Cairo Geological Museum, Cairo, Egypt |
| CCNHM | Mace Brown Museum of Natural History, Charleston, South Carolina |
| GMTSNUK | Geological Museum of Taras Shevchenko National University of Kiev, Ukraine |
| GNM | Georgian National Museum |
| GRMP | Central Geological Research Museum, St. Petersburg, Russia |
| GSM | Georgia Southern University Museum, Stateboro, Georgia, United States |
| KOM | Kirovograd Oblast Museum, Ukraine |
| MAUL | Museo dell'Ambiente, Università di Lecce, Italy |
| MNHN | Muséum national d'Histoire naturelle, Paris, France |
| MUSM | Museo de Historia Natural, Universidad Nacional, Mayor de San Marcos, Lima, Peru |
| SMNS | Staatliches Museum für Naturkunde, Stuttgart, Germany |
| UM | Museum of Paleontology, University of Michigan, Ann Arbor, Michigan, United States |
| USNM | United States National Museum of Natural History, Smithsonian Institution, Washington DC, United States |
| UWBM | Burke Museum of Natural History and Culture, University of Washington, Seattle, WA, USA |
| ZPAL | Institute of Paleobiology, Polish Academy of Sciences, Warsaw, Poland. |

Supplemental table SI

Comparison of torso vertebrae features of NRM-PZ M8154, other Eocene and Oligocene cetaceans

| Taxon | Vertebra position | Taxonomic group | Age | Separate prezygapophyses and metapophyses | Position of transverse processes (base midline) relative to height of the centrum: the most ventral point of the centrum is 0%, the most dorsal point is 100% | Anteroposterior length of the transverse processes relative to length of the centrum | Shape of the neural canal | Ventral keel | Centrum length/height ratio |
|--------------------------------|-------------------|-----------------|--------|---|---|--|---------------------------|--------------|-----------------------------|
| <i>Protocetus atavus</i> | L3 | Protocetidae | Eocene | - | 68% | 39% | Oval | - | 1.15 |
| <i>Aegicetus gehennae</i> | T12 | Protocetidae | Eocene | + | 100+% | 29% | Oval | - | 0.89 |
| <i>Aegicetus gehennae</i> | L1 | Protocetidae | Eocene | - | 69% | 55% | Oval | + | 0.88 |
| <i>Dorudon atrox</i> | T13 | Basilosauridae | Eocene | + | 50% | 37% | Oval | - | 1.06 |
| <i>Dorudon atrox</i> | L1 | Basilosauridae | Eocene | - | 27% | 47% | Oval | - | 0.94 |
| <i>Cynthiacetus peruvianus</i> | T14 | Basilosauridae | Eocene | + | 61% | 43% | Oval | - | 1.17 |
| <i>Cynthiacetus peruvianus</i> | L1 | Basilosauridae | Eocene | - | 29% | 66% | Oval | - | 1.02 |
| <i>Zygorhiza kochii</i> | L1 | Basilosauridae | Eocene | - | 38% | 50% | Triangular | - | 0.93 |
| <i>Stromerius nidensis</i> | L2 | Basilosauridae | Eocene | - | 28% | 74% | Triangular | - | 1.12 |
| <i>Basilotritus wardii</i> | L | Basilosauridae | Eocene | - | 30% | 86% | Oval | - | 1.77 |
| MUSM 1443 | L | Basilosauridae | Eocene | ? | 24% | 80% | Oval | - | 1.47 |
| GMTSNUK 2638 | L | Basilosauridae | Eocene | ? | 26% | 86% | ? | - | 1.82 |
| ZPAL M-VII/1 | L | Basilosauridae | Eocene | ? | 30% | 95% | ? | - | 1.14 |

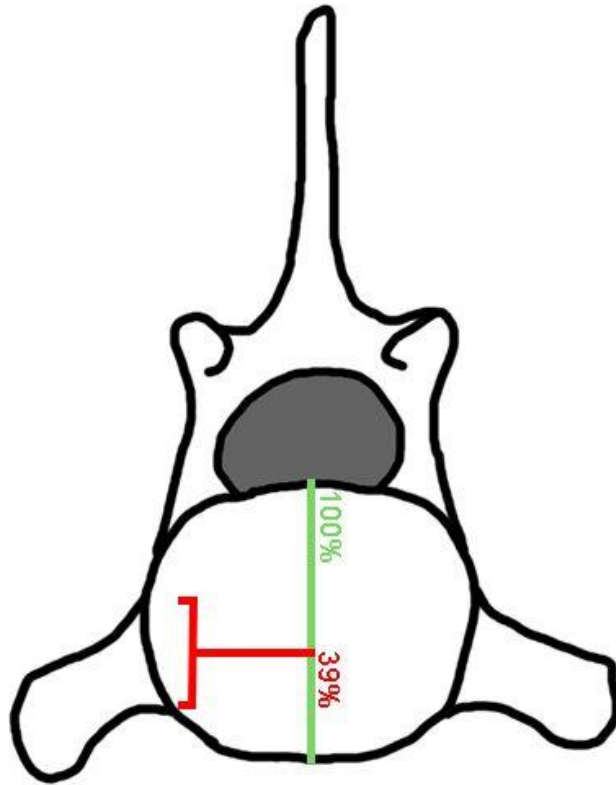
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|-------------------------------------|------|---------------------------------|-----------|---|------|------|-----------------------------------|---|-------|
| NRM-PZ M8154 | T/L | Neoceti: based on this study | Eocene | + | 11% | 82% | Triangular | + | 0.79 |
| <i>Mystacodon selenensis</i> | ?T14 | Neoceti, Mysticeti | Eocene | ? | 62%* | 64%* | ? | - | 1.15 |
| <i>Fucaia buelli</i> | L | Neoceti, Mysticeti | Oligocene | - | 68%* | ? | Triangular | ? | ? |
| <i>Aetiocetus cotylalveus</i> | L6 | Neoceti, Mysticeti | Oligocene | - | 58% | 85% | Triangular (rounded angles) | + | 1.13 |
| <i>Waharoa ruwhenua</i> | L(B) | Neoceti, Mysticeti | Oligocene | ? | 40% | ? | Triangular (rounded angles) | ? | 0.43* |
| <i>Mirocetus riabinini</i> | L1 | Neoceti, Odontoceti | Oligocene | - | 31%* | 80% | Triangular | + | 1.07 |
| <i>Albertocetus meffordorum</i> | L(A) | Neoceti, Odontoceti | Oligocene | - | 37% | 80% | Triangular | + | 1.34 |
| <i>Ankylorhiza tiedemani</i> | L1 | Neoceti, Odontoceti | Oligocene | ? | 41% | ? | Triangular | + | 1.15 |
| <i>Sulakocetus dagestanicus</i> | L | Neoceti, Odontoceti | Oligocene | ? | 45% | 79% | ? | + | 1.30 |
| <i>Piscolithax longirostris</i> | L | Neoceti, Odontoceti | Miocene | - | 84% | ? | Triangular | + | 0.68 |
| <i>Zygophyseter varolai</i> | L | Neoceti, Odontoceti | Miocene | - | 81% | 73% | Triangular | - | 1.28 |

Specimens used for Principal Component Analysis are marked as bold type.

* estimated values

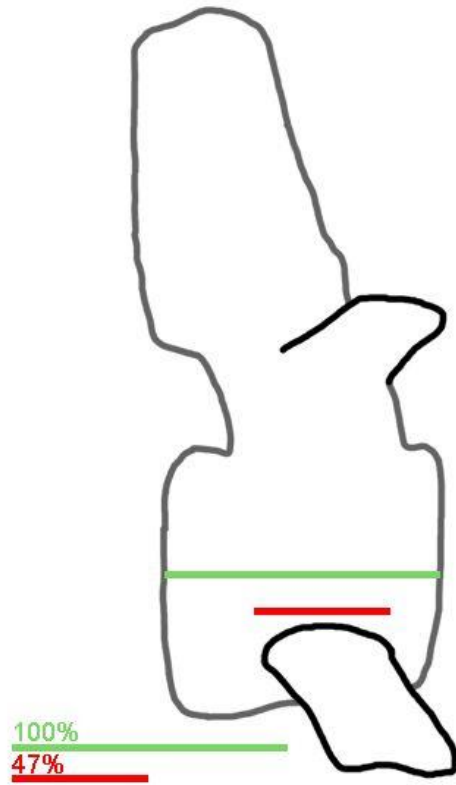
Supplemental Figure S1

Measure protocol (height of transverse processes bases)



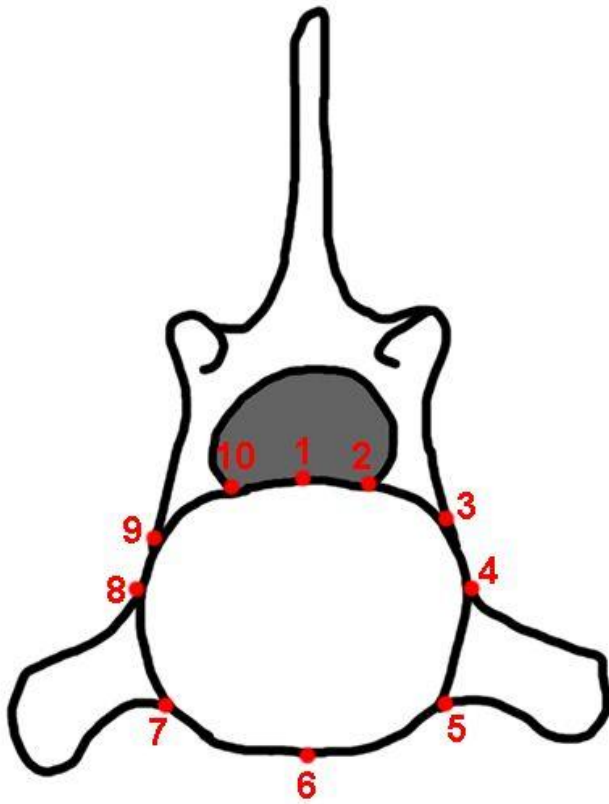
Supplemental Figure S2

Measure protocol (anteroposterior length of transverse processes bases)



Supplemental Figure S3

Placement and description of landmarks (lumbar vertebra, anterior view):



- 1) upper sagittal point of the centrum
- 2) medial wall of the left pedicle of neural arch
- 3) lateral wall of the left pedicle of neural arch
- 4) dorsal margin of the base of left transverse process
- 5) ventral margin of the base of left transverse process
- 6) lower sagittal point of the centrum
- 7) ventral margin of the base of right transverse process
- 8) dorsal margin of the base of right transverse process
- 9) lateral wall of the right pedicle of neural arch
- 10) medial wall of the right pedicle of neural arch

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