P A U P \*

Version 4.0a147 for Macintosh (X86) (built on Jan 6 2016 at 05:15:49)

Sunday, February 22, 2015 at 8:47:11 PM Pacific Standard Time

Running on IA-32 architecture (64-bit word length)

SSE vectorization enabled

Multithreading enabled for likelihood using Pthreads

Compiled using Intel compiler (icc) 11.1.0 (build 20091012)

 -----------------------------NOTICE-----------------------------

 This is an alpha-test version prepared for the exclusive

 use of course and workshop participants, as well as other

 authorized testers. It will expire on 1 Jul 2016.

 Please report bugs to david.swofford@duke.edu

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Processing of file "Moba-matrix+Isengops.nex" begins...

Data matrix has 22 taxa, 27 characters

Valid character-state symbols: 0123

Missing data identified by '?'

Gaps identified by '-'

Character types changed:

 Of 27 total characters:

 3 characters are of type 'ord' (Wagner)

 24 characters are of type 'unord'

\*\*\* Skipping "MESQUITECHARMODELS" block

\*\*\* Skipping "MESQUITE" block

Processing of input file "Moba-matrix+Isengops.nex" completed.

paup> Outgroup 1;

Outgroup status changed:

 1 taxon transferred to outgroup

 Total number of taxa now in outgroup = 1

 Number of ingroup taxa = 21

paup> HSearch;

Heuristic search settings:

 Optimality criterion = parsimony

 Character-status summary:

 Of 27 total characters:

 3 characters are of type 'ord' (Wagner)

 24 characters are of type 'unord'

 All characters have equal weight

 All characters are parsimony-informative

 Gaps are treated as "missing"

 Multistate taxa interpreted as uncertainty

 Starting tree(s) obtained via stepwise addition

 Addition sequence: simple (reference taxon = Biarmosuchus tener)

 Number of trees held at each step = 1

 Branch-swapping algorithm: tree-bisection-reconnection (TBR) with reconnection limit = 8

 Steepest descent option not in effect

 Initial 'Maxtrees' setting = 100

 Branches collapsed (creating polytomies) if maximum branch length is zero

 'MulTrees' option in effect

 No topological constraints in effect

 Trees are unrooted

Maxtrees will be automatically increased by 100 when the limit is hit

Heuristic search completed

 Total number of rearrangements tried = 60113833

 Score of best tree(s) found = 50

 Number of trees retained = 18768

 Time used = 26.68 sec (CPU time = 18.27 sec)

paup> ConTree / majRule;

Strict consensus of 18768 trees:

/------------------------------------------------------------------------------------------------------------------------------- Biarmosuchus tener

| /------------------------------------------------------------------------------------------------------------- Hipposaurus boonstrai

| | /------------------------------------------------------------------------------------------- Herpetoskylax hopsoni

\-----------------+ +------------------------------------------------------------------------------------------- Lycaenodon longiceps

 | +------------------------------------------------------------------------------------------- Ictidorhinus martinsi

 \-----------------+------------------------------------------------------------------------------------------- RC 20

 | /------------------ Lemurosaurus pricei

 | /------------------------------------------------------+------------------ Lophorhinus willodenensis

 | | /------------------------------------------------------ Lobalopex mordax

 \-----------------+ | /------------------------------------ Lende chiweta

 | | +------------------------------------ Leucocephalus wewersi

 \------------------+ +------------------------------------ Proburnetia viatkensis

 | +------------------------------------ Paraburnetia sneeubergensis

 | +------------------------------------ NHMUK R871

 \-----------------+------------------------------------ BP/1/7098

 +------------------------------------ Isengops

 | /------------------ Niuksenitia sukhonensis

 | +------------------ Burnetia mirabilis

 | +------------------ Mobaceras zambeziensis

 \-----------------+------------------ Bullacephalus jacksoni

 +------------------ Pachydectes elsi

 \------------------ TM 4305

50% Majority-rule consensus of 18768 trees

/--------------------------------------------------------------------------------------------------------------------------- Biarmosuchus tener(1)

| /------------------------------------------------------------------------------------------------------------- Hipposaurus boonstrai(2)

| | /------------------------------------------------------------------------------------------------ Herpetoskylax hopsoni(3)

\-------------+ +------------------------------------------------------------------------------------------------ Lycaenodon longiceps(4)

 | +------------------------------------------------------------------------------------------------ Ictidorhinus martinsi(5)

 \----100-----+------------------------------------------------------------------------------------------------ RC 20(6)

 | /-------------- Lemurosaurus pricei(7)

 | /--------------------------------100--------------------------------+-------------- Lophorhinus willodenensis(9)

 | | /-------------------------------------------------------------------- Lobalopex mordax(8)

 \-----100-----+ | /------------------------------------------------------- Isengops(22)

 | | | /----------------------------------------- Proburnetia viatkensis(12)

 \-----100-----+ +-----94------+ /--------------------------- Leucocephalus wewersi(11)

 | | | +--------------------------- Paraburnetia sneeubergensis(13)

 | | \-----54------+--------------------------- BP/1/7098(21)

 \----100-----+ | /-------------- Lende chiweta(10)

 | \-----76-----+-------------- NHMUK R871(20)

 | /--------------------------- Mobaceras zambeziensis(16)

 | +--------------------------- Bullacephalus jacksoni(17)

 \------------100------------+--------------------------- Pachydectes elsi(18)

 +--------------------------- TM 4305(19)

 | /-------------- Niuksenitia sukhonensis(14)

 \-----53-----+-------------- Burnetia mirabilis(15)

Bipartitions found in one or more trees and frequency of occurrence:

 1 2 2

1234567890123456789012 Freq %

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.............\*\*\*\*\*\*... 18768 100.00%

.........\*\*\*\*\*\*\*\*\*\*\*\*\* 18768 100.00%

.......\*.\*\*\*\*\*\*\*\*\*\*\*\*\* 18768 100.00%

......\*.\*............. 18768 100.00%

......\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* 18768 100.00%

..\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* 18768 100.00%

.........\*\*\*\*......\*\*. 17628 93.93%

.........\*.........\*.. 14238 75.86%

.........\*\*.\*......\*\*. 10220 54.45%

.............\*\*....... 10023 53.40%

.............\*\*...\*... 9373 49.94%

.........\*\*\*\*......\*\*\* 8548 45.55%

................\*\*.... 8129 43.31%

...............\*\*\*.... 6876 36.64%

.........\*.........\*\*. 6810 36.29%

.........\*\*.\*......\*.. 6269 33.40%

..\*\*.\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* 5927 31.58%

...\*.\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* 5924 31.56%

.........\*\*\*\*\*\*\*\*\*\*\*\*. 5700 30.37%

...\*..\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* 4947 26.36%

.....\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* 4945 26.35%

................\*.\*... 4389 23.39%

................\*\*\*... 4389 23.39%

..............\*...\*... 4387 23.37%

.............\*\*.\*\*\*... 4381 23.34%

...............\*.\*.... 4378 23.33%

.........\*\*\*\*......\*.. 3420 18.22%

...............\*\*\*\*... 3130 16.68%

.............\*\*\*..\*... 3127 16.66%

....\*.\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* 2967 15.81%

..\*.\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* 2967 15.81%

...\*\*.\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* 2966 15.80%

...................\*\*. 2280 12.15%

............\*.......\*. 2280 12.15%

.............\*\*\*...... 1881 10.02%

...............\*\*..... 1872 9.97%

.............\*.\*...... 1254 6.68%

...........\*........\*. 1140 6.07%

...............\*\*.\*... 627 3.34%

.............\*\*\*\*\*.... 627 3.34%

..............\*\*...... 627 3.34%

.................\*\*... 627 3.34%

..............\*\*..\*... 626 3.34%

.............\*\*\*\*\*\*.\*. 570 3.04%

.........\*\*\*\*\*\*\*\*\*\*\*.. 570 3.04%

paup> Delete 19-21/clear;

All trees cleared from memory.

Taxon-deletion status changed:

 3 taxa deleted

 Total number of taxa now deleted = 3

 Number of nondeleted taxa = 19

paup> HSearch;

Heuristic search settings:

 Optimality criterion = parsimony

 Character-status summary:

 Of 27 total characters:

 3 characters are of type 'ord' (Wagner)

 24 characters are of type 'unord'

 All characters have equal weight

 All characters are parsimony-informative

 Gaps are treated as "missing"

 Multistate taxa interpreted as uncertainty

 Starting tree(s) obtained via stepwise addition

 Addition sequence: simple (reference taxon = Biarmosuchus tener)

 Number of trees held at each step = 1

 Branch-swapping algorithm: tree-bisection-reconnection (TBR) with reconnection limit = 8

 Steepest descent option not in effect

 Initial 'Maxtrees' setting = 18800 (will be auto-increased by 100)

 Branches collapsed (creating polytomies) if maximum branch length is zero

 'MulTrees' option in effect

 No topological constraints in effect

 Trees are unrooted

Heuristic search completed

 Total number of rearrangements tried = 1175138

 Score of best tree(s) found = 49

 Number of trees retained = 532

 Time used = 0.33 sec (CPU time = 0.34 sec)

paup> ConTree;

Strict consensus of 532 trees:

/------------------------------------------------------------------------------------------------------------------------------- Biarmosuchus tener

| /------------------------------------------------------------------------------------------------------------- Hipposaurus boonstrai

| | /------------------------------------------------------------------------------------------- Herpetoskylax hopsoni

\-----------------+ +------------------------------------------------------------------------------------------- Lycaenodon longiceps

 | +------------------------------------------------------------------------------------------- Ictidorhinus martinsi

 \-----------------+------------------------------------------------------------------------------------------- RC 20

 | /------------------ Lemurosaurus pricei

 | /------------------------------------------------------+------------------ Lophorhinus willodenensis

 \-----------------+ /------------------------------------------------------ Lobalopex mordax

 | | /------------------------------------ Isengops

 \------------------+ | /------------------ Lende chiweta

 | | +------------------ Leucocephalus wewersi

 | +-----------------+------------------ Proburnetia viatkensis

 \-----------------+ \------------------ Paraburnetia sneeubergensis

 | /------------------ Niuksenitia sukhonensis

 | +------------------ Burnetia mirabilis

 \-----------------+------------------ Mobaceras zambeziensis

 +------------------ Bullacephalus jacksoni

 \------------------ Pachydectes elsi

50% Majority-rule consensus of 532 trees

/--------------------------------------------------------------------------------------------------------------------------- Biarmosuchus tener(1)

| /------------------------------------------------------------------------------------------------------------ Hipposaurus boonstrai(2)

| | /-------------------------------------------------------------------------------------------- Herpetoskylax hopsoni(3)

\--------------+ +-------------------------------------------------------------------------------------------- Lycaenodon longiceps(4)

 | +-------------------------------------------------------------------------------------------- Ictidorhinus martinsi(5)

 \------100------+-------------------------------------------------------------------------------------------- RC 20(6)

 | /--------------- Lemurosaurus pricei(7)

 | /-----------------------------100-----------------------------+--------------- Lophorhinus willodenensis(9)

 \-----100------+ /------------------------------------------------------------- Lobalopex mordax(8)

 | | /---------------------------------------------- Isengops(22)

 \------100------+ | /------------------------------- Proburnetia viatkensis(12)

 | +-----100------+ /--------------- Lende chiweta(10)

 \-----100------+ \------75-------+--------------- Leucocephalus wewersi(11)

 | \--------------- Paraburnetia sneeubergensis(13)

 | /------------------------------- Mobaceras zambeziensis(16)

 | | /--------------- Niuksenitia sukhonensis(14)

 \-----100------+------71-------+--------------- Burnetia mirabilis(15)

 | /--------------- Bullacephalus jacksoni(17)

 \------71-------+--------------- Pachydectes elsi(18)

Bipartitions found in one or more trees and frequency of occurrence:

 1111111112

1234567890123456782 Freq %

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.............\*\*\*\*\*. 532 100.00%

.........\*\*\*\*...... 532 100.00%

.........\*\*\*\*\*\*\*\*\*\* 532 100.00%

.......\*.\*\*\*\*\*\*\*\*\*\* 532 100.00%

......\*.\*.......... 532 100.00%

......\*\*\*\*\*\*\*\*\*\*\*\*\* 532 100.00%

..\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* 532 100.00%

.........\*\*.\*...... 399 75.00%

.............\*\*.... 380 71.43%

................\*\*. 380 71.43%

.........\*\*\*\*.....\* 266 50.00%

...............\*\*\*. 228 42.86%

.............\*\*\*... 228 42.86%

..\*\*.\*\*\*\*\*\*\*\*\*\*\*\*\*\* 168 31.58%

...\*.\*\*\*\*\*\*\*\*\*\*\*\*\*\* 168 31.58%

.....\*\*\*\*\*\*\*\*\*\*\*\*\*\* 140 26.32%

...\*..\*\*\*\*\*\*\*\*\*\*\*\*\* 140 26.32%

.........\*\*\*\*\*\*\*\*\*. 133 25.00%

....\*.\*\*\*\*\*\*\*\*\*\*\*\*\* 84 15.79%

..\*.\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* 84 15.79%

...\*\*.\*\*\*\*\*\*\*\*\*\*\*\*\* 84 15.79%

...............\*\*.. 76 14.29%

...............\*.\*. 76 14.29%

.............\*\*.\*\*. 76 14.29%

..............\*\*... 76 14.29%

.............\*.\*... 76 14.29%

paup> DescribeTrees / plot=Both apoList;

Tree description:

 Unrooted tree(s) rooted using outgroup method

 Optimality criterion = parsimony

 Character-status summary:

 Of 27 total characters:

 3 characters are of type 'ord' (Wagner)

 24 characters are of type 'unord'

 All characters have equal weight

 All characters are parsimony-informative

 Gaps are treated as "missing"

 Multistate taxa interpreted as uncertainty

 Character-state optimization: Accelerated transformation (ACCTRAN)

Tree 1 (rooted using user-specified outgroup)

Tree length = 49

Consistency index (CI) = 0.7347

Homoplasy index (HI) = 0.2653

Retention index (RI) = 0.8818

Rescaled consistency index (RC) = 0.6479

/------------- Biarmosuchus tener

| / Hipposaurus boonstrai

\-36 / Ictidorhinus martinsi

 \-----------35 Herpetoskylax hopsoni

 + Lycaenodon longiceps

 34 / RC 20

 | | / Lemurosaurus pricei

 \------33 /--23 Lophorhinus willodenensis

 \-------------------------------32 / Lobalopex mordax

 | | /-------- Isengops

 \----------31 /------25 /---- Lende chiweta

 | | | + Leucocephalus wewersi

 | | \------24--------- Proburnetia viatkensis

 \---------------30 \ Paraburnetia sneeubergensis

 | / Niuksenitia sukhonensis

 | /-----------26-------- Burnetia mirabilis

 \------------------29 /---- Pachydectes elsi

 \-------28 / Mobaceras zambeziensis

 \--27---- Bullacephalus jacksoni

/------------------------------------------------------------------------------------------------------------------------------- Biarmosuchus tener

| /------------------------------------------------------------------------------------------------------------------- Hipposaurus boonstrai

\----------36 /-------------------------------------------------------------------------------------------------------- Ictidorhinus martinsi

 \---------35 /-------------------------------------------------------------------------------------------- Herpetoskylax hopsoni

 | +-------------------------------------------------------------------------------------------- Lycaenodon longiceps

 \----------34 /--------------------------------------------------------------------------------- RC 20

 | | /------------ Lemurosaurus pricei

 \---------33 /-------------------------------------------------------23------------ Lophorhinus willodenensis

 \----------32 /---------------------------------------------------------- Lobalopex mordax

 | | /----------------------- Isengops

 \---------31 /---------------------25 /------------ Lende chiweta

 | | | +------------ Leucocephalus wewersi

 | | \---------24------------ Proburnetia viatkensis

 \----------30 \------------ Paraburnetia sneeubergensis

 | /------------ Niuksenitia sukhonensis

 | /---------------------26------------ Burnetia mirabilis

 \---------29 /----------------------- Pachydectes elsi

 \----------28 /------------ Mobaceras zambeziensis

 \---------27------------ Bullacephalus jacksoni

Apomorphy lists:

 Branch Character Steps CI Change

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Biarmosuchus tener <-> node\_36 14 (Preparietal) 1 1.000 0 <=> 1

 19 (Skull roof-occiput contact) 1 0.500 1 <=> 0

 24 (Post-temporal fenestra) 1 0.500 1 <=> 0

 25 (Palatine boss morphology) 1 0.500 0 <=> 1

 node\_36 --> node\_35 1 (Length of dorsal process of premaxilla) 1 1.000 0 --> 1

 9 (Posterolateral process of frontal) 1 0.500 0 ==> 1

 27 (Dentition on transverse process of pterygoid) 1 0.500 0 --> 1

 node\_34 --> node\_33 17 (Ventral squamosal boss) 1 1.000 0 --> 1

 23 (Squamosal-tabular border) 1 0.500 0 --> 1

 node\_33 --> node\_32 3 (Preorbital fossae) 1 1.000 0 ==> 1

 4 (Deep pits on lateral surface of snout) 1 1.000 0 ==> 1

 5 (Median nasal excrescence) 1 1.000 0 ==> 1

 8 (Median frontal excrescence) 1 0.333 0 ==> 1

 10 (Anterior supraorbital boss) 1 1.000 0 ==> 1

 13 (Posterior supraorbital boss) 1 0.667 0 ==> 1

 14 (Preparietal) 1 1.000 1 --> 2

 16 (Zygomatic bosses) 1 1.000 0 ==> 1

 node\_32 --> node\_23 25 (Palatine boss morphology) 1 0.500 1 ==> 2

 node\_32 --> node\_31 18 (Dorsal squamosal boss) 1 1.000 0 ==> 1

 21 (Paired ridge on occipital surface of postparietal lateral to nuchal crest) 1 1.000 0 ==> 1

 26 (Pterygoid boss morphology) 1 0.333 0 ==> 1

 node\_31 --> node\_30 15 (Pineal boss) 1 1.000 0 --> 1

 17 (Ventral squamosal boss) 1 1.000 1 ==> 2

 22 (Nuchal crest) 1 1.000 0 ==> 1

 24 (Post-temporal fenestra) 1 0.500 0 ==> 1

 node\_30 --> node\_25 12 (Posterior margin of anterior supraorbital boss) 1 0.500 0 ==> 1

 15 (Pineal boss) 1 1.000 1 --> 2

 node\_25 --> node\_24 6 (Morphology of median nasal excrescence) 1 1.000 0 ==> 1

 19 (Skull roof-occiput contact) 1 0.500 0 ==> 1

 node\_24 --> Lende chiweta 15 (Pineal boss) 1 1.000 2 ==> 3

 node\_24 --> Proburnetia viatkensis 12 (Posterior margin of anterior supraorbital boss) 1 0.500 1 ==> 0

 25 (Palatine boss morphology) 1 0.500 1 ==> 2

 node\_25 --> Isengops 13 (Posterior supraorbital boss) 1 0.667 1 ==> 0

 23 (Squamosal-tabular border) 1 0.500 1 ==> 0

 node\_30 --> node\_29 6 (Morphology of median nasal excrescence) 1 1.000 0 ==> 2

 7 (Discrete prefrontal boss) 1 1.000 0 ==> 1

 11 (Morphology of anterior supraorbital boss) 1 1.000 0 ==> 1

 13 (Posterior supraorbital boss) 1 0.667 1 ==> 2

 27 (Dentition on transverse process of pterygoid) 1 0.500 1 --> 0

 node\_29 --> node\_26 8 (Median frontal excrescence) 1 0.333 1 --> 0

 17 (Ventral squamosal boss) 1 1.000 2 ==> 3

 20 (Occipital dimensions) 1 1.000 0 ==> 1

 node\_26 --> Burnetia mirabilis 25 (Palatine boss morphology) 1 0.500 1 ==> 2

 26 (Pterygoid boss morphology) 1 0.333 1 ==> 0

 node\_29 --> node\_28 2 (Ornamentation on lateral surface of maxilla) 1 1.000 0 ==> 1

 16 (Zygomatic bosses) 1 1.000 1 ==> 2

 node\_28 --> node\_27 9 (Posterolateral process of frontal) 1 0.500 1 --> 0

 node\_27 --> Bullacephalus jacksoni 8 (Median frontal excrescence) 1 0.333 1 ==> 0

 node\_28 --> Pachydectes elsi 26 (Pterygoid boss morphology) 1 0.333 1 ==> 0

paup> Log start;