Patterns of variation in canal and root number in human post-canine teeth

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Abstract

Descriptive morphology of tooth roots traditionally focuses on number of canals and roots. However, how or if canal and root number are related is poorly understood. While it is often assumed that canal number is concomitant with root number and morphology, in practice canal number and morphology do not always covary with external root features. To investigate the relationship between canal and root number, fully developed, adult post-canine teeth were examined and quantified from medical computerized tomography scans from a global sample of 945 modern humans. We tested the hypotheses that root and canal number do not follow a 1:1 ratio, that canal to root ratios differ between teeth, and that canal to root ratios differ across populations. Results indicate that not only is root number dependent on canal number, but that this relationship become more variable as canal number increases, varies both between individual teeth and by population, and changes as populations increase in distance from Sub-Saharan Africa. These results show that the ratio of canal number to root number is an important indicator of variation in dental phenotypes.

Key words: Tooth roots, human diversity, dental anthropology, tooth root morphology, root canal morphology, human dental evolution

Introduction

Tooth root anatomy varies in canal and root number, and canal number does not always covary with root number. Various aspects of this have been studied in modern humans (Kovacs, 1971; Ackerman et al., 1973; Vertucci and Gegauff, 1979; Hsu and Kim, 1997; Zorbaa et al., 2014; Ahmed et al., 2017), extant hominoids (Kupczik et al., 2005; Emonet et al., 2012; Moore et al., 2013, 2015), and fossil hominins (Wood et al., 1988a; Plavcan and Daegling, 2006; Kupczik et al., 2009; Kupczik and Hublin, 2010; Le Cabec et al., 2013; Moore et al., 2016). However, the numerical relationship between canals and roots is poorly understood. This study uses medical CT scans to investigate the relationship and variability between canal and root number of fully developed, adult post-canine teeth in a global sample of modern humans (n = 945 individuals) from several archaeological/osteological collections. Specifically, we asked (1) what is the relationship between root number and canal number; (2) does this relationship vary by tooth; and (3) does the relationship between canal and root number vary in global groups?

Root and canal formation

Tooth canal and root formation are comprised of a series of reciprocal cellular interactions in the dental papilla of the developing tooth (Jernvall and Thesleff, 2000). Central to the process, is Hertwig's epithelial root sheath (HERS), which is derived from the cervical loop of the enamel organ and is thought to be responsible for root number, shape and length (Nanci, 2012; Luder, 2015). Following crown formation, mesenchyme cells form the blood vessels, nerves, and connective tissue of the pulp cavity and root canals (Wright, 2007). Simultaneously, the HERS extends apically, interacting with the mesenchyme cells of the developing canal structures, and differentiating into odontoblasts responsible for dentin and cementum production (Li et al., 2017).

During root morphogenesis, the HERS produces inter-radicular processes (IRP's), finger-like protrusions adjacent the cervical foramen of the tooth crown. The extension and fusion of opposing IRPs across the cervical foramen create multiple secondary foramina which, in turn, form multiple tooth roots (Kovacs, 1971; Orban and Bhaskar, 1980); and it may be that number and orientation of IRP's are responsible for the variation in canal and root forms (Figure 1). While molecular regulation and tooth morphogenesis have been

extensively studied in tooth crowns, the mechanisms responsible for variation in canal and root structures is poorly understood. Because of its extensive role in root formation, HERS has been an area of focus; and several studies have shown that disturbances in formation of the HERS results in abnormalities in root number and shape (see Luder, 2015 for a review).

Figure 1: Top: The location and on the apical foramen of the tooth crown where the inter-radicular processes (IRP's) form determines the number and orientation of each tooth root/tooth roots. For example, in a tooth with mesial and distal roots, two inter-radicular processes arise from the buccal and lingual borders of the apical foramen, forming mesial and distal secondary apical foramina upon fusion. Grey = apical foramina of the developing tooth crown. **Bottom:** Fully developed roots of different types of teeth with the same number, but different orientation of IRPs. From right to left: single rooted teeth, single rooted teeth in which IRP did not fuse with opposing side of apical foramen, 2 rooted teeth in which 2 opposing IRPs fused, 3 rooted teeth in which 3 opposing IRPs fused, 4 rooted teeth in which 4 opposing IRPs fused.

Though morphogenesis of internal and external root structures are concurrent processes, the completed structures do not always covary. There is great variation and complexity in root canals. While it is easy to conceptualize canals as round holes which taper towards the roots' apex, in reality, many teeth have multiple canals of differing shape and orientation within a single root. These canals can join and separate in unpredictable places and the more ovoid the cross-section the greater the propensity for complexity (Vertucci and Gegauff, 1979; De Pablo et al., 2010; Ahmed et al., 2017). Possible causes of divergence in canal and root number have been attributed to uneven deposition of dentin on the walls of the canal (Manning, 1990), trauma to the HERS by radiation or chemical interference (Fischischweiger and Clausnitzer, 1988), and/or failure of the HERS to fuse on different sides of the root (Nelson and Ash, 2010; Nanci, 2012).

In this paper we (1) test the hypothesis that there is no difference between canal and root number in the pooled post-canine teeth in our sample; (2) test the relationship between canal and root number in the individual post-canine teeth of the jaws; (3) test the

relationship between canal and root number in pooled and individual teeth, by geographical regions.

Materials and Methods

Dental formula

Categorically premolars with P, and molars with M. Tooth numbers are labelled with super- and subscripts to differentiate the teeth of the maxilla and mandible respectively. For example, M^1 indicates the 1st maxillary molar while M_1 indicates the 1st mandibular molar.. Through the course of evolution, apes and old world monkeys have lost the first and second premolars of their evolutionary ancestors (Novacek, 1986; White et al., 2012), thus the remaining 2 premolars are numbered 3 and 4.

Human samples

The 945 individuals used in this study were recovered from archaeological sites across the globe (Figure 2). These individuals are stored in osteological collections at the Smithsonian National Museum of Natural History, Washington D.C., USA (SI), American Museum of Natural History, New York, USA (AMNH), and the Duckworth Laboratory (DW) at the University of Cambridge, England (summarized in Figure 3). Only adult individuals, based on the eruption, occlusion, and closed root apices of M^3/M_3 's (or M^2/M_2 's in the case of congenitally absent M^3/M_3 's), were used in this study.

Figure 2: Map of archaeological sites for individuals used in this study.

American Museum of Natural History

The 186 individuals from the AMNH collection are comprised of humans from Point Hope, Alaska, North America (Figure 3, right). These individuals, are attributed to the Ipiutak (500 BCE – 500 CE) and Tigara (1300-1700 CE) cultures (Rainey, 1941, 1947, 1971; Larsen and Rainey, 1948). Information on sex (Figure 4) and antiquity come from the AMNH archives and publications associated with the collection (ibid).

Figure 3: Human population sample sizes by collection. **Left:** Bar plot of counts for entire sample (n = 945). **Right:** Counts of samples divided up by collection, and geographic locations given by collection records. A complete list of the individuals used in this study, their collection information, antiquity, sex, and locality based on available records is listed in Supplementary Materials Table A.

Duckworth Laboratory

The majority of individuals (n = 621) used in this study come from the DW Laboratory collections (Figure 3, right). The DW is comprised of several private collections as well as research collections from the University of Cambridge Departments of Zoology, Anatomy, and Museum of Archaeology and Anatomy (Mirazón-Lahr, 2011). The oldest individuals used in this study come from the archaeological sites of Badari, Egypt (4000-3200 BCE), Jebel Moya, Sudan (100 BCE-500 CE) and Ngada, Egypt (4400-4000 BCE), in North-East Africa. The majority of the remaining individuals are ~200 years old. In many cases information on exact locality, age, and age of death, is unavailable. Information on sex (Figure 4) comes from DW archives. A complete list of the DW individuals used in this study, their collection information, antiquity, sex, and locality based on available records is listed in Supplementary Materials Table A.

Smithsonian National Museum of Natural History

The 138 individuals from the SI collection are from Oceania, Southeast Asia, and Greenland. Individuals from Oceania belong ($n = 67$) to four different populations: Australia (Aboriginal), New Zealand (Maori), the Philippines, and Papua New Guinea (Figure 3, right). Individuals from Southeast Asia ($n = 19$) are from Indonesia. Inuit individuals comes from the North-West coast of Greenland ($n = 52$). While all SI individuals were recovered from archaeological sites, information on exact locality, age, and age of death, is unavailable. However, information on sex taken from archives at the SI (Figure 4) as reported in Copes (2012).

Figure 4: Human population sample sizes by location and sex. **Left:** Bar plot of sex for entire sample ($n = 945$). **Right:** Sex divided up by collection and geographic locations given by collection records. Individuals of undetermined sex ('NA') are not included in the plot on the right to improve readability. They are: AMNH (NA = 3), DW (NA = 12), and SI (NA = 2). A complete list of the individuals used in this study, their collection information, antiquity, sex, and locality based on available records is Supplementary Materials Table A.

The populations in this study have been, at their broadest level, grouped into five major human populations: Sub-Saharan Africa, West-Eurasia, Sahul-Pacific, Sunda-Pacific, and Sino-Americas (Table 1 & Figure 5). Though Table 1 reports information for sex, this is for descriptive purposes. All analyses and reported results are for pooled sex samples. A complete list and description of individuals included in this study is listed in the Supplementary Materials Table A.

Table 1: Sample populations used in this study

Populations*	Male	Female	Unknown	Total
Sahul-Pacific	84	74	9	167
Sunda-Pacific	42	28	3	73
Sub-Saharan Africa	119	65	-	184
West Eurasia	111	70	2	183
Sino-Americas	163	168	7	338
Total	519	405	21	945

These groupings are derived from two major works. The first is Cavalli-Sforza's *The History and Geography of Human Genes* (1994), a synthesis of global genetics with nearly half a century's worth of geographical, ecological, linguistic, archaeological, and paleoanthropological research. Among the author's many conclusions are that all available evidence points to 1) an African origin for *H. sapiens*; and 2) the fact that a series of dispersal and admixture events can classify and map where major human populations (as listed above) and their subsequent subdivisions originated and dispersed through the ancient world. The volume (1994:317) also recognises that dental data "on northern Asia, southeast Asia, and the Americas are generally in excellent agreement with those from single genes." The dental data they refer to are crown and root trait frequencies collected and analysed by Christy Turner (Nichol et al., 1984; Turner II, 1986, 1987, 1989). These data, along with later core collected works on dental crown traits and biogeography utilising the ASUDAS (Scott, 1988; Turner II et al., 1991; Stringer et al., 1997; Irish, 1998; Hanihara, 2013; Scott et al., 2018), form the second basis for major human geographical subdivisions presented here. These researchers (ibid) have shown that teeth are effective for identifying the same prehistoric population identities and movements discussed by Cavalli-Sforza (1994), as well as capturing the phenotypic diversity within populations, and the differences that arise between them after extended periods of isolation. The most current collections of dental anthropological research (Rathmann et al., 2017; Scott et al., 2018; Rathmann and Reyes-Centeno, 2020) are increasingly in accordance with the most recent genomic studies (Pickrell and Reich, 2014; Fu et al., 2016; Skoglund et al., 2016; Rathmann et al., 2017; Posth et al., 2018; Reich, 2018), further reinforcing the utility of teeth as phenotypic records of human biogeography and evolutionary history.

Figure 5: Map of archaeological sites for individuals used in this dissertation adapted to show the five major human populations.

Use of cone beam computed tomography for visualizing internal and external features of tooth roots

In clinical settings (e.g., dental, hospital, etc.), cone beam computed tomography (CBCT or CT) is widely utilized to visualize internal and external structures of the crown and root(s) (see Martins and Versiani (2018) for an in-depth discussion of this topic). An important parameter supporting reliability of visualization for the study of root and canal anatomy is voxel size. In 3D medical imaging a single voxel is a cubic representation of a single value of space within a cubic volume. For example, a hypothetical 300x300x300 cubic volume would have 27,000,000 voxels. Thus, the lower the voxel size relative to the volume of 3D CBCT, the greater the resolution. Compared to micro-CT (μ CT) which operates on the micron scale (a thousandth of a millimetre) for increased resolution, CBCT uses larger voxel sizes at the millimetre scale which results in a relatively decreased resolution. However, CBCT has been proven to be reliable for detecting root an canal number and morphology in specific teeth or individual roots (Blattner et al., 2010; Michetti et al., 2010; Domark et al., 2013; Pécora et al., 2013). Maret et al. (2014) compared in vitro CBCT images of different voxel sizes (76, 200, and 300 μ m) with μ CT (41 μ m) and observed discrepancies of hard tissue morphology (i.e. cervical margins, cusp tips, incisal edges) were only significant at 300 μ m ($P = .01$, Wilcoxon test). These studies (additionally, see Martins and Versiani (2018) for an extensive overview of CBCT and μ CT on root canal anatomy by tooth) have shown

that CBCT can clearly and accurately detect structures such as root number, canal number, and configuration of the main root canal systems.

Imaging of osteological collections

Following the method developed by Gellis and Foley (2021) we used cone-beam computed tomography (CT) to analyse 5,970 post-canine teeth (Table 2) from the right sides of the maxillary and mandibular dental arcades of individuals (n= 945) from a global sample of humans (Table 1). While information for all teeth from both sides of the maxillary and mandibular arcades was recorded, only the right sides were analysed to avoid issues with asymmetry and artificially inflated sample size. Full skulls of specimens from the SI and AMNH were scanned by Dr. Lynn Copes (Copes, 2012) using a Siemens Somatom spiral scanner (70 μ A, 110 kV, slice thickness 1.0 mm, reconstruction 0.5 mm, voxel size mm³: 0.5x0.5x0.3676). Full skulls from the DC were scanned by Professor Marta Mirazón-Lahr and Dr. Frances Rivera (Rivera and Mirazón-Lahr, 2017) using a Siemens Somatom Definition Flash scanner at Addenbrooke's Hospital, Cambridge England (80 μ A, 120kV, slice thickness 0.6mm, voxel size mm³: 0.3906x0.3906x0.3). For all collections, crania and mandibles were oriented on the rotation stage, with the coronal plane orthogonal to the x-ray source and detector. Permission to use the scans has been granted by Dr. Copes, Professor Mirazón-Lahr and Dr. Rivera.

Table 2: Tooth counts of the right side of the maxillary and mandibular dental arcades.

Tooth	n	Tooth	n	Total
Maxilla		Mandible		
P³	515	P₃	343	858
P⁴	467	P₄	313	780
M¹	697	M₁	410	1,107
M²	596	M₂	385	981
M³	362	M₃	278	640
Total	3,495	-	2,475	5,970

Superscript = maxilla, **subscript** = mandible. **I** = incisor, **C** = canine, **P** = premolar, **M** = molar. Numbers in parentheses indicate congenitally absent teeth (discussed in section).

Analysis of CT images

Transverse CT cross sections of roots and canals were assessed in the coronal, axial, and sagittal planes across the CT stack, using measurement tools in the Horos Project Dicom

Viewer (Figure 6) version 3.5.5 (<https://www.horosproject.org>, 2016). Only permanent teeth with completely developed roots and closed root apices were used for this study. While information for all teeth from both sides of the maxillary and mandibular arcades was recorded, only the right sides were analysed to avoid issues with asymmetry and artificially inflated sample size.

Figure 6: Horos Dicom Viewer 2D orthogonal view used to assess root and canal morphologies. **Left:** Coronal view at mid-point of roots. **Centre:** Anterior view at midpoint of roots. **Right:** Lateral view at midpoint of roots.

Determination of root and canal number

Root and canal number are determined by applying the Turner Index (1991), which compares the point of bifurcation relative to total root or canal length, as measured in Horos Dicom Viewer from the cemento-enamel junction (CEJ) to the root apex/canal apical foramen (Figure 3). When this ratio is greater than one-third (33%) of the total root or canal length, the root or canal is classified as multi-rooted. When the ratio is less than one-third (33%) the root or canal is considered single rooted, or with a bifid apical third. Individual root/canal number for analysis is recorded as a simple numerical count (e.g., 1,2,3, etc.). Using measurement tools in Horos Dicom Viewer, the midpoint of the root was measured halfway between the CEJ and the apices of the root/s (Figure 7). It is by these methods that data were acquired for the analyses described and carried out through this study. Here, a single root canal is defined as a canal which extends from the pulp chamber within the crown and exits at a single foramen. Accessory canals are not included in this study.

Figure 7: Left: Locations of measurements taken in Horos Dicom Viewer of (a) CEJ to point of bifurcation, (b) point of bifurcation to root apices, (m) mid-point between CEJ and root apices. **Right:** Determination of root and canal number. Distal view of single-rooted premolar with bifurcation of the apical third of the root. Lingual view of double-rooted mandibular molar. Distal root of double-rooted mandibular molar with examples of canal counts in solid grey. Dotted grey lines indicate canal/s position in root. CEJ = Cemento-enamel junction, POB = Point of bifurcation, Solid grey = canals. CT = cervical third, MT = middle third, AT = apical third.

Statistical analyses

Data were analysed with the R Project for Statistical Computing. Because the osteological materials used in this study were recovered from excavation sites, many of the individuals comprising our sample are missing one or more teeth. As the mechanism causing these missing data are unrelated to the values of any variables used in analysis (missing completely at random), our observed values are essentially a random sample of the full data set and not biased (Sterne et al., 2009). Thus, multiple imputation is appropriate for our data set (Garson, 2015; Zhang et al., 2017). Using the missMDA package, we performed multiple imputation on missing data in preparation for analysis (Josse and Husson, 2016).

Because the Poisson distribution is typically used for count data, a Poisson general linear model (PGLM) was used to test the association between canal and root number at the $p = 0.05$ significance level (Zeileis et al., 2008). A key assumption underlying PGLM is the independence of observations (Hoffmann, 2004). Thus, the inclusion of multiple teeth from the same individuals may violate assumptions of independence for the PGLM used in this study. To account for this, we fit our PGLM with Generalized Estimating Equations (GEE). GEE estimates population-averaged parameters and their standard errors based on a number of assumptions: (1) The responses variables are correlated or clustered; (2) There is a linear relationship between the covariates and a transformation of the response; and (3) within-subject covariance has a correlation structure (Zeger and Liang, 1986; Diggle et al., 2002). In order to determine our correlation structure and how root and canal number correlated within and between teeth we conducted a Pearson correlation analysis of canal

and root number. We selected and Auto Regressive Order 1 (AR1) correlation structure for our GEE covariance matrix. While GEE estimates of model parameters are valid regardless of the specified correlation structure, the AR1 correlation structure is appropriate because it (a) has no distributional assumptions (Zuur et al., 2009); (b) can accurately model covariance for cross-sectional individual and clustered studies (Müller et al., 2009; Muoka et al., 2021); (c) accurately model within-subject correlation decreasing across time and/or space (Agresti, 2002); and (d) assumes observations within and individual are non-independent (Zeger and Liang, 1986). Thus, AR1 is appropriate at the individual and population levels, and for the temporospatial distances within and between individuals and groups within our sample. GEE was carried out using 'geepack: Generalized Estimating Equation Package' version 1.3.2 (Halekoh et al., 2006). Stepwise model selection was tested and quantified using Akaike Information Criteria (stepAIC). Tukey's multiple comparison test was used for pair-wise analysis of population groups (Full statistical output is presented in Appendix Section 9.3). PGLM extended with GEE was also used to test for association between root and canal number by tooth and population groups. Tukey's multiple comparison test was used for pair-wise analysis of population groups.

Results

Number of teeth, roots, and canals

Tables 3 and 4 report counts for number of roots and canals from post-canine teeth belonging to the right side of the maxilla and mandible. The number of roots in teeth from the sample are between one and four (Table 3). In this sample, teeth with four roots are limited to maxillary molars and appear with a relatively low frequency compared to 2 and 3 rooted teeth. Premolars, especially P_3 and P_4 , are predominantly single-rooted, while the majority mandibular molars in this sample are double-rooted. Entomolaris (En), or three-rooted molars, appear in 18.05 % $M1s$, 1.23% of $M2s$, and 5.94% of $M3s$, and three-rooted paramolaris (Pa) appears in 3.63% of $M3s$.

Table 3: Number of roots in teeth of the maxilla and mandible by tooth

Tooth	Root number	n	Total Roots	% of teeth*	Tooth	Root number	n	Total Roots	% of teeth*
Maxilla					Mandible				
P³	1	295	739	57.28	P₃	1	341	99.42	345
	2	216		41.94		2	2	0.58	
	3	4		0.78					
P⁴	1	405	530	86.72	P₄	1	313	100.0	313
	2	61		13.06					
	3	1		0.22					
M¹	1	2	2,060	0.29	M₁	2	336	81.95	894
	2	28		4.02		3**	74	18.05	
	3	666		95.55					
	4	1		0.14					
M²	1	56	1,561	9.39	M₂	1	49	12.73	727
	2	117		19.63		2	330	85.71	
	3	421		70.64		3	1	0.26	
	4	2		0.34		3**	5	1.30	
M³	1	89	831	24.59	M₃	1	20	7.19	563
	2	82		22.65		2	231	83.09	
	3	186		51.38		3*	16	5.76	
	4	5		1.38		3†	11	3.96	

* From Table 2. Congenitally absent teeth not included in statistics for this table. ** =Entomolaris, †=Paramolaris.

Teeth from this sample contain between one and six canals, and canal number often exceeds root number (Table 4). Many teeth contain two or more canals, especially in the molars. Molars have the greatest number of canals per tooth, with M¹s showing the most variation in canal number.

Table 4: Number of canals per tooth in the maxilla and mandible by tooth

Tooth	Canal number	n	Total Canals	% of teeth*	Tooth	Canal number	n	Total Canals	% of teeth*
Maxilla					Mandible				
P³	1	82	959	15.92	P₃	1	254	433	74.05
	2	422		81.94		2	88		25.66
	3	11		2.14		3	1		0.29
P⁴	1	233	708	49.89	P₄	1	300	326	95.85
	2	228		48.82		2	13		4.15
	3	5		1.07	M₁	2	27	1,421	6.58
	4	1		0.22					
M¹	2	4	2,430	0.57					
	3	355		50.93					
	4	334		47.92					
	5	3		0.43					
	6	1		0.14					
M²	1	8	1,910	1.34	M₂	1	2	1,093	0.52
	2	21		3.52		2	105		27.27
	3	408		68.46		3	231		60.0
	4	159		26.68		4	47		12.21
M³	1	32	1,065	8.84	M₃	1	10	747	3.60
	2	24		6.63		2	86		30.94
	3	239		66.02		3	163		58.62
	4	67		18.51		4	19		6.84

* From Table 2. Congenitally absent teeth not included in statistics for this table.

Inter-trait correlation

Pearson product-moment correlation coefficients (Figure 8) were computed to assess linear correlation between root number (RN) and canal number (CN) for teeth used in this study (Table 2). The majority of variables have negligible to weak positive or negative correlation coefficient strength values of 0.01 - $\pm$ 0.30 (Akoglu, 2018). Within same teeth moderate to strong correlation coefficient values of 0.31 - $\pm$ 0.69 (ibid) are found in P⁴ RN:P⁴ CN (0.46), M³ RN:M³ CN (0.47), M₂ RN:M₂ CN (0.35), and M₃ RN:M₃ CN (0.50). With the exception of P³ RN:P⁴ CN (0.46), P³ RN:P⁴ CN (0.65), P₃ CN:P₄ CN (0.43), M³ RN:M² CN (0.31), and M₂ CN:M₃ CN (0.31), there are no significant correlations of RN to CN across different teeth.

Figure 8: Pearson correlation of root number (RN) to canal number (CN). Significance level = 0.05. Significant positive correlation coefficients in blue. Significant negative correlation coefficients in red. Blank cells in P₄ RN: P₄ RN due to all P₄s having the same level (i.e., one root. See Table 3).

PGLM of relationship between canal and root number in individual teeth

While independent variables are uncorrelated, uncorrelated variables are not always independent. To address this, we fit PGLM with GEE to account for low levels of correlation between some traits (Figure 8), and to account for using multiple teeth from the same individuals, which may violate assumptions of variable independence. PGLM fitted with PGEE was used to directly test the linear relationship of root to canal number by tooth - in other words, to see how the relationship between canal and root number varies across

different tooth types. PGLM of individual teeth reveal that for M^1 - M^3 , and M_1 - M_3 , as canal count increases, so does root count (Table 5). In the maxilla, the greatest increase in root to canal number is found in M^1 (99.99%), and similar relationships are found in M^2 and M^3 . Maxillary premolars remain relatively stable, with a minimal increase (0.03%) in P^3 , and no increase in root number in P^4 . Mandibular molar (M_1 - M_3) roots are comparatively similar to one another in their odds ratios, especially M_1 and M_2 ; while surprisingly, mandibular premolars (P_3 - P_4) show that as canal number increases root number does not

Table 5. Regression parameters for PGLM and GEE regression of the association between canal-to-root number by tooth, ranked by odds ratios from greatest to least*

	Estimate	Odds ratio	Std. error	Wald	P-value
<i>Canal number</i>	0.117	1.124	0.007	251.300	< .0001
Maxilla					
M^1	0.693	1.999	0.025	750.400	< .0001
M^3	0.650	1.916	0.025	683.700	< .0001
M^2	0.648	1.911	0.025	651.900	< .0001
P^3	0.000	1.000	0.018	0.000	0.990
P^4	-0.091	0.913	0.011	69.100	< .0001
Mandible					
M_3	0.356	1.428	0.022	264.800	< .0001
M_2	0.127	1.135	0.049	2.604	< .0001
M_1	0.287	1.330	0.028	106.700	< .0001
P_4	-0.119	0.887	0.008	248.000	< .0001
P_3	-0.127	0.881	0.008	236.100	< .0001

*Model fitted without intercept.

Prediction curves differ for each tooth, and the maxilla and mandible as a whole (Figure 9). Similar tooth groups have similar prediction curves — P_3 , P_4 , and P^4 ; M_3 , M_2 , and M_1 ; and M^1 , M^2 , M^3 ; and these differ between the maxilla and mandible. As prediction curves diverge from the 1:1 canal-to-root ratio, root number decreases, though this does not necessitate a concomitant reduction in canal number (Figure 5).

Figure 9: PGLM prediction curves with error bars for canal to root number for individual teeth. Dotted red line represents 1:1 canal to root relationship (i.e., what would be observed if there was a simple 1:1 relationship between roots and canals). Over prediction in the number of roots for single canaled M¹/M_{1S}-M³/M_{3S} is owing to very small sample of individuals with one root to one canal (see Table 3 for counts).

Figure 10 plots proportions of canal to root number of individual teeth within the sample. Different patterns are clearly evident across all teeth and between the maxilla and mandible and help to explain groupings of individual tooth prediction curves in Figure 9. There is a slight over-prediction in the number of roots for single canaled M¹-M³'s owing to 1) very small sample of individuals with one root to one canal for these teeth (see Table 3 for counts); and 2) because we have used a fixed non-parametric model to capture the non-linearity between canal and root number. Variation in canal to root number decreases in the premolars while increasing in the molars, though this variation does not covary between

opposing individual maxillary and mandibular teeth. The greatest variation is found in the maxillary molars (M^1 - M^3) while the least is found in P_4 .

Figure 10: Proportion of canal to root number for individual teeth. 5 canaled teeth = 14, 6 canaled teeth = 2, are included in calculations of proportions but are not visualized on this plot due to small sample size.

Tukey pair-wise comparisons of PGLM of root to canal number by tooth (Figure 11) show that patterns in prediction curves and canal-to-root proportions plotted in Figures 9 and 10 reflect significant differences between teeth. Full statistical output is presented in the Supplementary Materials Table B.

Figure 11: Estimated marginal means derived from Tukey pair-wise comparisons of canal to root number by tooth. Black dot= mean value; Blue bar = confidence intervals. The degree to which red comparison arrows overlap reflects the significance ($p = 0.05$) of the comparison of the two estimates. Full statistical output is presented in Supplementary Materials Table B.

PGLM of relationship between canal and root number in geographical populations

We used PGLM to test the linear relationship of root to canal number by tooth across population groups (Table 6). To avoid emphasizing results against one geographical region or tooth we fitted the model without an intercept.

Table 6: Regression parameters for the PGLM testing the association between canal and root number by tooth in geographic populations, ranked by odds ratio from greatest to least*.

Groups	Estimate	Odds ratio	Std. error	Wald	P-value
Canal number	0.329	1.389	0.002	29139.9	< .0001
Sub-Saharan Africa	-0.211	0.810	0.007	816.8	< .0001
Sino-Americas	-0.235	0.790	0.006	1749.3	< .0001
Sunda-Pacific	-0.250	0.779	0.010	658.8	< .0001
West Eurasia	-0.238	0.789	0.007	1065.3	< .0001
Sahul-Pacific	-0.258	0.773	0.007	1206.2	< .0001

* Model fitted without intercept

Individual teeth of geographical groups are relatively similar in their odds ratios and prediction curves; and follow a similar pattern of divergence from a 1:1 canal-to-root ratio (Figure 12). Prediction curves for Sub-Saharan African populations are closest to the 1:1 canal-to-root ratio, while Sino-American populations are the furthest. While odds ratios of Sub-Saharan African and Sino-American populations are most similar, marginal effects quantify how both groups vary differently in their canal to root ratios (Figure 13).

Figure 12: PGLM prediction curve for root to canal number by population. Dotted red line represents 1:1 root to canal relationship. Over prediction in the number of roots for single canaled M^1/M_{1S} - M^3/M_{3S} is owing to very small sample of individuals with one root to one canal (see Table 3 for counts).

Marginal effects quantify how both groups vary differently in their canal to root ratios (Figure 13) when the explanatory variable (canals) changes by one unit. For all teeth, the Sino-American groups have the lowest percentage of change in root number as canal number increases, while Sub-Saharan Africans show a higher percentage of root number change as canal number increases.

Figure 13: Marginal effects of canal to root count in individual teeth by geographical region.

Tukey pair-wise comparisons of PGLM of canal to root number by population show that patterns in prediction curves and marginal effects plotted in Figures 12 and 13 reflect significant differences between Sub-Saharan Africa and all other groups (Figure 14). Significant differences are also shown between Sahul-Pacific and Sino-Americans. Full statistical out is provided in Supplementary Materials Table C).

Figure 14: Estimated marginal means derived from Tukey pair-wise comparisons of PGLM of canal to root number by geographical region. Black dot= mean value; Blue bar = confidence intervals. The degree to which red comparison arrows overlap reflects the significance ($p = 0.05$) of the comparison of the two estimates. Full statistical output is presented in Supplementary Materials Table C.

Discussion

In the analyses presented above we have been able to show that there is little to no correlation between root and canal number in teeth (Figure 8). However, because uncorrelated random variables are not always independent, we extended our PGLM with GEE to develop a predictive model of the relationship between canal and root number, globally and by region, and we show that this relationship is not perfectly linear. We have found that canal number predicts root number, and that the greater the number of canals

the more complex, and less predictable the number of roots. This relationship varies by maxillary and mandibular teeth and tooth row. These results raise a number of issues: what does the complexity of canal to root number relationships mean developmentally? Why does this complexity vary across particular tooth types? How does divergence in canal and root number vary between maxillary and mandibular teeth in total, by population, and individually?

Differences in root and canal number

Currently, there is no consensus as to why canals and roots should differ in number, given that canal formation precedes root formation. Clusters of blood vessels entering the dental papilla early in tooth formation coincide with the positions where roots will eventually form (Nanci, 2012). The HERS and expanding dental pulp form around these nerves and blood vessels before dentin formation. Thus, each root must contain at least one canal for the pulp, and the nerve and blood supply that precede the formation of the surrounding root structure. It is possible that number, size, and configuration of blood and nerve supplies is, in part, responsible for variation in canal number with the roots, and not variation in the number and orientation of the interradicular processes alone.

Variance across teeth and between the maxilla and mandible

Why canal and root number should vary both within and between teeth of the maxilla and mandible is also unknown. Prediction curves and proportions of canal to root numbers show that the relationship between canals and roots within tooth types are similar to one another, i.e., maxillary molars are alike, while being significantly different from other tooth types, i.e., such as premolars and mandibular molars. Similar estimates (Table 5) and PGLM curves of tooth types (Figure 9) seem to lend support to the morphogenetic field model in which teeth within a field are more similar to one another than to teeth of another field (Butler, 1937, 1963; Dahlberg, 1945); especially for molar fields in both jaws. These results suggest that the number of canals and roots within tooth types are relatively "fixed" with little intra-tooth type variation. We propose two possible explanations, the first functional, the second spatial.

Megadonty is a hallmark of early hominin evolution (Robinson, 1956; Wood and Abbott, 1983; Reed, 1997; Wood and Constantino, 2007); and heavy chewing requires large teeth. The majority of chewing actions occur on the broad occlusal surfaces of the post-canine teeth where, compared to anterior teeth, masticatory movements are complex combinations of antero-posterior, vertical and lateral movements (van Eijden, 1991; Ledogar et al., 2016). Chewing pressures on the maxillary teeth result from absorption of shearing and compressive forces generated by the active movement of the mandible (Ledogar et al., 2016). During mastication, maxillary molars are subjected to greater medio-lateral directed loads than mandibular molars (Dempster et al., 1963; Spears and Macho, 1998). These medio-lateral forces are dissipated into the jaws via the tooth roots (Nikolai and Zwemer, 1985; Baragar and Osborn, 1987); and, in humans, are strongest at, and decrease posteriorly from M^1/M_1s (Gordon, 1984; Macho and Spears, 1999). Consequently, as root surface area decreases in M^2 and M^3 , so does root number ((Dempster et al., 1963); Table 3).

It is possible that where increased masticatory loadings are a selective pressure for larger teeth, an increased blood supply required for developing a larger tooth will result in an increase in canal number. This will, in turn, result in more roots. The increased mesio-distal and bucco-lingual dimensions of premolars tooth crowns belonging to megadontic "robust australopiths" (*Paranthropus boisei*, *P. robustus*, *P. aethiopicus*), support such as hypothesis. These "hyper-robust" hominins regularly had multi-rooted/canaled premolars (Robinson, 1954, 1956; Wood et al., 1988b; Brook et al., 2014; Moore et al., 2016; Kupczik et al., 2018), and the ancestral hominin phenotype has been proposed as three-root maxillary premolars, and two-root mandibular premolars. In modern humans, molars withstand the heaviest masticatory loadings while premolars are subjected to the least (Demes and Creel, 1988; Ledogar et al., 2016). That masticatory stresses produce high strains in the alveolar margin of the anterior maxilla (Ledogar et al., 2016) may act to increase canal and root number in the maxillary premolars compared to mandibular premolars. Developmentally, Shields (2005) proposed that tooth germ size influenced the number and development of IRP's. However, multiple studies have noted that tooth crown size (used as proxy for tooth germ size) does not always covary with root number and size in humans and hominoids (Abbot, 1984; Shields, 2005; Moore et al., 2013, 2016).

Different masticatory forces resulting from dietary demands have been shown to increase tooth root surface area, and thus size, in primates (Kovacs, 1971; Spencer, 2003; Kupczik and Dean, 2008; Ledogar et al., 2016). A possible selective mechanism to increase tooth root surface area would be to increase the number of roots, which would in turn enlarge the cervical base area of the crown (Kupczik et al., 2005). A study of *Gorilla gorilla*, *Pan troglodytes*, as well as of 26 fossil gracile and robust hominins from South Africa concluded that dietary adaptations produced mesio-distal expansion at the base of tooth roots in M¹s (Kupczik et al., 2018). The authors (ibid) concluded that it was increases in root splay that accommodated higher masticatory loadings, but that the mesio-distal expansion of the root bases in robust hominins might be an adaptive response to different jaw kinematics for chewing different food types — horizontally directed repetitive chewing in *P. boisei* (Demes and Creel, 1988; Wood and Constantino, 2007), versus multi- directional loading of *P. robustus* (Macho, 2015). However, the extant and fossil species from this study are already characterized by multi rooted molars and premolars (Sperber, 1973; Wood et al., 1988a; Kupczik et al., 2005; Shields, 2005); so it is difficult to discern if mesio-distal expansion of the roots is an adaptive response to biomechanical pressures, a bi-product of additional roots, or both. If root splay is in fact the primary adaptive response to increased masticatory loading, the selective pressures underlying what point single root surface area/size stops increasing and root differentiation begins have yet to be elucidated.

Alternatively, variation may arise from space required for growing teeth in the developing jaws. Consider that maxillary and mandibular 1st molars are the first adult teeth to erupt (at 6-7 years) followed by the anterior teeth (7-10 years), premolars (10-12 years), followed by 2nd (12-13 years) and 3rd molars (17-21 years). In this spatial scenario maxillary and mandibular 1st molars have the greatest number of roots and canals, while late-forming and erupting premolars have the least as they are sandwiched between 1st molars and the already erupted anterior teeth. Constrained variation, especially in the premolars may be explained by limited space for growth and development, while maxillary and mandibular molars have spatial restrictions on their growth and development limited by dimensions of the palate and by the ascending ramus of the mandible.

Biomechanical and spatial explanations need not be mutually exclusive. It may be the case that canal, and root variation found in modern humans is a product of reduction in space as a consequence of reduced selection for intensive biomechanical chewing pressures

in early human evolutionary history. Premolar root number has been documented as more variable than in all other tooth types (Sperber, 1973; Wood et al., 1988a; Kupczik et al., 2005; Shields, 2005). Contrary to the molarization of the robust Paranthropines, the reduction of premolar root number is present in South-African gracile hominins. Robinson (1956) and Sperber (1974) report predominantly (84%) double-rooted maxillary premolars in a sample of *Australopithecus africanus*, though single (8%) and triple-rooted (8%) variants do occur. *A. africanus* mandibular premolars are reported as having single C-shaped (also referred to as Tomes' root) and double-rooted mandibular molars (Robinson 1952, 1956; Sperber, 1974, Moore et al., 2016). Thus, this trend for reduction in premolar root number appears early in human evolutionary history (3.4 -2.4 Ma) and coincides with dietary shifts towards meat and/or softer cooked foods (Luca et al., 2010), and reduction of hominin tooth crowns, jaws and face. At 1.8 Ma *Homo erectus* has fewer tooth roots, especially M₃'s, than earlier members of our genus, and *H. erectus* premolars are frequently single rooted (Antón, 2003). This trend in root number reduction continues through more recent members of Genus *Homo* including some specimens allocated to *H. heidelbergensis* and *H. neanderthalensis* (Benazzi et al., 2011; Martínón-Torres et al., 2012; Zanolli and Mazurier, 2013).

Differences in geographical groups

Sino-American and Sub-Saharan African populations are significantly different from one another (Figure 11, Supplementary Materials Table C), and these differences can be explained by reduction in root number in the former. Compared to all other groups, Sino-Americans have the greatest proportion of single rooted teeth across all populations while Sub-Saharan African populations have the smallest (Figure 10). This trend is present regardless of canal number. The exception to this is the presence of three-rooted mandibular molars (ento- and para-molaris root forms) in Sino-Americans (Carlsen and Alexandersen, 1990). This form represents a relatively rare polymorphism, and appears with frequencies around 30-50% in East Asian, Inuit, and Aleut populations; 5-15% in Southeast Asian and Pacific populations; compared to 1% in European and Sub-Saharan African populations (Scott et al., 2018).

As with tooth types, there is no clear explanation for changes in canal to root number between populations. The reasons may be biomechanical in nature and relate to different diets between populations. However, this is unlikely as the Sino-American populations included in this study (primarily comprised of North American First peoples; see Figure 4 & Supplementary Materials Table C), did not pursue uniform subsistence strategies. However, the effect of different diets on tooth root and canal morphologies is poorly understood, with only a few studies centred on non-human primates, and gracile and robust Australopiths (see Kupczik et al., 2018 for an overview).

The study of dental traits have an extensive history and utility for characterizing and assessing the biological relationships within and populations (see Scott et al., 2018 for a comprehensive review). Dental morphology has been shown to be under strong genetic control and minimally affected by environmental factors (Corruccini et al., 1986; Dempsey and Townsend, 2001). The evolutionary trend of teeth has also been described as towards reduction in size and simplification in morphology (Scott and Turner II, 1988). While the authors of these studies were describing tooth crowns, tooth roots are presumably operating under the same genetic and environmental constraints, and evolutionary trends.

PGLM predictions (Table 6) and marginal effects (Figure 13) support evidence of simplification in terms of reduction. Sub-Saharan Africans and Sino-Americans are furthest in distance from one another in time and space, and the former group shows the greatest variation in root and canal number, while the latter shows a reduction. For example, Sino-Americans have a higher proportion of single rooted, double-canaled M_2 's and M_3 's than all other groups. Additionally, congenitally absent M_3 's are common (>25%) in Sino-American populations (Turner II et al., 1991; Daito et al., 1992; Rakhshan, 2015; Scott et al., 2018). Compared to Sub-Saharan African populations, Western Eurasia, Sahul- and Sunda-Pacific groups have reduced variability, though not as much as Sino-Americans. These three groups share similar linear relationships (Figure 8) and canal to root proportions (Figure 10), though marginal means of West Eurasian and Sunda-Pacific populations reveal their canal to root relationships are more similar to Sub-Saharan Africa, while Sahul-Pacific is closer to Sino-Americans.

Recent studies have highlighted the decrease of genetic and phenotypic diversity in human populations with increasing distance from Sub-Saharan Africa (Handley et al., 2007). This decrease in diversity has been interpreted as evidence of an African origin for

anatomically modern humans. Reduced intra-population diversity has been ascribed to an "Out of Africa" migration, and sequence of founder events due to rapid expansions and colonization of the world (Prugnolle et al., 2005; Liu et al., 2006; Li et al., 2008). This reduction in diversity has been recorded in human dental (Hanihara and Ishida, 2005; Hanihara, 2008), craniofacial (Hanihara and Ishida, 2009; Betti et al., 2012), and morphometric traits (Manica et al., 2007), further supporting genetic hypotheses of this single, African origin and subsequent expansions. However, some exceptions to this exist. For example, three rooted M_1 's, sometime referred to as *Radix entomolaris* (see Calberson, De Moor and Deroose, 2007 for a review), increase in Sino-American populations while appearing in low frequency in other populations; especially Sub-Saharan Africa (Scott et al., 2018). This trait has been most commonly attributed to genetic drift (Scott et al., 2018), though a recent study has suggested archaic introgression (Bailey et al., 2019); however, see Richard Scott, Irish and Martín-Torres (2020) for a rebuttal.

Conclusion

This paper presents a novel investigation into the relationship between canal and root number in human post-canine teeth. In all cases, canal number is either equal to or exceeds root number, supporting our hypothesis that canal number precedes and is, in part, responsible for root number in all post-canine teeth. These canal to root relationships are significantly different between tooth types (i.e., molars and premolars), within and between the maxilla and mandible. Results indicate that Sub-Sharan African and Sino-American populations are significantly different in their canal to root numbers, and this difference represents an overall reduction in root number with distance from Africa, but not necessarily canal number. Canal to root relationships differ across all populations studied, however the reasons for these differences are not ultimately clear. To test population affinities and differences, future studies should include morphological distance-based analysis to test divergence, as well as consider additional biological, historical, linguistic and cultural data. Results also show that tooth types within and between the jaws have different linear relationships and that these relationships are significantly different. These results support biomechanical and spatial hypotheses related to tooth crown size in hominin evolution, and future studies should include root *and* canal count in their analysis.

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Author contributions

Concept and design by Jason Gellis and Robert Foley. Acquisition of data and data analysis by Jason Gellis. Drafting of the manuscript by Jason Gellis and Robert Foley. Revision of the manuscript by Jason Gellis.

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1051 Supplementary Material

1052

1053 **Table A: Collection information for individuals used in this study**

ID	Collection	Sex	Years BP*	G1 [†]	G2	G3	G4	G5
99_1_102	AMNH	F	~1600	Sino-Americas	North America	American Arctic	Alaska	Ipiutak
99_1_103	AMNH	M	~1600	Sino-Americas	North America	American Arctic	Alaska	Ipiutak
99_1_105	AMNH	M	~1600	Sino-Americas	North America	American Arctic	Alaska	Ipiutak
99_1_161	AMNH	F	~1600	Sino-Americas	North America	American Arctic	Alaska	Ipiutak
99_1_163	AMNH	F	~1600	Sino-Americas	North America	American Arctic	Alaska	Ipiutak
99_1_165	AMNH	M	~1600	Sino-Americas	North America	American Arctic	Alaska	Ipiutak
99_1_166	AMNH	M	~1600	Sino-Americas	North America	American Arctic	Alaska	Ipiutak
99_1_168	AMNH	F	~1600	Sino-Americas	North America	American Arctic	Alaska	Ipiutak
99_1_181	AMNH	M	~1600	Sino-Americas	North America	American Arctic	Alaska	Ipiutak
99_1_192	AMNH	M	~1600	Sino-Americas	North America	American Arctic	Alaska	Ipiutak
99_1_194	AMNH	M	~1600	Sino-Americas	North America	American Arctic	Alaska	Ipiutak
99_1_196	AMNH	M	~1600	Sino-Americas	North America	American Arctic	Alaska	Ipiutak
99_1_197	AMNH	F	~1600	Sino-Americas	North America	American Arctic	Alaska	Ipiutak
99_1_198	AMNH	NA	~1600	Sino-Americas	North America	American Arctic	Alaska	Ipiutak
99_1_201	AMNH	F	~1600	Sino-Americas	North America	American Arctic	Alaska	Ipiutak
99_1_252	AMNH	M	~1600	Sino-Americas	North America	American Arctic	Alaska	Ipiutak
99_1_684	AMNH	F	~1600	Sino-Americas	North America	American Arctic	Alaska	Ipiutak
99_1_72	AMNH	M	~1600	Sino-Americas	North America	American Arctic	Alaska	Ipiutak
99_1_80	AMNH	M	~1600	Sino-Americas	North America	American Arctic	Alaska	Ipiutak
99_1_90	AMNH	F	~1600	Sino-Americas	North America	American Arctic	Alaska	Ipiutak
99_1_92	AMNH	M	~1600	Sino-Americas	North America	American Arctic	Alaska	Ipiutak
99_1_93	AMNH	M	~1600	Sino-Americas	North America	American Arctic	Alaska	Ipiutak
99_1_94	AMNH	M	~1600	Sino-Americas	North America	American Arctic	Alaska	Ipiutak
99_1_95	AMNH	NA	~1600	Sino-Americas	North America	American Arctic	Alaska	Ipiutak
99_1_256	AMNH	M	Unkw	Sino-Americas	North America	American Arctic	Alaska	NA
99_1_569	AMNH	F	Unkw	Sino-Americas	North America	American Arctic	Alaska	NA
99_1_575	AMNH	F	Unkw	Sino-Americas	North America	American Arctic	Alaska	NA
99_1_586	AMNH	F	Unkw	Sino-Americas	North America	American Arctic	Alaska	NA
99_1_592	AMNH	F	Unkw	Sino-Americas	North America	American Arctic	Alaska	NA
99_1_606	AMNH	F	Unkw	Sino-Americas	North America	American Arctic	Alaska	NA
99_1_607	AMNH	M	Unkw	Sino-Americas	North America	American Arctic	Alaska	NA
99_1_608	AMNH	F	Unkw	Sino-Americas	North America	American Arctic	Alaska	NA

99_1_61	AMNH	M	Unkw	Sino-Americas	North America	American Arctic	Alaska	NA
99_1_619	AMNH	M	Unkw	Sino-Americas	North America	American Arctic	Alaska	NA
99_1_671	AMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_672	AMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_88	AMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_96A	AMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_224	AMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_225	AMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_228	AMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_233	AMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
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99_1_235	AMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
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99_1_242	AMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_246	AMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_248	AMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
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99_1_278	AMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
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99_1_414	AMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_417	AMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara

99_1_421	AMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_422	AMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
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99_1_476	AMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_478	AMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara

99_1_480	AMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
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99_1_497	AMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
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99_1_499	AMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_500	AMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_502	AMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_504	AMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_506	AMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_507	AMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_508	AMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_509	AMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_510	AMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_511	AMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_513	AMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_514	AMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_515	AMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_517	AMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_520	AMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_521	AMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_522	AMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_523	AMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_524	AMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_525	AMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_526	AMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_527	AMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_532	AMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_535	AMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara

99_1_536	AMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_541	AMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_542	AMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_543	AMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_544	AMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_546	AMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_549	AMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_551	AMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_552	AMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_643	AMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_644	AMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_666	AMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_667	AMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_675	AMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_69	AMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
226086	NMNH	F	Unkw	Sahul-Pacific	Oceania	Australia	Victoria	Hexham
226087	NMNH	F	Unkw	Sahul-Pacific	Oceania	Australia	Victoria	Hexham
226089	NMNH	M	Unkw	Sahul-Pacific	Oceania	Australia	South Australia	Murray River
226090	NMNH	F	Unkw	Sahul-Pacific	Oceania	Australia	South Australia	Murray River
329778	NMNH	F	Unkw	Sahul-Pacific	Oceania	Australia	South Australia	Cape Spencer Aborigine
329779	NMNH	M	Unkw	Sahul-Pacific	Oceania	Australia	South Australia	Murray River
330604	NMNH	M	Unkw	Sahul-Pacific	Oceania	Australia	Western Australia	Derby Coast Aborigine
331242	NMNH	M	Unkw	Sahul-Pacific	Oceania	Australia	Central Australia	Aborigine
331243	NMNH	M	Unkw	Sahul-Pacific	Oceania	Australia	South Australia	Plympton Aborigine
331247	NMNH	F	Unkw	Sahul-Pacific	Oceania	Australia	South Australia	Swanport Aborigine
344711	NMNH	M	Unkw	Sahul-Pacific	Oceania	Australia	Victoria	Loddon River Aborigine
344712	NMNH	F	Unkw	Sahul-Pacific	Oceania	Australia	Victoria	Mortlake Aborigine
344713	NMNH	F	Unkw	Sahul-Pacific	Oceania	Australia	Victoria	Murray River Aborigine
344714	NMNH	F	Unkw	Sahul-Pacific	Oceania	Australia	Victoria	Murray River Aborigine
344715	NMNH	F	Unkw	Sahul-Pacific	Oceania	Australia	Victoria	Murray River Aborigine
350096	NMNH	M	Unkw	Sahul-Pacific	Oceania	Australia	South Australia	Aborigine
242687	NMNH	M	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242690	NMNH	F	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242693	NMNH	F	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242694	NMNH	F	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242695	NMNH	M	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242697	NMNH	M	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242698	NMNH	M	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242699	NMNH	F	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit

242702	NMNH	F	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242704	NMNH	F	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242706	NMNH	M	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242707	NMNH	M	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242708	NMNH	F	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242709	NMNH	M	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242710	NMNH	F	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242711	NMNH	F	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242712	NMNH	F	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242714	NMNH	F	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242716	NMNH	M	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242717	NMNH	F	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242718	NMNH	F	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242719	NMNH	F	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242720	NMNH	F	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242721	NMNH	M	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242724	NMNH	F	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242725	NMNH	F	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242726	NMNH	M	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242729	NMNH	M	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242730	NMNH	M	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
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242734	NMNH	M	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242735	NMNH	F	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242736	NMNH	F	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242738	NMNH	F	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242741	NMNH	F	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242742	NMNH	F	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242743	NMNH	F	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242744	NMNH	M	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242745	NMNH	F	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242746	NMNH	F	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242747	NMNH	M	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242748	NMNH	M	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242757	NMNH	F	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242758	NMNH	F	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit

242759	NMNH	F	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242760	NMNH	M	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242761	NMNH	M	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242831	NMNH	M	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242832	NMNH	M	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
242835	NMNH	F	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
225044	NMNH	M	Unkw	Sunda-Pacific	South East Asia	Malay Archipelago	Indonesia	Java
225046	NMNH	M	Unkw	Sunda-Pacific	South East Asia	Malay Archipelago	Indonesia	Java
225047	NMNH	M	Unkw	Sunda-Pacific	South East Asia	Malay Archipelago	Indonesia	Java
225053	NMNH	F	Unkw	Sunda-Pacific	South East Asia	Malay Archipelago	Indonesia	Java
225054	NMNH	M	Unkw	Sunda-Pacific	South East Asia	Malay Archipelago	Indonesia	Java
225055	NMNH	F	Unkw	Sunda-Pacific	South East Asia	Malay Archipelago	Indonesia	Java
225399	NMNH	M	Unkw	Sunda-Pacific	South East Asia	Malay Archipelago	Indonesia	Java
225120	NMNH	NA	Unkw	Sunda-Pacific	South East Asia	Malay Archipelago	Indonesia	Java
225007	NMNH	NA	Unkw	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	New Britain
226096	NMNH	M	Unkw	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	New Britain
226099	NMNH	F	Unkw	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	New Britain
226101	NMNH	F	Unkw	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	New Britain
226102	NMNH	F	Unkw	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	New Britain
226103	NMNH	M	Unkw	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	New Britain
226105	NMNH	F	Unkw	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	New Britain
226107	NMNH	M	Unkw	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	New Britain
226108	NMNH	M	Unkw	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	New Britain
226109	NMNH	F	Unkw	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	New Britain
226110	NMNH	F	Unkw	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	New Britain
226111	NMNH	M	Unkw	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	New Britain
226112	NMNH	F	Unkw	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	New Britain
226113	NMNH	M	Unkw	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	New Britain
226114	NMNH	M	Unkw	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	New Britain
226115	NMNH	M	Unkw	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	New Britain
226116	NMNH	F	Unkw	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	New Britain
226117	NMNH	F	Unkw	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	New Britain
226118	NMNH	M	Unkw	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	New Britain
227464	NMNH	F	Unkw	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	New Britain
381080	NMNH	F	Unkw	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	New Britain
381082	NMNH	F	Unkw	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	New Britain
381083	NMNH	M	Unkw	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	New Britain
205333	NMNH	M	Unkw	Sahul-Pacific	Oceania	Polynesia	New Zealand	NA
225113	NMNH	F	Unkw	Sahul-Pacific	Oceania	Polynesia	New Zealand	NA

225114	NMNH	M	Unkw	Sahul-Pacific	Oceania	Polynesia	New Zealand	NA
225115	NMNH	M	Unkw	Sahul-Pacific	Oceania	Polynesia	New Zealand	NA
226140	NMNH	F	Unkw	Sahul-Pacific	Oceania	Polynesia	New Zealand	NA
226142	NMNH	M	Unkw	Sahul-Pacific	Oceania	Polynesia	New Zealand	NA
226145	NMNH	M	Unkw	Sahul-Pacific	Oceania	Polynesia	New Zealand	NA
226147	NMNH	F	Unkw	Sahul-Pacific	Oceania	Polynesia	New Zealand	NA
226150	NMNH	M	Unkw	Sahul-Pacific	Oceania	Polynesia	New Zealand	NA
226151	NMNH	F	Unkw	Sahul-Pacific	Oceania	Polynesia	New Zealand	NA
226152	NMNH	F	Unkw	Sahul-Pacific	Oceania	Polynesia	New Zealand	NA
226153	NMNH	F	Unkw	Sahul-Pacific	Oceania	Polynesia	New Zealand	NA
226154	NMNH	F	Unkw	Sahul-Pacific	Oceania	Polynesia	New Zealand	NA
226159	NMNH	F	Unkw	Sahul-Pacific	Oceania	Polynesia	New Zealand	NA
381086	NMNH	F	Unkw	Sahul-Pacific	Oceania	Polynesia	New Zealand	NA
381087	NMNH	F	Unkw	Sahul-Pacific	Oceania	Polynesia	New Zealand	NA
221998	NMNH	F	Unkw	Sunda-Pacific	South East Asia	Malay Archipelago	Indonesia	Pagi Island
221999	NMNH	F	Unkw	Sunda-Pacific	South East Asia	Malay Archipelago	Indonesia	Pagi Island
222000	NMNH	F	Unkw	Sunda-Pacific	South East Asia	Malay Archipelago	Indonesia	Pagi Island
222002	NMNH	F	Unkw	Sunda-Pacific	South East Asia	Malay Archipelago	Indonesia	Pagi Island
222003	NMNH	M	Unkw	Sunda-Pacific	South East Asia	Malay Archipelago	Indonesia	Pagi Island
276076	NMNH	F	Unkw	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	NA
276077	NMNH	M	Unkw	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	NA
276078	NMNH	F	Unkw	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	NA
276079	NMNH	M	Unkw	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	NA
276080	NMNH	F	Unkw	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	NA
225129	NMNH	M	Unkw	Sunda-Pacific	South East Asia	Malay Archipelago	Philippines	NA
259353	NMNH	F	Unkw	Sunda-Pacific	South East Asia	Malay Archipelago	Philippines	NA
227456	NMNH	M	Unkw	Sahul-Pacific	Oceania	Melanesia	Solomon Islands	NA
227457	NMNH	F	Unkw	Sahul-Pacific	Oceania	Melanesia	Solomon Islands	NA
227458	NMNH	M	Unkw	Sahul-Pacific	Oceania	Melanesia	Solomon Islands	NA
ANI_23	DW	F	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Andaman Island	NA
ANI_16	DW	F	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Andaman Island	NA
ANI_35	DW	F	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Andaman Island	NA
ANI_37	DW	M	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Andaman Island	NA
ANI_39_40	DW	F	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Andaman Island	NA
ANI_32	DW	F	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Andaman Island	NA
ANI_27	DW	F	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Andaman Island	NA
ANI_36	DW	M	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Andaman Island	NA
ANI_29	DW	F	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Andaman Island	NA
ANI_31	DW	M	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Andaman Island	NA
ANI_33	DW	M	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Andaman Island	NA
ANI_26	DW	F	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Andaman Island	NA
ANI_28	DW	M	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Andaman Island	NA
ANI_30	DW	F	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Andaman Island	NA
ANI_17	DW	F	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Andaman Island	NA
ANI_07	DW	F	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Andaman Island	NA

ANI_11	DW	M	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Andaman Island	NA
ANI_18	DW	F	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Andaman Island	NA
ANI_15	DW	F	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Andaman Island	NA
ANI_10	DW	F	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Andaman Island	NA
ANI_12	DW	F	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Andaman Island	NA
ANI_13	DW	M	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Andaman Island	NA
ANI_19	DW	M	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Andaman Island	NA
ANI_38	DW	M	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Andaman Island	NA
ANI_34	DW	F	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Andaman Island	NA
ANI_43	DW	M	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Nicobar Island	NA
ANI_42	DW	M	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Nicobar Island	NA
ANI_54	DW	M	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Nicobar Island	NA
ANI_41	DW	M	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Nicobar Island	NA
ANI_44	DW	F	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Nicobar Island	NA
ANI_59	DW	M	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Nicobar Island	NA
ANI_56	DW	M	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Nicobar Island	NA
ANI_50	DW	M	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Nicobar Island	NA
ANI_55	DW	M	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Nicobar Island	NA
ANI_61	DW	M	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Nicobar Island	NA
ANI_57	DW	M	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Nicobar Island	NA
ANI_58	DW	M	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Nicobar Island	NA
ANI_47	DW	M	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Nicobar Island	NA
ANI_49	DW	M	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Nicobar Island	NA
ANI_51	DW	M	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Nicobar Island	NA
ANI_48	DW	M	<200	Sunda-Pacific	South East Asia	Andaman Archipelago	Nicobar Island	NA
BU_28	DW	F	<200	Sunda-Pacific	South East Asia	Indochinese Peninsula	Myanmar	NA
BU_29	DW	M	<200	Sunda-Pacific	South East Asia	Indochinese Peninsula	Myanmar	NA
BU_21	DW	M	<200	Sunda-Pacific	South East Asia	Indochinese Peninsula	Myanmar	NA
BU_19	DW	M	<200	Sunda-Pacific	South East Asia	Indochinese Peninsula	Myanmar	NA
BU_04	DW	M	<200	Sunda-Pacific	South East Asia	Indochinese Peninsula	Myanmar	NA
BU_32	DW	M	<200	Sunda-Pacific	South East Asia	Indochinese Peninsula	Myanmar	NA
BU_14	DW	M	<200	Sunda-Pacific	South East Asia	Indochinese Peninsula	Myanmar	NA
BU_01	DW	F	<200	Sunda-Pacific	South East Asia	Indochinese Peninsula	Myanmar	NA
BU_31	DW	M	<200	Sunda-Pacific	South East Asia	Indochinese Peninsula	Myanmar	NA
BU_16	DW	M	<200	Sunda-Pacific	South East Asia	Indochinese Peninsula	Myanmar	NA
BU_10	DW	M	<200	Sunda-Pacific	South East Asia	Indochinese Peninsula	Myanmar	NA
MEL_120	DW	M	<200	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	Oriomo River Daudai
MEL_219	DW	F	<200	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	Murua Island Muyuw

MEL_264	DW	M	<200	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	NA
MEL_104	DW	F	<200	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	Kwaiawata Island Muyuw
MEL_197	DW	M	<200	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	Murua Island Muyuw
MEL_258	DW	M	<200	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	Kwaiawata Island Muyuw
MEL_259	DW	M	<200	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	Kwaiawata Island Muyuw
MEL_272	DW	M	<200	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	Kwaiawata Island Muyuw
MEL_273	DW	M	<200	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	Kwaiawata Island Muyuw
MEL_189	DW	M	<200	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	Murua Island Muyuw
SAS_13	DW	F	<200	West Eurasia	South Asia	Indian Sub-Continent	North India	Punjab
SAS_19	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	Pakistan	NA
SAS_16	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	Pakistan	Pathan
SAS_44	DW	F	<200	West Eurasia	South Asia	Indian Sub-Continent	South India	Deccan Berars
SAS_45	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	East India	Patna
SAS_08	DW	F	<200	West Eurasia	South Asia	Indian Sub-Continent	North India	Naharhmpikya Sinhalese
SAS_29	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	North India	Punjab
SAS_23	DW	F	<200	West Eurasia	South Asia	Indian Sub-Continent	North India	Punjab
SAS_07	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	North India	NA
SAS_04	DW	F	<200	West Eurasia	South Asia	Indian Sub-Continent	North India	Veddah
SAS_31	DW	F	<200	West Eurasia	South Asia	Indian Sub-Continent	North India	Punjab
SAS_81	DW	F	<200	West Eurasia	South Asia	Indian Sub-Continent	India	NA
SAS_57	DW	F	<200	West Eurasia	South Asia	Indian Sub-Continent	East India	Hindustan Bihar
SAS_10	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	Sri Lanka	Colombo
SAS_17	DW	F	<200	West Eurasia	South Asia	Indian Sub-Continent	Pakistan	Pathan
SAS_15	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	Pakistan	Pathan
SAS_27	DW	F	<200	West Eurasia	South Asia	Indian Sub-Continent	North India	Punjab
SAS_20	DW	F	<200	West Eurasia	South Asia	Indian Sub-Continent	North India	Punjab
SAS_03	DW	F	<200	West Eurasia	South Asia	Indian Sub-Continent	North India	Veddah
SAS_60	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	North India	NA
SAS_54	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	North India	Hindustan
SAS_71	DW	F	<200	West Eurasia	South Asia	Indian Sub-Continent	Bangladesh	Bengal
SAS_46	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	East India	Bihari
SAS_61	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	North India	Pakistan
SAS_39	DW	F	<200	West Eurasia	South Asia	Indian Sub-Continent	East India	Bengal
SAS_35	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	East India	Bengal
SAS_47	DW	F	<200	West Eurasia	South Asia	Indian Sub-Continent	East India	Bihari
SAS_02	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	North India	Veddah
SAS_51	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	South India	Coorg
SAS_40	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	East India	Bengal

SAS_84	DW	F	<200	West Eurasia	South Asia	Indian Sub-Continent	India	NA
SAS_34	DW	F	<200	West Eurasia	South Asia	Indian Sub-Continent	East India	Bengal
SAS_01	DW	F	<200	West Eurasia	South Asia	Indian Sub-Continent	North India	Veddah
SAS_09	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	Sri Lanka	Colombo
SAS_69	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	Bangladesh	Bengal
SAS_83	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	India	Hindu
SAS_77	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	South India	Dravidian
SAS_56	DW	F	<200	West Eurasia	South Asia	Indian Sub-Continent	West India	Mumbai Parsi
SAS_38	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	East India	Bengal
SAS_53	DW	F	<200	West Eurasia	South Asia	Indian Sub-Continent	Sri Lanka	Ballam Coffa
SAS_78	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	South India	NA
SAS_36	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	East India	Bengal
SAS_42	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	India Unkw	Ballam Coffa
SAS_11	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	North India	NA
SAS_55	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	Sri Lanka	Eingenadu
SAS_67	DW	F	<200	West Eurasia	South Asia	Indian Sub-Continent	India Unkw	NA
SAS_70	DW	F	<200	West Eurasia	South Asia	Indian Sub-Continent	Bangladesh	Bengal
SAS_75	DW	F	<200	West Eurasia	South Asia	Indian Sub-Continent	India Unkw	NA
SAS_79	DW	F	<200	West Eurasia	South Asia	Indian Sub-Continent	India	Hindu
SAS_37	DW	F	<200	West Eurasia	South Asia	Indian Sub-Continent	East India	Bengal Bangladesh
SAS_28	DW	F	<200	West Eurasia	South Asia	Indian Sub-Continent	North India	Punjab
SAS_26	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	North India	Punjab
SAS_30	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	North India	Punjab
SAS_52	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	South India	Paliyan Tribe
SAS_25	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	North India	Punjab
SAS_24	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	North India	Punjab
SAS_21	DW	F	<200	West Eurasia	South Asia	Indian Sub-Continent	North India	Punjab
SAS_33	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	East India	Bengal
SAS_05	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	North India	Veddah
SAS_62	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	East India	NA
SAS_48	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	East India	Hindustan Bihar
SAS_68	DW	F	<200	West Eurasia	South Asia	Indian Sub-Continent	East India	Bengal Bangladesh
5423	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Western Africa	Nigeria	Kagoro
6087	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Western Africa	Nigeria	Kaduna
1734	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Southern Africa	South Africa	Basuto
1743	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Southern Africa	South Africa	Port Elizabeth
5340	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Akamba
AF1082	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	NA

1755	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Southern Africa	South Africa	Wynberg San
3731	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Southern Africa	South Africa	Knysna Cave
1728	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Western Africa	Guinea	NA
5585	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Southern Africa	Namibia	Walvis Bay
5651	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Western Africa	Nigeria	Muri Province
1735	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Southern Africa	South Africa	Manatee Cradock
5425	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Western Africa	Nigeria	Gannawarri
1747	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Southern Africa	South Africa	Korana
5060	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Central Africa	Congo	Brazaville
4_93	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Western Africa	Nigeria	NA
1733	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Southern Africa	South Africa	Amaponda
6097	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Western Africa	Nigeria	Yola
AF_35_0_1	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Southern Africa	South Africa	NA
1731	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Southern Africa	Angola	Luanda
4697	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Western Africa	Nigeria	NA
6110	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Southern Africa	South Africa	Bechuanaland
1732	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Southern Africa	SSA Unkw	NA
6109	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Southern Africa	South Africa	Bechuanaland
5424	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Western Africa	Nigeria	Kagoro
6093	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Uganda	Teso
4197	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Southern Africa	South Africa	NA
6089	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Nigeria	Kaduna
AF_0_1	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Mozambique	Makua
1721	DW	M	<1000	West Eurasia	North Africa	Northern Africa	Canary Islands	Guanche
1769	DW	M	<200	West Eurasia	North Africa	Northern Africa	Egypt	NA
1777	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Central Africa	Congo	Upper Congo River
1751	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Southern Africa	South Africa	Kalahari
5058	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Central Africa	Congo	Bambuti Pygmy
5643	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Western Africa	Ghana	Ashanti
1749	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Southern Africa	South Africa	NA
1729	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Central Africa	Congo	NA
1709	DW	M	<1000	West Eurasia	North Africa	Northern Africa	Canary Islands	Guanche
1722	DW	F	<1000	West Eurasia	North Africa	Northern Africa	Canary Islands	Guanche
6094	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Uganda	Teso
1711	DW	M	<1000	West Eurasia	North Africa	Northern Africa	Canary Islands	Guanche
3732	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Southern Africa	South Africa	Knysna Cave
6092	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Uganda	NA

1737	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Southern Africa	South Africa	Amakhosa Great Winterberg
1727	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Makua
1774	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	NA
4696	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Western Africa	Nigeria	NA
Af_31_0_1	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Zimbabwe	NA
1730	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Western Africa	Guinea	NA
1739	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Southern Africa	South Africa	Khoikhoi
6096	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Western Africa	Nigeria	Yola
1744	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Southern Africa	South Africa	Knysna Cave
149	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Southern Africa	South Africa	NA
Af_44_0_2	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Western Africa	Nigeria	Yoruba Ilorin
1738	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Southern Africa	South Africa	NA
Af_20_0_1	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	SSA Unkw	SSA Unkw	Bantu Kaoisoudo
6085	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	NA
1778	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Central Africa	Congo	NA
AF_30_0_1	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Southern Africa	South Africa	NA
5418	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Kikuyu
AF_44_0_4	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Western Africa	Nigeria	Yoruba Ilorin
1725	DW	M	200	Sub-Saharan Africa	Sub-Saharan Africa	Western Africa	Ghana	Fanti
5428	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Western Africa	Nigeria	Kagoro
5701	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Western Africa	Nigeria	Muri Province
AF_15_0_6	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	Jilili
AF_15_0_27	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	Darood
AF_15_0_30	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	NA
AF_15_0_22	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	Darood
AF_15_0_34	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	Darood Hawiya
AF_15_0_17	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	Darood
AF_15_0_50	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	Darood Hawiya
AF_15_0_48	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	Darood Hawiya
AF_15_0_19	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	Darood
AF_15_0_11	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	Tegera Well
AF_15_0_23	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	Darood
AF_15_0_70	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	Darood Hawiya
AF_15_0_62	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	NA
AF_15_0_5	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	Didali
AF_15_0_55	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	Darood Hawiya
AF_15_0_53	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	Darood Hawiya

AF_15_0_12	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	Ainaho, Hahr Jalo or Daldshantu tribe
AF_15_0_18	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	Darood
AF_15_0_69	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	Darood Hawiya
AF_15_0_1	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	Ali Kush
AF_15_0_41	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	Darood Hawiya
AF_15_0_64	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	Darood Hawiya
AF_15_0_32	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	Darood Hawiya
AF_15_0_42	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	Darood Hawiya
AF_15_0_65	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	Darood Hawiya
AF_15_0_02	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	Hariya
AF_15_0_31	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	NA
AF_15_0_25	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	Darood
AF_15_0_16	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	Ainaho, Burao
AF_15_0_13	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	Ainaho, Burao
AF_15_0_03	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	Hadad
AF_15_0_47	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	Darood Hawiya
AF_15_0_67	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	Darood Hawiya
AF_15_0_33	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	Darood Hawiya
AF_23_0_22	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_0_30	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_0_19	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_0_23	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_0_32	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_0_112	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_0_113	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_0_17	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_0_31	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_0_109	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_0_04	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_0_20	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_0_219	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_0_223	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_0_228	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_0_224	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_0_39	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_0_27	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_0_37	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya

AF_23_O_111	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_O_21_	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_O_209	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_O_35	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_O_118	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_O_115	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_O_225	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_O_119	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_O_110	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_O_44	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_O_38	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_O_213	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_O_36	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_O_218	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_O_25	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_O_42	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_O_114	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_O_200	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_O_18	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_O_202	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_O_116	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_O_227	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_O_226	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_O_34	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_O_8	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_O_16	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
AF_23_O_2	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Haya
1067	DW	M	<200	West Eurasia	Europe	Western Europe	France	NA
1065	DW	M	<200	West Eurasia	Europe	Central Europe	Switzerland	St Bernard
Eu_25_00_2	DW	F	<200	West Eurasia	Europe	Central Europe	Switzerland	Graubunden Saint Moritz
Eu_25_00_1	DW	M	<200	West Eurasia	Europe	Central Europe	Switzerland	Graubunden Saint Moritz
1036	DW	M	<200	West Eurasia	Europe	Western Europe	France	NA
1181	DW	M	<200	West Eurasia	Europe	Central Europe	Austrian	NA
1178	DW	M	<200	West Eurasia	Europe	Northern Europe	Sweden	NA
2235	DW	M	<200	West Eurasia	Europe	Western Europe	France	Paris
3000	DW	M	<200	West Eurasia	Europe	Central Europe	Hungary	NA
1143	DW	M	<200	West Eurasia	Europe	Central Europe	Austrian	Vienna
Eu_26_00_2	DW	M	<200	West Eurasia	Europe	Central Europe	Germany	Halle

1150	DW	F	<200	West Eurasia	Europe	Central Europe	Austrian	NA
Eu_31_0_1	DW	M	<200	West Eurasia	Europe	Eastern Europe	Ukraine	Crime Sebastopol
1051	DW	M	<200	West Eurasia	Europe	Western Europe	France	Brittany
1042	DW	M	<200	West Eurasia	Europe	Western Europe	France	NA
Eu_26_00_1	DW	M	<200	West Eurasia	Europe	Central Europe	Germany	Halle
Eu_31_00_1	DW	M	<200	West Eurasia	Europe	Eastern Europe	Russia	Khanty Kondinski
1155	DW	M	<200	West Eurasia	Europe	Central Europe	Czechoslovakia	NA
Eu_31_00_2	DW	F	<200	West Eurasia	Europe	Eastern Europe	Russia	Salekhard
1173	DW	F	<200	West Eurasia	Europe	Northern Europe	Finland	Lapland
Eu_42_00_1	DW	F	<200	West Eurasia	Europe	Southern Europe	Italy	NA
Eu_34_4_1	DW	F	<200	West Eurasia	Europe	Central Europe	Hungary	Toszeg
Eu_24_00_2	DW	F	<200	West Eurasia	Europe	Western Europe	France	NA
Eu_45_4_1	DW	M	<200	West Eurasia	Europe	Southern Europe	Spain	Minorca
Eu_44_0_3	DW	M	<200	West Eurasia	Europe	Southern Europe	Italy	Sardinia
1114	DW	M	<200	West Eurasia	Europe	Southern Europe	Italy	Paestum
Eu_42_00_5	DW	F	<200	West Eurasia	Europe	Southern Europe	Italy	Lazio
Eu_44_00_1	DW	F	<200	West Eurasia	Europe	Southern Europe	Italy	Sardinia
Eu_24_00_1	DW	M	<200	West Eurasia	Europe	Western Europe	France	NA
Eu_1_5_67	DW	M	<200	West Eurasia	Europe	Western Europe	England	NA
1121	DW	M	<200	West Eurasia	Europe	Southern Europe	Italy	Rome
Eu_43_00_4	DW	F	<200	West Eurasia	Europe	Southern Europe	Malta	Bingemma
Eu_1_5_82	DW	M	<200	West Eurasia	Europe	Western Europe	England	South Wilshire
Eu_45_4_2	DW	F	<200	West Eurasia	Europe	Southern Europe	Spain	Minorca
Eu_45_4_3	DW	F	<200	West Eurasia	Europe	Southern Europe	Spain	Minorca
1118	DW	F	<200	West Eurasia	Europe	Southern Europe	Italy	Sardinia
Eu_42_00_2	DW	F	<200	West Eurasia	Europe	Southern Europe	Italy	NA
Eu_43_00_3	DW	M	<200	West Eurasia	Europe	Southern Europe	Malta	Tal Horr
5903	DW	M	<200	West Eurasia	Europe	Southern Europe	Greece	Thessaly
1120	DW	M	<200	West Eurasia	Europe	Southern Europe	Italy	Rome
6044	DW	M	<200	West Eurasia	Europe	Southern Europe	Italy	Sicily
1898	DW	M	<200	Sino-Americas	South America	Andean	Argentina	Rio Gallegos
CA019	DW	F	<200	Sino-Americas	North America	Caribbean	Jamaica	NA
CA004	DW	F	<200	Sino-Americas	Central America	Central America	Guatemala	Gondaiaio
CA025	DW	M	<200	Sino-Americas	North America	Caribbean	Jamaica	NA
CA017	DW	M	<200	Sino-Americas	North America	Caribbean NA	Jamaica	NA
NA023	DW	F	<200	Sino-Americas	North America	Northeast Woodlands	United States	Iroquois
SA032	DW	M	<200	Sino-Americas	South America	Andean	Peru	NA
SA010	DW	F	<200	Sino-Americas	South America	Andean	Chile	Valparaiso
SA008	DW	M	<200	Sino-Americas	South America	Andean	Chile	NA
SA021	DW	M	<200	Sino-Americas	South America	Andean	Peru	NA
SA038	DW	M	<200	Sino-Americas	South America	Andean	Peru	Pasamayo
SA001	DW	F	<200	Sino-Americas	South America	SA Unkw	SA Unkw	NA
CA001	DW	M	<200	Sino-Americas	South America	Caribbean	Barbados	Arawak

NA065	DW	F	<200	Sino-Americas	North America	NA Unkw	NA Unkw	NA
NA024	DW	F	<700	Sino-Americas	North America	NA South West	United States	Ketchipawan
CA014	DW	M	<200	Sino-Americas	North America	Caribbean	Jamaica	NA
NA015	DW	F	<700	Sino-Americas	North America	NA South West	United States	Ketchipawan
NA011	DW	F	<700	Sino-Americas	North America	NA South West	United States	Ketchipawan
SA045	DW	F	<200	Sino-Americas	South America	Andean	Peru	NA
SA019	DW	M	<200	Sino-Americas	South America	Andean	Peru	NA
NA52	DW	M	<700	Sino-Americas	North America	NA South West	United States	Ketchipawan
SA26	DW	F	<200	Sino-Americas	South America	Andean	Peru	NA
NA72	DW	M	<200	Sino-Americas	North America	NA Plains	United States	Sioux
SA23	DW	F	<200	Sino-Americas	South America	Andean	Peru	NA
NA001	DW	F	<700	Sino-Americas	North America	NA South West	United States	Ketchipawan
NA46	DW	F	<700	Sino-Americas	North America	NA South West	United States	Ketchipawan
SA39	DW	M	<200	Sino-Americas	South America	Andean	Peru	NA
SA37	DW	M	<200	Sino-Americas	South America	Andean	Peru	NA
SA44	DW	F	<200	Sino-Americas	South America	Andean	Peru	NA
SA17	DW	M	<200	Sino-Americas	South America	Andean	Peru	NA
SA007	DW	M	<200	Sino-Americas	South America	Andean	Chile	NA
SA020	DW	F	<200	Sino-Americas	South America	Andean	Peru	NA
NA002	DW	F	<700	Sino-Americas	North America	NA South West	United States	Ketchipawan
NA071	DW	M	<200	Sino-Americas	North America	NA South West	United States	Apache
NA034	DW	F	<700	Sino-Americas	North America	NA South West	United States	Ketchipawan
SA18	DW	F	<200	Sino-Americas	South America	Andean	Peru	NA
CA10	DW	F	<200	Sino-Americas	North America	Caribbean	Jamaica	NA
SA15	DW	F	<200	Sino-Americas	South America	Andean	Peru	NA
SA006	DW	M	<200	Sino-Americas	South America	Andean	Chile	NA
NA_12	DW	F	<700	Sino-Americas	North America	NA South West	United States	Ketchipawan
CA95	DW	F	<200	Sino-Americas	North America	Caribbean	Jamaica	NA
CA26	DW	M	<200	Sino-Americas	North America	Caribbean	Jamaica	NA
NA45	DW	F	<700	Sino-Americas	North America	NA South West	United States	Ketchipawan
SA16	DW	M	<200	Sino-Americas	South America	Andean	Peru	NA
SA25	DW	M	<200	Sino-Americas	South America	Andean	Peru	NA
NA68	DW	F	<200	Sino-Americas	North America	NA Plains	United States	NA
SA_58	DW	F	<200	Sino-Americas	South America	Andean	Peru	NA
POL_41	DW	F	<200	Sahul-Pacific	Oceania	Polynesia	New Zealand	Maori
POL_43	DW	F	<200	Sahul-Pacific	Oceania	Polynesia	New Zealand	Maori
POL_002	DW	M	<200	Sahul-Pacific	Oceania	Polynesia	New Zealand	Maori
POL_11	DW	F	<200	Sahul-Pacific	Oceania	Polynesia	New Zealand	Maori
POL_19	DW	M	<200	Sahul-Pacific	Oceania	Polynesia	New Zealand	Maori
POL_05	DW	F	<200	Sahul-Pacific	Oceania	Polynesia	New Zealand	Maori
POL_24	DW	M	<200	Sahul-Pacific	Oceania	Polynesia	New Zealand	Maori
POL_22	DW	M	<200	Sahul-Pacific	Oceania	Polynesia	New Zealand	Maori
POL_09	DW	M	<200	Sahul-Pacific	Oceania	Polynesia	New Zealand	Maori
POL_40	DW	F	<200	Sahul-Pacific	Oceania	Polynesia	New Zealand	Maori
NA_138	DW	M	<200	Sino-Americas	North America	American Arctic	American Arctic Unkw	Inuit
POL_15	DW	M	<200	Sahul-Pacific	Oceania	Polynesia	New Zealand	Maori
POL_23	DW	F	<200	Sahul-Pacific	Oceania	Polynesia	New Zealand	Maori
NA_139	DW	F	<200	Sino-Americas	North America	American Arctic	American Arctic Unkw	Inuit
POL_12	DW	M	<200	Sahul-Pacific	Oceania	Polynesia	New Zealand	Maori
NA_163	DW	F	<200	Sino-Americas	North America	American Arctic	American Arctic Unkw	Inuit
NA_147	DW	M	<200	Sino-Americas	North America	American Arctic	American Arctic Unkw	Inuit
POL_17	DW	M	<200	Sahul-Pacific	Oceania	Polynesia	New Zealand	Maori
NA_173	DW	F	<200	Sino-Americas	North America	NA Unkw NA	NA Unkw	NA
NA_110	DW	NA	<200	Sino-Americas	North America	Northwest Coast	Canada	Vancouver Island
NA_154	DW	F	<200	Sino-Americas	North America	American Arctic	American Arctic Unkw	Inuit
POL_45	DW	M	<200	Sahul-Pacific	Oceania	Polynesia	New Zealand	Maori
NA_149	DW	M	<200	Sino-Americas	North America	American Arctic	American Arctic Unkw	Inuit

NA_87	DW	M	<200	Sino-Americas	North America	NA Northwest Coast	Canada	New Westminster
POL_06	DW	M	<200	Sahul-Pacific	Oceania	Polynesia	New Zealand	Maori
POL_18	DW	M	<200	Sahul-Pacific	Oceania	Polynesia	New Zealand	Maori
NA_137	DW	F	<200	Sino-Americas	North America	American Arctic	American Arctic Unkw	Inuit
POL_13	DW	M	<200	Sahul-Pacific	Oceania	Polynesia	New Zealand	Maori
NA_145	DW	F	<200	Sino-Americas	North America	American Arctic	American Arctic Unkw	Inuit
NA_67	DW	F	<200	Sino-Americas	North America	NA Northwest Coast	United States	NA
NA_133	DW	F	<200	Sino-Americas	North America	American Arctic	American Arctic Unkw	Inuit
NA_151	DW	F	<200	Sino-Americas	North America	American Arctic	American Arctic Unkw	Inuit
NA_123	DW	M	<200	Sino-Americas	North America	American Arctic	American Arctic Unkw	Inuit
NA_124	DW	F	<200	Sino-Americas	North America	American Arctic	Greenland	Inuit
NA_136	DW	M	<200	Sino-Americas	North America	American Arctic	American Arctic Unkw	Inuit
NA_140	DW	M	<200	Sino-Americas	North America	American Arctic	American Arctic Unkw	Inuit
NA_105	DW	F	<200	Sino-Americas	North America	NA Northwest Coast	Canada	Vancouver Island
NA_62	DW	M	<200	Sino-Americas	North America	NA South West	United States	Zuni
NA_135	DW	M	<200	Sino-Americas	North America	American Arctic	American Arctic Unkw	Inuit
NA_68	DW	F	<200	Sino-Americas	North America	NA Plains	United States	NA
NA_111	DW	F	<200	Sino-Americas	North America	NA Northwest Coast	United States	Makah
NA_150	DW	F	<200	Sino-Americas	North America	American Arctic	American Arctic Unkw	Inuit
NA_144	DW	F	<200	Sino-Americas	North America	American Arctic	American Arctic Unkw	Inuit
NA_121	DW	F	<200	Sino-Americas	North America	American Arctic	Greenland	Inuit
NA_182	DW	M	<200	Sino-Americas	North America	NA Unkw	NA Unkw	Eleanor Bay Native American
NA_82	DW	M	<200	Sino-Americas	North America	NA Northeast Woodlands	Canada	Huron
POL_44	DW	M	<200	Sahul-Pacific	Oceania	Polynesia	New Zealand	Maori
NA_95	DW	M	<200	Sino-Americas	North America	NA Northwest Coast	Canada	Vancouver Island
NA_72	DW	M	<200	Sino-Americas	North America	NA Plains	United States	Sioux
NA_89	DW	M	<200	Sino-Americas	North America	NA Northwest Coast	Canada	New Westminster
NA_132	DW	F	<200	Sino-Americas	North America	American Arctic	American Arctic Unkw	Inuit
NA_75	DW	F	<200	Sino-Americas	North America	NA Northeast Woodlands	United States	Iroquois
NA_71	DW	M	<200	Sino-Americas	North America	NA South West	United States	Apache
NA_84	DW	F	<200	Sino-Americas	North America	NA Subarctic	Canada	Manitoba
NA_153	DW	M	<200	Sino-Americas	North America	American Arctic	American Arctic Unkw	Inuit
NA_98	DW	F	<200	Sino-Americas	North America	NA Northwest Coast	Canada	Vancouver Island
NA_164	DW	F	<200	Sino-Americas	North America	American Arctic	American Arctic Unkw	Inuit
NA_102	DW	M	<200	Sino-Americas	North America	NA Northwest Coast	Canada	Vancouver Island

NA_97	DW	F	<200	Sino-Americas	North America	NA Northwest Coast	Canada	Vancouver Island
NA_183	DW	M	<200	Sino-Americas	North America	NA Unkw	NA Unkw	Native American
NA_61	DW	F	<200	Sino-Americas	North America	NA South West NA	United States	Zuni
NA_83	DW	M	<200	Sino-Americas	North America	NA Northeast Woodlands	Canada	Huron
NA_104	DW	M	<200	Sino-Americas	North America	NA Northwest Coast	Canada	Vancouver Island
NA_76	DW	M	<200	Sino-Americas	North America	NA Northeast Woodlands	United States	Iroquois
NA_101	DW	F	<200	Sino-Americas	North America	NA Northwest Coast	Canada	Vancouver Island
NA_92	DW	M	<200	Sino-Americas	North America	NA Northwest Coast	Canada	Vancouver Island
NA_81	DW	M	<200	Sino-Americas	North America	NA Northeast Woodlands	Canada	Huron
NA_74	DW	M	<200	Sino-Americas	North America	NA Northeast Woodlands	Canada	Huron
NA_134	DW	F	<200	Sino-Americas	North America	NA American Arctic	American Arctic Unkw	Inuit
NU_761	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	SSA Unkw	SSA Unkw	NA
AUS_001	DW	M	<200	Sahul-Pacific	Oceania	Australia	Australia Unkw	NA
AUS_016	DW	M	<200	Sahul-Pacific	Oceania	Australia	Australia Unkw	Aborigine
AUS_017	DW	F	<200	Sahul-Pacific	Oceania	Australia	Australia Unkw	NA
AUS_020	DW	M	<200	Sahul-Pacific	Oceania	Australia	Australia Unkw	NA
AUS_022	DW	F	<200	Sahul-Pacific	Oceania	Australia	Australia Unkw	NA
AUS_023	DW	M	<200	Sahul-Pacific	Oceania	Australia	Australia Unkw	NA
AUS_024	DW	M	<200	Sahul-Pacific	Oceania	Australia	Australia Unkw	Aborigine
AUS_025	DW	M	<200	Sahul-Pacific	Oceania	Australia	Australia Unkw	Aborigine
AUS_027	DW	F	<200	Sahul-Pacific	Oceania	Australia	Australia Unkw	NA
AUS_028	DW	F	<200	Sahul-Pacific	Oceania	Australia	Australia Unkw	NA
AUS_029	DW	M	<200	Sahul-Pacific	Oceania	Australia	Australia Unkw	NA
AUS_030	DW	M	<200	Sahul-Pacific	Oceania	Australia	Australia Unkw	Aborigine
AUS_032	DW	M	<200	Sahul-Pacific	Oceania	Australia	Australia Unkw	NA
AUS_037	DW	M	<200	Sahul-Pacific	Oceania	Australia	Victoria	NA
AUS_046	DW	F	<200	Sahul-Pacific	Oceania	Australia	Australia Unkw	Aborigine
AUS_047	DW	F	<200	Sahul-Pacific	Oceania	Australia	Australia Unkw	NA
AUS_048	DW	F	<200	Sahul-Pacific	Oceania	Australia	Australia Unkw	NA
AUS_049	DW	F	<200	Sahul-Pacific	Oceania	Australia	Australia Unkw	NA
AUS_050	DW	F	<200	Sahul-Pacific	Oceania	Australia	Australia Unkw	NA
AUS_051	DW	M	<200	Sahul-Pacific	Oceania	Australia	Australia Unkw	Aborigine
AUS_053	DW	M	<200	Sahul-Pacific	Oceania	Australia	Australia Unkw	Aborigine
AUS_054	DW	F	<200	Sahul-Pacific	Oceania	Australia	Australia Unkw	NA
AUS_055	DW	M	<200	Sahul-Pacific	Oceania	Australia	Australia Unkw	NA
AUS_056	DW	F	<200	Sahul-Pacific	Oceania	Australia	Australia Unkw	NA
AUS_058	DW	M	<200	Sahul-Pacific	Oceania	Australia	Australia Unkw	NA
AUS_059	DW	F	<200	Sahul-Pacific	Oceania	Australia	Western Australia	Baiono
AUS_062	DW	M	<200	Sahul-Pacific	Oceania	Australia	Western Australia	Perth
AUS_077	DW	M	<200	Sahul-Pacific	Oceania	Australia	Australia Unkw	Aborigine
AUS_078	DW	M	<200	Sahul-Pacific	Oceania	Australia	Australia Unkw	NA
AUS_079	DW	F	<200	Sahul-Pacific	Oceania	Australia	South Australia	NA
AUS_080	DW	M	<200	Sahul-Pacific	Oceania	Australia	South Australia	NA
AUS_081	DW	M	<200	Sahul-Pacific	Oceania	Australia	South Australia	NA
AUS_082	DW	M	<200	Sahul-Pacific	Oceania	Australia	South Australia	NA
AUS_083	DW	F	<200	Sahul-Pacific	Oceania	Australia	Australia Unkw	NA
AUS_093	DW	F	<200	Sahul-Pacific	Oceania	Australia	South Australia	NA
AUS_094	DW	F	<200	Sahul-Pacific	Oceania	Australia	South East Australia	NA

AUS_095	DW	F	<200	Sahul-Pacific	Oceania	Australia	South East Australia	NA
AUS_096	DW	F	<200	Sahul-Pacific	Oceania	Australia	Victoria	NA
AUS_102	DW	M	<200	Sahul-Pacific	Oceania	Australia	New South Wales	Aborigine
AUS_104	DW	M	<200	Sahul-Pacific	Oceania	Australia	South East Australia	NA
AUS_105	DW	M	<200	Sahul-Pacific	Oceania	Australia	New South Wales	Aborigine
AUS_106	DW	M	<200	Sahul-Pacific	Oceania	Australia	Australia Unkw	NA
AUS_107	DW	F	<200	Sahul-Pacific	Oceania	Australia	New South Wales	Mem Mem
AUS_108	DW	M	<200	Sahul-Pacific	Oceania	Australia	New South Wales	Berida
AUS_109	DW	M	<200	Sahul-Pacific	Oceania	Australia	New South Wales	Wollongong
AUS_110	DW	F	<200	Sahul-Pacific	Oceania	Australia	New South Wales	Newcastle
AUS_113	DW	M	<200	Sahul-Pacific	Oceania	Australia	New South Wales	Murray River
AUS_114_1	DW	M	<200	Sahul-Pacific	Oceania	Australia	New South Wales	Murray River
AUS_116	DW	F	<200	Sahul-Pacific	Oceania	Australia	New South Wales	Murray River
AUS_119	DW	F	<200	Sahul-Pacific	Oceania	Australia	New South Wales	Murray River
AUS_120	DW	M	<200	Sahul-Pacific	Oceania	Australia	New South Wales	Murray River
AUS_121	DW	F	<200	Sahul-Pacific	Oceania	Australia	New South Wales	Murray River
AUS_122	DW	M	<200	Sahul-Pacific	Oceania	Australia	Queensland	NA
AUS_123	DW	F	<200	Sahul-Pacific	Oceania	Australia	Queensland	Mackay Aborigine
AUS_124	DW	M	<200	Sahul-Pacific	Oceania	Australia	Queensland	Aborigine
AUS_125	DW	F	<200	Sahul-Pacific	Oceania	Australia	Queensland	Croydon
AUS_126	DW	M	<200	Sahul-Pacific	Oceania	Australia	Queensland	Queensland Croydon
AUS_127	DW	M	<200	Sahul-Pacific	Oceania	Australia	Queensland	Queensland North
AUS_128	DW	M	<200	Sahul-Pacific	Oceania	Australia	Queensland	Queensland North
AUS_129	DW	M	<200	Sahul-Pacific	Oceania	Australia	Queensland	Queensland North
AUS_130	DW	F	<200	Sahul-Pacific	Oceania	Australia	Queensland	Queensland North
AUS_131	DW	F	<200	Sahul-Pacific	Oceania	Australia	Queensland	Queensland North
AF_11_5_28	DW	F	6400-6000	West Eurasia	North Africa	North East Africa	Egypt	Badari
AF_11_5_21	DW	F	6400-6000	West Eurasia	North Africa	North East Africa	Egypt	Badari
AF_11_5_42	DW	M	6400-6000	West Eurasia	North Africa	North East Africa	Egypt	Badari
AF_11_5_04	DW	F	6400-6000	West Eurasia	North Africa	North East Africa	Egypt	Badari
AF_11_5_17	DW	F	6400-6000	West Eurasia	North Africa	North East Africa	Egypt	Badari
AF_11_5_10	DW	M	6400-6000	West Eurasia	North Africa	North East Africa	Egypt	Badari
AF_11_5_40	DW	M	6400-6000	West Eurasia	North Africa	North East Africa	Egypt	Badari
AF_12_4_25	DW	M	2100-1400	West Eurasia	North Africa	North East Africa	Sudan	Jebel Moya
AF_11_5_22	DW	F	6400-6000	West Eurasia	North Africa	North East Africa	Egypt	Badari
AF_11_5_25	DW	F	6400-6000	West Eurasia	North Africa	North East Africa	Egypt	Badari
AF_12_4_28	DW	M	2100-1400	West Eurasia	North Africa	North East Africa	Sudan	Jebel Moya
AF_12_4_18	DW	M	2100-1400	West Eurasia	North Africa	North East Africa	Sudan	Jebel Moya
AF_12_4_08	DW	M	2100-1400	West Eurasia	North Africa	North East Africa	Sudan	Jebel Moya
AF_11_5_27	DW	F	6000-5200	West Eurasia	North Africa	North East Africa	Egypt	Nagada

AF_11_5_59	DW	M	6000-5200	West Eurasia	North Africa	North East Africa	Egypt	Nagada
AF_11_5_55	DW	M	6000-5200	West Eurasia	North Africa	North East Africa	Egypt	Nagada
AF_11_5_34	DW	M	6000-5200	West Eurasia	North Africa	North East Africa	Egypt	Nagada
AF_11_5_53	DW	M	6000-5200	West Eurasia	North Africa	North East Africa	Egypt	Nagada
AF_11_5_02	DW	F	6000-5200	West Eurasia	North Africa	North East Africa	Egypt	Nagada
AF_12_4_07	DW	M	6000-5200	West Eurasia	North Africa	North East Africa	Egypt	Nagada
AF_11_5_12	DW	F	6000-5200	West Eurasia	North Africa	North East Africa	Egypt	Nagada
AF_12_4_15	DW	M	2100-1400	West Eurasia	North Africa	North East Africa	Sudan	Jebel Moya
AF_12_4_103	DW	M	2100-1400	West Eurasia	North Africa	North East Africa	Sudan	Jebel Moya
AF_11_5_07	DW	F	6000-5200	West Eurasia	North Africa	North East Africa	Egypt	Nagada
AF_11_5_44	DW	M	6000-5200	West Eurasia	North Africa	North East Africa	Egypt	Nagada
AF_11_5_54	DW	F	6000-5200	West Eurasia	North Africa	North East Africa	Egypt	Nagada
AF_11_5_24	DW	F	6000-5200	West Eurasia	North Africa	North East Africa	Egypt	Nagada
AF_11_5_32	DW	M	6000-5200	West Eurasia	North Africa	North East Africa	Egypt	Nagada
AF_11_5_43	DW	M	6000-5200	West Eurasia	North Africa	North East Africa	Egypt	Nagada
AF_11_5_16	DW	M	6000-5200	West Eurasia	North Africa	North East Africa	Egypt	Nagada
AF_12_4_91	DW	M	2100-1400	West Eurasia	North Africa	North East Africa	Sudan	Jebel Moya
AF_11_5_18	DW	M	6000-5200	West Eurasia	North Africa	North East Africa	Egypt	Nagada
AF_12_4_21	DW	F	2100-1400	West Eurasia	North Africa	North East Africa	Sudan	Jebel Moya
AF_11_5_41	DW	F	6000-5200	West Eurasia	North Africa	North East Africa	Egypt	Nagada
AF_11_5_52	DW	F	6000-5200	West Eurasia	North Africa	North East Africa	Egypt	Nagada
AF_12_4_17	DW	NA	2100-1400	West Eurasia	North Africa	North East Africa	Sudan	Jebel Moya
AF_12_4_19	DW	M	2100-1400	West Eurasia	North Africa	North East Africa	Sudan	Jebel Moya
AF_11_5_58	DW	F	6000-5200	West Eurasia	North Africa	North East Africa	Egypt	Nagada
AF_12_4_10	DW	M	2100-1400	West Eurasia	North Africa	North East Africa	Sudan	Jebel Moya
AF_11_5_39	DW	M	6000-5200	West Eurasia	North Africa	North East Africa	Egypt	Nagada
AF_11_5_46	DW	F	6000-5200	West Eurasia	North Africa	North East Africa	Egypt	Nagada
AF_11_5_33	DW	F	6000-5200	West Eurasia	North Africa	North East Africa	Egypt	Nagada
AF_11_5_47	DW	F	6000-5200	West Eurasia	North Africa	North East Africa	Egypt	Nagada
AF_11_5_35	DW	F	6000-5200	West Eurasia	North Africa	North East Africa	Egypt	Nagada
AF_11_5_37	DW	M	6000-5200	West Eurasia	North Africa	North East Africa	Egypt	Nagada
AF_11_536	DW	M	6000-5200	West Eurasia	North Africa	North East Africa	Egypt	Nagada
AF_11_5_57	DW	M	6000-5200	West Eurasia	North Africa	North East Africa	Egypt	Nagada
AF_12_4_22	DW	F	2100-1400	West Eurasia	North Africa	North East Africa	Sudan	Jebel Moya
AF_11_5_26	DW	F	6000-5200	West Eurasia	North Africa	North East Africa	Egypt	Nagada
AF_11_5_29	DW	F	6000-5200	West Eurasia	North Africa	North East Africa	Egypt	Nagada
AF_12_4_26	DW	M	2100-1400	West Eurasia	North Africa	North East Africa	Sudan	Jebel Moya
AF_12_4_108	DW	M	2100-1400	West Eurasia	North Africa	North East Africa	Sudan	Jebel Moya

AF_11_5_31	DW	F	6000-5200	West Eurasia	North Africa	North East Africa	Egypt	Nagada
AF_11_5_56	DW	F	6000-5200	West Eurasia	North Africa	North East Africa	Egypt	Nagada
AF_11_5_38	DW	F	6000-5200	West Eurasia	North Africa	North East Africa	Egypt	Nagada
SUD_11	DW	M	3750-3500	West Eurasia	North Africa	North East Africa	Sudan	Kerma
SUD_05	DW	M	3750-3500	West Eurasia	North Africa	North East Africa	Sudan	Kerma
SUD_13	DW	M	3750-3500	West Eurasia	North Africa	North East Africa	Sudan	NA
SUD_5343	DW	M	3750-3500	West Eurasia	North Africa	North East Africa	Sudan	NA
SUD_08	DW	M	3750-3500	West Eurasia	North Africa	North East Africa	Sudan	Kerma
SUD_14	DW	M	3750-3500	West Eurasia	North Africa	North East Africa	Sudan	Kerma
SUD_04	DW	M	3750-3500	West Eurasia	North Africa	North East Africa	Sudan	Kerma
SUD_20	DW	M	3750-3500	West Eurasia	North Africa	North East Africa	Sudan	Kerma
SUD_10	DW	M	3750-3500	West Eurasia	North Africa	North East Africa	Sudan	Kerma
SUD_01	DW	M	3750-3500	West Eurasia	North Africa	North East Africa	Sudan	Kerma
SUD_26	DW	M	3750-3500	West Eurasia	North Africa	North East Africa	Sudan	Kerma
SUD_38	DW	M	3750-3500	West Eurasia	North Africa	North East Africa	Sudan	Kerma
SUD_16	DW	M	3750-3500	West Eurasia	North Africa	North East Africa	Sudan	Kerma
SUD_27	DW	M	3750-3500	West Eurasia	North Africa	North East Africa	Sudan	Kerma
SUD_15	DW	M	3750-3500	West Eurasia	North Africa	North East Africa	Sudan	Kerma
SUD_02	DW	M	3750-3500	West Eurasia	North Africa	North East Africa	Sudan	Kerma
SUD_5053	DW	F	<200	West Eurasia	North Africa	North East Africa	Sudan	NA
SUD_4438	DW	M	<200	West Eurasia	North Africa	North East Africa	Sudan	NA
MEL_255	DW	F	<200	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	Muyuw Kwaiaiwata Island
AF_11_5_48	DW	NA	<200	West Eurasia	North Africa	North East Africa	Egypt	NA
4434	DW	M	200	Sub-Saharan Africa	Sub-Saharan Africa	Western Africa	Ghana	Ashanti
5419	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Western Africa	Nigeria	Kagoro
AF_21_0_14	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_62	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_102	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_100	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_48	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_108	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_107	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_93	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_95	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_50	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_45	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_68	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita

AF_21_0_71	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_41	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_82	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_94	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_67	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_70	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_60	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_34	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_24	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_9	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_20	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_18	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_43	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_16	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_13	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_40	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_25	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_12	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_29	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_118	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_121	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_133	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_129	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_123	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_126	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
AF_21_0_113	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Kenya	Teita
1742	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Southern Africa	South Africa	NA
AF_23_0_28	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Tanzania	Bukoba
AF_15_0_2	DW	M	<200	Sub-Saharan Africa	Sub-Saharan Africa	Eastern Africa	Somalia	Hariya
AF112	DW	F	<200	Sub-Saharan Africa	Sub-Saharan Africa	Southern Africa	South Africa	NA
SAS_14	DW	M	<200	West Eurasia	South Asia	Indian Sub-Continent	Pakistan	NA
209305	NMNH	M	<200	Sunda-Pacific	South East Asia	Malay Archipelago	Philippines	Tagalog Island
209307	NMNH	F	<200	Sunda-Pacific	South East Asia	Malay Archipelago	Philippines	Tagalog Island
209310	NMNH	F	<200	Sunda-Pacific	South East Asia	Malay Archipelago	Philippines	Tagalog Island
226155	NMNH	F	<200	Sahul-Pacific	Oceania	Polynesia	New Zealand	NA
226156	NMNH	F	<200	Sahul-Pacific	Oceania	Polynesia	New Zealand	NA
226158	NMNH	M	<200	Sahul-Pacific	Oceania	Polynesia	New Zealand	NA
222001	NMNH	M	<200	Sunda-Pacific	South East Asia	Malay Archipelago	Indonesia	Pagi Island
381079	NMNH	F	<200	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	New Britain

99_1_109	NMNH	M	~1600	Sino-Americas	North America	American Arctic	Alaska	Ipiutak
99_1_199	NMNH	F	~1600	Sino-Americas	North America	American Arctic	Alaska	Ipiutak
99_1_209	NMNH	M	~1600	Sino-Americas	North America	American Arctic	Alaska	Ipiutak
99_1_211	NMNH	F	~1600	Sino-Americas	North America	American Arctic	Alaska	Ipiutak
99_1_174	NMNH	F	~1600	Sino-Americas	North America	American Arctic	Alaska	NA
99_1_568	NMNH	M	~1600	Sino-Americas	North America	American Arctic	Alaska	NA
99_1_594	NMNH	M	~1600	Sino-Americas	North America	American Arctic	Alaska	NA
99_1_593	NMNH	F	~1600	Sino-Americas	North America	American Arctic	Alaska	NA
99_1_64	NMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_642	NMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_649	NMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_222	NMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_231	NMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_231A	NMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_232	NMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_260	NMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_262	NMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_402	NMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_403	NMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_404	NMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_415	NMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_420	NMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_435	NMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_462	NMNH	M	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
99_1_503	NMNH	F	~800	Sino-Americas	North America	American Arctic	Alaska	Tigara
226098	NMNH	NA	<200	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	New Britain
227454	NMNH	NA	<200	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	New Britain
227459	NMNH	NA	<200	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	New Britain
227465	NMNH	NA	<200	Sahul-Pacific	Oceania	Melanesia	Papua New Guinea	New Britain
242755	NMNH	NA	<200	Sino-Americas	North America	American Arctic	Canada	Baffin Island
242834	NMNH	NA	<200	Sino-Americas	North America	American Arctic	Canada	Baffin Island
259354	NMNH	NA	<200	Sunda-Pacific	South East Asia	Malay Archipelago	Philippines	NA
342024	NMNH	NA	Unkw	Sino-Americas	North America	American Arctic	Greenland	Inuit
379058	NMNH	NA	<200	Sunda-Pacific	South East Asia	Malay Archipelago	Philippines	NA
380430	NMNH	F	<200	Sunda-Pacific	South East Asia	Malay Archipelago	NA	Malaysian
380447	NMNH	M	<200	Sunda-Pacific	South East Asia	Malay Archipelago	NA	NA
380448	NMNH	M	<200	Sunda-Pacific	South East Asia	Malay Archipelago	NA	Malaysian
380450	NMNH	M	Unkw	Sahul-Pacific	Oceania	Australia	Northern Territory	Crocodile Island

ID = collection identification number, **M** = Male, **F** = female, ***BP** = before present, **DW** = Duckworth, **AMNH** = American Museum of Natural History, **NMNH** = Smithsonian National Museum of Natural History, **†G1** = Major Human Subdivisions, **G2** = Continental Group, **G3** = Continental Region, **G4** = Country/State, **G5** = Locality/Tribe, **Unkw** = unknown

Table B: Tukey Pair-wise comparisons of from PGLM model of canal to root number by tooth

Contrast	Estimate	Odds Ratio	Std. Error	z-value	P-value
P ³ - P ⁴	0.0911	1.0953	0.0123	7.4180	<.00001
P ³ - M ¹	-0.6923	0.5004	0.0165	-41.9106	<.00001
P ³ - M ²	-0.6476	0.5233	0.0165	-39.2830	<.00001
P ³ - M ³	-0.6500	0.5221	0.0164	-39.6955	<.00001
P ³ - P ₃	0.1272	1.1356	0.0129	9.8777	<.00001
P ³ - P ₄	0.1197	1.1272	0.0128	9.3303	<.00001
P ³ - M ₁	-0.2871	0.7504	0.0186	-15.4013	<.00001
P ³ - M ₂	-0.3234	0.7237	0.0145	-22.2508	<.00001
P ³ - M ₃	-0.3557	0.7006	0.0141	-25.1822	<.00001
P ⁴ - M ¹	-0.7834	0.4569	0.0183	-42.9011	<.00001
P ⁴ - M ²	-0.7386	0.4778	0.0183	-40.3220	<.00001
P ⁴ - M ³	-0.7410	0.4766	0.0179	-41.3743	<.00001
P ⁴ - P ₃	0.0361	1.0368	0.0073	4.9477	<.00001
P ⁴ - P ₄	0.0286	1.0290	0.0071	4.0477	<.00001
P ⁴ - M ₁	-0.3782	0.6851	0.0208	-18.1390	<.00001
P ⁴ - M ₂	-0.4145	0.6607	0.0158	-26.2447	<.00001
P ⁴ - M ₃	-0.4468	0.6397	0.0152	-29.4156	<.00001
M ¹ - M ²	0.0448	1.0458	0.0061	7.2915	<.00001
M ¹ - M ³	0.0423	1.0433	0.0072	5.8984	0.0001
M ¹ - P ₃	0.8195	2.2694	0.0174	47.1051	<.00001

M ¹ - P ₄	0.8120	2.2525	0.0178	45.6536	<.00001
M ¹ - M ₁	0.4052	1.4997	0.0055	73.7824	<.00001
M ¹ - M ₂	0.3689	1.4461	0.0053	69.3361	<.00001
M ¹ - M ₃	0.3366	1.4002	0.0055	61.0848	<.00001
M ² - M ³	-0.0024	0.9976	0.0078	-0.3101	0.0222
M ² - P ₃	0.7748	2.1701	0.0177	43.6840	<.00001
M ² - P ₄	0.7673	2.1539	0.0181	42.3303	<.00001
M ² - M ₁	0.3605	1.4340	0.0085	42.4873	<.00001
M ² - M ₂	0.3241	1.3828	0.0071	45.3929	<.00001
M ² - M ₃	0.2918	1.3389	0.0074	39.2476	<.00001
M ³ - P ₃	0.7772	2.1753	0.0174	44.7211	<.00001
M ³ - P ₄	0.7697	2.1591	0.0177	43.4366	<.00001
M ³ - M ₁	0.3629	1.4375	0.0094	38.4709	<.00001
M ³ - M ₂	0.3265	1.3862	0.0078	41.6325	<.00001
M ³ - M ₃	0.2942	1.3421	0.0080	36.9683	<.00001 [#]
P ₃ - P ₄	-0.0075	0.9925	0.0019	-3.8619	<.00001
P ₃ - M ₁	-0.4143	0.6608	0.0200	-20.6987	<.00001
P ₃ - M ₂	-0.4506	0.6372	0.0147	-30.7287	<.00001
P ₃ - M ₃	-0.4829	0.6170	0.0141	-34.2334	<.00001
P ₄ - M ₁	-0.4068	0.6658	0.0204	-19.9481	<.00001
P ₄ - M ₂	-0.4431	0.6420	0.0151	-29.3666	<.00001
P ₄ - M ₃	-0.4754	0.6216	0.0145	-32.8780	<.00001
M ₁ - M ₂	-0.0364	0.9643	0.0078	-4.6724	<.00001
M ₁ - M ₃	-0.0687	0.9336	0.0079	-8.7160	<.00001
M ₂ - M ₃	-0.0323	0.9682	0.0050	-6.4832	<.00001

[#] Does not meet Bonferroni correction of $0.05/45 \approx 0.001$, where 45 is the number of pair-wise tests.*

Significant values in bold after Bonferroni correction. Model fitted without intercept. Results are given on the log (not the response) scale.

Table C: Tukey pair-wise comparisons of canal to root number by geographical region

Contrast	Estimate	Odds Ratio	Std. Error	z-ratio	P-value*
Sahul-Pacific - Sino-Americas	-0.022	1.978	0.007	-3.165	0.014
Sahul-Pacific - Sub-Saharan Africa	-0.047	0.955	0.007	-6.191	<.0001
Sahul-Pacific - Sunda-Pacific	-0.008	0.993	0.011	-0.688	0.9591
Sahul-Pacific - West Eurasia	0.019	1.019	0.008	2.539	0.082
Sino-Americas - Sub-Saharan Africa	-0.024	0.976	0.007	-3.457	0.005
Sino-Americas - Sunda-Pacific	-0.015	1.015	0.011	1.402	0.626
Sino-Americas - West Eurasia	-0.003	0.997	0.007	-0.438	0.992
Sub-Saharan Africa - Sunda-Pacific	0.039	1.040	0.011	3.584	0.003
Sub-Saharan Africa - West Eurasia	-0.027	0.973	0.008	-3.622	0.003
Sunda-Pacific - West Eurasia	0.012	1.012	0.008	1.066	0.824

Model fitted without intercept. Results are averaged over tooth. * significant values in bold.