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Abstract

The 1943 Battle of Tarawa resulted in the loss of approximately 1000 U.S. service members on or around Betio Island, Tarawa Atoll, Republic of Kiribati. Nearly half the casualties were accounted for following the battle. The Defense POW/MIA Accounting Agency (DPAA) has worked to identify the remaining ~510 unaccounted-for service members, with successful identification of ~160 service members to date. Demographic data pulled from historical documentation of the U.S. losses indicate a relatively homogeneous population (99% White, 81% between the ages of 17 to 23 years, and only two individuals documented with a religious preference other than Protestant or Catholic). Using this demographic data as a framework, three case studies are presented to demonstrate how a holistic biosocial approach to identity building could facilitate forensic identifications. The temporal and sociocultural contextualization of analyses enables anthropologists to navigate the inconsistencies between 21st century and historical (1940s) social identity concepts and overcome challenges to identification. The case studies demonstrate how biological evidence, genetic evidence, and material culture (material evidence) differently contribute to the social identity of an individual and can impact identification efforts when analytical conclusions are incongruent with historical documentation. The first case examines how morphometric biological affinity assessments are biased by the fluidity of social identity concepts when complex morphological and metric indicators of biological affinity are not represented in the historical race categories for the U.S. Battle of Tarawa casualties. The second case demonstrates how biogeographic genetic affinity predictions, through a discussion of the G2a4 haplogroup, need to be examined holistically in the context of other lines of evidence. The third case highlights how material evidence can further define social identity beyond physicality, genetic structure, and race. The challenges of interpreting identity

from human remains, as highlighted through these examples, are common among anthropologists working in disaster victim identification and other humanitarian contexts. Thus, it is imperative for anthropologists to be self-aware of implicit biases toward the current prevailing definitions of biological and social identity and to consider historical perceptions of identity when working in these contexts.

The Defense Prisoner of War (POW)/Missing in Action (MIA) Accounting Agency (DPAA) is a United States federal agency tasked with the recovery and identification of unaccounted-for U.S. service members from past conflicts. The DPAA developed special projects led by anthropologists to tackle more complex cases, particularly those associated with commingled human remains, to aid in the identification efforts. One such project, the Tarawa Commingled Human Remains Project (Tarawa Project), focuses on the identification of service members lost during the World War II Battle of Tarawa (Scott et al. 2019; Taylor et al. 2019). This battle spanned November 20th–23rd 1943, and resulted in over 6000 casualties (~1000 U.S. service members and ~5000 foreign nationals) on or around Betio Island, Tarawa Atoll, Republic of Kiribati, as part of the U.S. campaign in the Pacific (Alexander 2008; 2013; Stockman 1947). After the war, approximately half of the casualties were deemed unrecoverable or unidentifiable. Some unidentified, but recovered, remains were buried at the National Memorial Cemetery of the Pacific, Honolulu, HI. However, ~510 unaccounted-for service members remained on Betio Island (Steere and Boardman 1957). Since this historic battle, the DPAA has made significant strides in the identification efforts of these losses due to the advent of the Tarawa Project in 2016, as well as ongoing recovery efforts on Betio Island (Taylor et al. 2019). To date ~160 service members have been positively identified by the DPAA and its predecessor organizations.

The anthropologists at the DPAA must synthesize conclusions from the various scientific analyses (e.g., anthropological, dental, historical, archaeological, material evidence, etc.) that are associated with a case to recommend an identification to the medical examiner. In doing so, the anthropologists must exceed the burden of proof, as set by the medical examiner, for a case to move forward towards identification. The burden of proof is defined by the highest probability attainable, typically $\geq 98\%$, that the biological and circumstantial evidence supports the

identification, and it can be computed using statistical algorithms (Aitken and Taroni 2004; Steadman et al. 2006). The conclusions provided by different analyses do not always concur because they are sourced from different materials: historical documentation, material culture (referred to here as material evidence based on standard operating procedures [SOP] at the DPAA), and biological remains, so discordances must be explained in a scientifically-defensible manner. If, due to incongruences between the antemortem records of a decedent and the results of the scientific analyses, the burden of proof cannot be met to the medical examiner's satisfaction a case will not move forward. The remains will not be identified until all inconsistencies are addressed or new information supporting the identification becomes available. This means that the identification of a case can be paused if one line of evidence cannot be resolved in the case narrative to avoid the possibility of misidentification.

The synthesis and contextualization of multiple lines of evidence into the numerous components of an individual's social identity highlights how forensic anthropology, and bioarchaeology, are at the nexus of biology and culture (Sofaer 2006; Knudson and Stojanowski 2020). Anthropologists at the DPAA must provide objective, scientifically-derived analytical conclusions for every aspect of a case to meet forensic identification standards, but must also consider how demographic details for the individuals they are tasked to identify are dictated by the historical temporality of their loss without biasing their conclusions (Dror and Pierce 2020; Nakhaeizadeh et al. 2014). Thus, the biosocial contextualization of analytical conclusions can rectify potential inconsistencies between these conclusions and historical records to meet the burden of proof and lead to the successful identification of a decedent.

This paper utilizes the demographic, genetic, and material evidence associated with U.S. losses suffered by the Second Marine Division of the United States Marine Corps (USMC)

during the Battle of Tarawa to demonstrate the complexity of making identifications when the individuals being identified are associated with a historical context (1940s) and, thus, may have adhered to different social identity definitions than those used in the present-day (21st century) context. We explore how biology and culture influence concepts of social identity through a discussion of the ways in which morphometric biological affinity assessments are biased by concurrent societal norms, how inherent human variation affects interpretations of biogeographic genetic affinity, and how material evidence can further define aspects of social identity in making forensic identifications. The information utilized is discussed broadly, without any potentially identifying information, to preserve the anonymity of the service members and their families.

The USMC Second Marine Division, during WWII, is an example of 1940s military-based homogeneity when it came to aspects of social identity, such as race and religion (Browning 2013). Military documentation was based on identity categories available during the 1940s, which are different from 21st century categories. The demographic distribution of losses indicate that the vast majority of individuals are documented as White (99.0%) with most service members being generally of the same age and stature (**Tables 1 through 3**). Less than 1% of losses are documented as Native American or unknown/unable to determine at the time of writing. Only three individuals are referred to as Native American without White included as a qualifier somewhere in their records. There are no individuals associated with U.S. losses from the Battle of Tarawa who were documented as "Asian," Black," "Mexican," "Mongoloid," or "Puerto Rican;" all terms observed on other WWII-era records. One individual is documented as "White - Puerto Rico" in some records but is largely referred to as White. The predominant religions listed in the personnel records are Protestant and Catholic. Records for a few service

members list Mormon (now referred to as the Church of Jesus Christ of Latter-day Saints), some are blank, and no records indicate Jewish or other religious affiliations.

These 1940s categorizations minimized aspects of social identity in the personnel records when compared to the categorizations available in 21st century documentation. We present three examples in tandem with the available demographic information for the U.S. WWII Battle of Tarawa losses to discuss how DPAA anthropologists contextualize analytical conclusions to facilitate comparison with decedent records. The complex interactions between the genetic, social, and biological facets that define human variation are appreciated when these overlapping lines of evidence are considered and understood in reference to historical perceptions of identity.

What Is Identity?

Identity is the interaction of multiple socially-mediated categories, including, but not limited to, age, gender, biological affinity, ethnicity, religion, and genetics, that provide an individual with a sense of belonging to a group (Diaz-Andreu et al. 2005; Diaz-Andreu and Lucy 2007; Gowland and Thompson 2013; Spears 2011). Identity and the perceptions of identity are fluid concepts that change with the socio-political climate and, as a result, many definitions that were deemed descriptive or acceptable in the 1940s are no longer acceptable to 21st century anthropologists (Spear 2011). Anthropologists working in various temporal and cultural contexts must consider this fluidity in the forensic identification process, so that they may better understand historical perspectives while being cognizant of their own implicit biases (Nakhaeizadeh et al. 2014; Winburn 2018). If aspects of an individual's prescribed social identity and self-perceived individual identity can differ (which still may differ from scientifically-derived biological

estimations), how can anthropologists rectify these differences during the forensic identification process in ways that support the families of the lost?

To illustrate the temporality of social identity concepts, we draw on the different racial/ethnic/heritage categories utilized in the 1940s census, contemporary for Battle of Tarawa losses, and the 2020 census, contemporary for the anthropologists responsible for their identification. The 1940s census permitted census collectors to select the following races: White, Negro, Indian, Chinese, Japanese, Filipino, Hindu, and Korean to describe the person they are counting. There is also an option to write in a different racial affiliation if the above categories did not capture someone's prescribed identity (NARA n.d.). The 2020 U.S. census, however, included the following self-selected racial categories on it: White, Black or African American, American Indian or Alaskan Native, Chinese, Filipino, Asian Indian, Other Asian, Vietnamese, Japanese, Korean, Native Hawaiian, Samoan, Chamorro, and Other Pacific Islander (Census Bureau 2020). Some of these categories then asked for more specific information:

White: *Print, for example, German, Irish, English, Italian, Lebanese, Egyptian, etc.*

Black or African American: *Print, for example, African American, Jamaican, Haitian, Nigerian, Ethiopian, Somali, etc.*

American Indian or Alaskan Native: *Print name of enrolled or principal tribe(s), for example, Navajo Nation, Blackfeet Tribe, Mayan, Aztec, Native Village of Barrow Inupiat Traditional Government, Nome Eskimo Community, etc.*

Other Asian: *Print race, for example, Pakistani, Cambodian, Hmong, etc.*

Other Pacific Islander: *Print race, for example, Tongan, Fijian, Marshallese, and so on.*

There is also an option for "some other race."

Between the 1940s and 2020 censuses, groups were removed (e.g., Hindu), and groups were renamed (e.g., Negro versus Black or African American and Indian versus American Indian or Alaskan Native). This is likely due to shifting social pressures, sociopolitical awareness, and sensitivity to cultural affiliations and social identity. The 2020 census attempts to capture ethnicity (defined by shared language, religion, and/or customs) as its primary driving force, rather than the country or region where an individual is from to qualify social race or ancestry. Notably, the 2020 census only holds the designation "Hispanic" apart from the self-selected racial categories. The census prompt states "Hispanic origins are not races. Hispanic origin can be viewed as the heritage, nationality, lineage, or country of birth of the person or the person's parents or ancestors before arriving in the United States. People who identify as Hispanic, Latino, or Spanish may be any race" (Census Bureau 2020). While this may seem like an open invitation, it is also limiting in its scope for those individuals whose self-identity is related to the "heritage, nationality, lineage, or country of birth" that they have because there are no other equivalent or alternative options provided. By removing Hispanic as a social race and qualifying the terminology separate from all other groups, the 2020 census is forcing individuals to choose a parent race that might conflict with their self-identity or social group identity. This is in line with contemporary moves within forensic anthropology to remove Hispanic as a biological affinity designation in favor of more geographically, region-specific terminology. As Ross et al. (2004) state, the "use of such an umbrella term [Hispanic] is problematic because it ignores the ethnohistories and migration patterns of each geographical region." However, the homogeneous and dichotomous designations of White and Black remain largely unaltered as categories defined by skin pigmentation regardless of the geographic regions of origin between the censuses.

The inherent problem with both the 1940 and 2020 census is that they both require selection of a predetermined category, thus limiting the fluidity of self-identity and human variation. While the 2020 census allows for an individual to self-identify their ethnicity within a parent racial category and the opportunity to select "some other race" or tick multiple boxes, it still requires at least one social race parent category. The parent category defines a social race category (e.g. White), while the optional open-ended responses (e.g. *Print, for example, German, Irish, English, Italian, Lebanese, Egyptian, etc.*) highlight aspects of ethnicity. Although ethnicity may be tied to a geographic origin and/or tribal affiliation, social race varies based on the culture and time period. Thus, the social race categories between the 1940 census and the 2020 census do not necessarily mean the same thing, which has implications for long-term identification efforts within the United States.

Biosocial synthesis concepts that integrate multiple lines of evidence for hypothesis building are utilized to provide a framework for understanding identity and identification making for Battle of Tarawa losses at the DPAA (Agarwal and Glencross 2011; Goodman 2013; Leatherman and Goodman 2020; Zuckerman and Armelagos 2011; Zuckerman and Martin 2016). Using this perspective, identity is defined through the dynamic integration of an individual's social, physical, and biological condition or environment (Hoke and Schell 2020; Leatherman and Goodman 2020; Zuckerman and Armelagos 2011). Anthropologists can better contextualize the dynamic nature of social identity over time and space by integrating the cultural factors that shape how we perceive identity, and by understanding how these factors can bias interpretations of seemingly objective biological analyses (Soler and Beatrice 2018; Nakhaeizadeh et al. 2014; Zuckerman and Martin 2016). At the DPAA, skeletal remains and associated material evidence are evaluated for the purpose of positive forensic identification of a

decedent. Any aspect of a case that can contribute to part of an individual's identity and facilitate an identification is utilized. Forensic identification is therefore defined as the comparison of the postmortem, scientifically-estimated identity parameters (e.g., age, biological sex, stature, biological affinity, etc.) to the available antemortem documentation that provides the perceived or reported social identity of an individual (e.g., injuries, age, stature, personal effects, race, etc.).

Thus, this paper compares reported historical definitions of social race in antemortem documentation to scientific descriptors of human skeletal and genetic variation such as biological affinity or biogeographical origin. Biological affinity, commonly referred to as ancestry within forensic anthropology, highlights the geographical patterning of human morphological variation that is generally attributed to the ancestral origin of an individual (Cuhna and Ubelaker 2019; Konigsberg et al. 2009; Ousley et al. 2009; Ousley et al. 2018; Relethford 2009; SWGANTH 2013). Similarly, biogeographic affinity is utilized here to specifically refer to genetics discourse that engages the complex interaction between genetics, environment, and culture to understand human variation and population structure (Harcourt 2012; Elhaik et al. 2014; Phillips 2015; Relethford 2001; 2002; Tishkoff and Kidd 2004).

Biological affinity, or biogeographic affinity, is often linked with social race because skin pigmentation has been used as a predominant cultural identifier for assortative mating practices (Caspari 2009; Gowland and Thompson 2013; Jablonski 2020; Relethford 2009); however, biological affinity and social race are not necessarily synonymous. The relationship between biological affinity and social race is complex and has been engaged with at length in the literature (Hunley et al. 2009; Jablonski 2020; Klimentidis et al. 2008; Lieberman and Reynolds 1996; Long et al. 2009; Sauer 1992; Wagner et al. 2016). This paper does not focus on whether or not biological affinity and social race are related, but rather emphasizes the practical

applications of often theoretical discussions within case context. Social race, as discussed in the case studies below, refers to the perceived, socially-defined categories utilized in WWII-era documentation to describe the physical appearance of a service member. Ethnicity refers to another aspect of social identity that is defined by language, nationality, religion, and/or customs and can be alluded to/suggested through biological evidence (e.g., cranial and tooth modification, kinship studies, biological distance studies, and body art), and/or from associated material evidence (e.g., clothing, personal items, etc.). Ethnicity has often been conflated with social race for the purpose of official/governmental documentation; however, ethnicity is distinct from biological affinity (Brodkin 1998; Edgar 2009; Jacobson 1999; Kolchin 2002).

Case Study 1: Shifting Perceptions of Biological Affinity

Forensic anthropologists use a variety of morphological, morphometric, and metric techniques to estimate biological affinity parameters from cranial, postcranial, and dental remains. Several of these techniques have been incorporated into statistical software, such as *FORDISC 3* (Jantz and Ousley 2005; Ousley and Jantz 2012), *hu(MAN)id* (Berg and Kenyhercz 2017), *3D-ID* (Ross et al. 2010), *AncesTrees* (Navega et al. 2015), and *rASUDAS* (Scott et al. 2018), to estimate group affinity from shared traits of human variation. Although these programs are still limited in their global population scope, the anthropologists managing these programs, and the application of the advanced statistical models they employ, have expanded our understanding of human trait variation beyond the typologies prescribed to White/Black/Asian groups that were prevalent in the 1940s (Algee-Hewitt et al. 2020). Regardless of the ongoing addition of represented populations, each of these analytical techniques are at their strongest when utilized along with multiple lines of evidence. For example, Hughes et al. (2019) demonstrate that *FORDISC 3*, like

other methods employed, should not be used as a sole source of evidence for assessing biological affinity, but rather used in conjunction with general morphology, investigative context, and material evidence.

But what happens when different methods used to assess biological affinity provide conflicting information? An example from the Tarawa Project demonstrates discordance between the assessment of biological affinity from skeletal remains and the recorded social race on 1940s USMC military records. This discordance highlights how social race in the USMC during World War II may have been overlooked and how the assumed, and sometimes forced, homogeneity in social race identity has the potential to affect present-day identification efforts.

In the example below, an analyst assigned to a Tarawa Project case used multiple lines of evidence to assess the biological affinity of skeletal remains (morphoscopic traits [Gill 1998; Hefner 2009], Optimized Summed Scored Attributes [Hefner and Ousley 2014], *hu(MAN)id* [Berg and Kenyhercz 2017], and *FORDISC 3*[Jantz and Ousley 2005]); however, the methods provided conflicting results:

"The results of the cranial morphoscopic trait assessment are equivocal, showing a combination of traits associated with European and African ancestry…The mid-face morphology of this individual…classifies this individual as American White."

"Metric and morphoscopic traits of the mandible suggest African ancestry."

"Metric analysis of the cranium suggests European ancestry…The final iteration [of *FORDISC 3*] compared White and Black males…Again, this individual classified as a White male. Black males, however, were also a likely group."

"...postcranial measurements were assessed for ancestry…This individual classified as a White male."

"Overall, these results support a probable European ancestry, with a majority of these methods classifying this individual as European. The trend of African ancestry, however, is obvious. Several lines of evidence support African ancestry, including some morphoscopic traits of the cranium, analysis of the mandible, and the likeness of African ancestry in metric comparisons of the cranium. The preponderance of evidence, however, suggests European ancestry."

The variation within the morphoscopic and craniometric analyses suggests a more complex biological affinity within this set of remains than is permissible within the confines of laboratory SOP reportable groups (African, Asian, European, or any of these with a Hispanic modifier and Indeterminate) that were established for comparison against historical documentation. Due to USMC 2nd Marine Division's desegregation policies in the 1940s, there were no service members that fought in the Battle of Tarawa whose race were recorded as Black. Therefore, for the above example, it is certain that no matter how this individual may or may not have self-identified in another context or knowing that there is significant overlap between morphoscopic and craniometric data among contemporary U.S. forensic populations (Algee-Hewitt 2016; 2017a; 2017b; Bertoni et al. 2003; Bryc et al. 2015; Dudzik and Jantz 2015;

Hughes et al. 2013; Hughes et al. 2017; Tise et al. 2014), his military records certainly listed him as White. Thus, given the *a priori* knowledge that this case was associated with the WWII Battle of Tarawa, the remains were fit into a category of "probable European" and were ultimately identified as a service member whose records recorded their social race as White.

The document-driven homogeneity of social race in the USMC during World War II can create difficulty for anthropologists who are working towards the identification of service members from this era. Not only can this homogeneity cause complications in the identification process when the ancestral information derived from skeletal analysis (and sometimes even DNA, as discussed below) do not match a service member's personnel record, but also the socially-prescribed identity categories used for comparison change over time.

The evolution of the U.S. census (as discussed previously) provides a strong indicator of how race and ethnicity are so deeply intertwined with a person's social identity, and lived experiences, that how to assess, whether to assess, and what method is best to assess identity in the context of unidentified remains creates a conundrum amongst anthropologists (Goodman et al. 2012; Konigsberg et al. 2009). The service members, who anthropologists working on the Tarawa Project are attempting to identify, exist in a 1940s moment in time. Thus, their historical records emphasize their documented identities in a 1940s context. Anthropologists at the DPAA are living and working in a 21st century context with different definitions for social identity and expanded analytical tools for understanding human variation. How, then, are forensic practitioners to reconcile the reported social race of an individual as it pertains to the restrictive categories employed in the 1940s with the generalized categories used by the available anthropological tools, and modern concepts of social race and identity?

While biological race does not exist, morphological variation caused by evolutionary factors such as genetic drift and gene flow, as well as the interplay of different groups defined by unique origins and population histories can be identified by anthropologists and used in the identification process (Konigsberg et al. 2009; Ousley et al. 2009; Van Arsdale 2019). A majority of anthropological scholars agree race is socially constructed, and has nothing to do with inherent physical, mental, or emotional qualities of a human being; however, the assessment of biological affinity or ancestry, as defined by ancestral geographical origin, is an important aspect of the biological profile in forensic contexts (Lieberman et al. 2003; Sauer et al. 2016; SWGANTH 2013). The dilemma for the forensic anthropologist is how to both acknowledge the racial underpinnings of many of the morphological methods used to assess ancestry and still provide meaningful interpretations that result in the personal identification of an individual.

The American Association of Physical Anthropology's (AAPA) statement on race (updated March 2019) states that "race" is insufficient for capturing true human variation and modern human populations (Fuentes et al. 2019). The statement refers to the fact that the concept of race was devised from European colonialism, oppression, and discrimination, and does not reflect true biological reality. However, it also states that while not rooted in biology, race and racism has real social implications for both identity and lived experience (Fuentes et al. 2019). The statement stresses that science, while a seemingly apolitical endeavor, striving to be free of subjectivity, has experienced the cultural influence of racial stereotypes and biases on biological concepts of race and these still inform and influence scientific research today.

Thus, the interrelatedness of biology affinity and race complicates social identity concepts and the identification process, which relies on scientifically-defensible comparisons to aspects of an individual's social identity at the DPAA. While the scientific analyses utilized to

support biological affinity assessments are conducted in the blind (i.e., without *a priori* knowledge of the specific person being identified or other case-specific details), the analysts who conduct these assessments may possess *a priori* knowledge about the WWII context that can be used to make analytical conclusions. The limited nature of 1940s social identity categories and a propensity for not recognizing or reporting social variation within military populations complicates identity building when skeletal data contradicts the 1940s definitions of identity. The limitations on how a person could be described and how they chose to self-identify in a given context impact anthropologists' ability to compare the expressions of human variation they observe in skeletal remains with available antemortem records. Moreover, present-day analytical processes provide flexibility in describing the observed skeletal traits to highlight the complexities of human variation, but final conclusions are ultimately placed into socially-defined categories that may minimize the observed complexities. Therefore, it is the ethical responsibility of the analyst to report the variation they observe, acknowledge when the complexity of the observations suggests a decedent's ancestral population is not well represented in the reference data of the analytical methods used, and to objectively draw analytical conclusions prior to comparison to antemortem records.

Case Study 2: Genetics and Identity

The perceived homogenization of the USMC in the 1940s extends beyond skeletal biological affinity into genetic biological affinity as well. As discussed above, the demographic distribution of reported races for WWII Battle of Tarawa losses demonstrates an overall homogenous group where 99% of reported races indicate White (**Table 1**). However, mitochondrial haplotype distributions demonstrate a slightly more heterogeneous story (**Figure 1**). Mitochondrial

haplotype data drawn from a dataset of 1,027 WWII Battle of Tarawa skeletal samples report that approximately 64% of samples represent European haplotypes, 32% represent Asian haplotypes, 1% represent Native American haplotypes, 1.4% have haplotypes whose continental origin cannot be determined, and 0.097% represent an African haplotype (Marshall et al. 2020). Due to the highly commingled nature of the remains recovered from Betio Island, many samples are taken from skeletal remains and may be ultimately associated with a single individual; therefore, these proportions are not necessarily representative of discrete individuals. Additionally, the high degree of commingling between U.S. losses and foreign national losses produces much higher frequencies of Asian haplogroups than are likely represented by U.S. losses (Marshall et al. 2020).

Further comparison of the historical records for Battle of Tarawa losses and the mitochondrial haplogroups associated with identified individuals reveals at least one instance in which the assigned haplogroup conflicts with haplogroups typically attributed to an individual's reported race. While there may be other examples in which biogeographic genetic affinity does not reflect the reported or self-perceived race of an individual, the focus here is on the example of haplogroup G2a4.

Haplogroup G2a4 was first introduced by Lee et al. (2006) in a study focusing on the distribution of haplogroups among Koreans from the Republic of Korea and consists of a rare marker motif (16223T, 16272G, 16278T, 16319A, 16362C, and 489C) that was observed only once in the source study. This haplotype was also recently observed once among the indigenous Hlai from Hainan Island, China (Wang et al. 2020a). In EMPOP, an mtDNA database largely utilized for forensic mtDNA haplogrouping, direct matches to G2a4 are observed only four times and they are all distributed throughout South and East Asia (**Figure 2**). Similarly, G2a

subhaplogroups have been observed throughout East and Southeast Asia among Han Chinese, Japanese, Pakistani, Thai, Tibetans, and Vietnamese populations (Auton et al. 2015; Duong et al. 2018; Khan et al. 2020; Kutanan et al. 2018; Lippold et al. 2014; Wang, et al. 2020b; Yao et al. 2002). Therefore, the G2a clade is firmly linked to various populations throughout Asia and is generally considered an Asian lineage. There is, however, recent evidence of G2a subhaplogroups G2a1 and G2a6 among Slavic populations (Mielnik-Sikorska et al. 2013).

Based on this information, and absent of any other context, biogeographic genetic affinity predictions establish haplogroup G2a4 as an Asian lineage haplogroup that is documented exclusively within Asian continental populations. In the context of the largely White WWII Battle of Tarawa losses who have haplotypes presently attributed to European populations, a sample with this haplogroup is more likely to be considered a foreign national in origin than that of a U.S. loss without any other contextual information (Chaitanya et al. 2014; Christensen 2015; Marshall et al. 2020; Phillips 2015). However, this is not the case for one set of remains that yielded a haplotype motif consistent with G2a4, as well as that of the family reference sample for a U.S. service member whose records report their race as White.

There are several plausible scenarios: 1) This haplogroup is poorly represented in modern populations at this time or has a greater distribution than is presently accounted for in the literature; 2) This individual is mixed-race, or his family has biogeographically-structured genetic affinity that is not fully accounted for by the reported race in his records; or 3) Independent mutation of the same motif throughout time occurred in different geographic contexts. Regardless of the possible origin of the motif, it presents an example of the complexity of identity and identity making in the forensic context.

In the context of the DPAA, where remains are skeletonized and DNA samples are often highly degraded making autosomal markers difficult to sequence, mitochondrial DNA (mtDNA) markers have become the first line of genetic interpretation for the relationship of individuals to a set of remains (Edson and Christensen 2015; Marshall et al. 2020). Haplotype information, in combination with provenience information, material evidence, isotopic data, etc., is used to guide the identification efforts of anthropologists, as well as to facilitate assessments on whether a set of remains is likely from the United States or possibly represent a foreign national. If the haplotype data combined with the results of other investigations' data indicate that the remains are likely that of a foreign national, they are considered for repatriation (Christensen 2015; Marshall et al. 2020). Absent a matching family reference sample or associated material evidence, remains with a G2a4 haplogroup may have been considered for repatriation so that the home nation of the individual could pursue an identification of their own and/or give the individual burial rights following their nation's customs. It is only through analyses conducted in case context with knowledge of the provenience, associated material evidence, and pertinent family reference samples that the remains of this individual were able to be reunited with their family.

This example raises the question, posed by many other researchers (Benn Torres 2020; Fujimura and Rajagopalan 2011) about what we are really assessing when utilizing genetic information. Autosomal, Y-chromosome, and mitochondrial genetic systems utilized alone and divorced from an interdisciplinary context can only tell one small facet of a person's story and it may not be the story with which they most identify (Banda et al. 2015; Christensen 2015; Corach et al. 2010; Lee et al. 2010; Teteh et al. 2020).

There is much debate in an ever-growing body of research, whose sample populations of choice vary as widely as the genetic data utilized, on the utility of examining the relationship between genetic biogeographic affinity and social race (Benn Torres 2020). Some geneticists suggest that studying genetic signatures of ancestry, and inferring their relationship to social race, allows researchers to avoid false positive relationships between genetic markers and disease susceptibility (Benn Torres 2020; Fujimura and Rajagopalan 2011). Other studies have utilized "ancestry informative markers" (AIMs) on autosomal and mitochondrial data to infer biogeographic relationships between individuals, populations, social conditions, and other biologically linked variants (Chaitanya et al. 2014; Klimentidis et al. 2008; Lee et al. 2010; Setser et al. 2020; Shriver et al. 2003; Teteh et al. 2020). In these studies, the relationship between self-reported race and biogeographic ancestry inference is complex.

Corach et al. (2010), for example, researched biogeographic ancestry components for Argentineans utilizing autosomal, Y-chromosome, and mitochondrial markers. They found that the complex heterogeneity introduced by tripartite ancestral components from African, Indigenous, and European ancestors cannot be fully accounted for by a single genetic system; rather, each genetic system assesses ancestral components differently. Therefore, the authors argue for the necessity of utilizing all three systems, where possible, particularly for largely "admixed" populations like those in Argentina/South America. In another example, Teteh et al. (2020) examined and compared AIMs, mitochondrial data, skin pigmentation, and survey answers for Black communities across the United States and found regionally distributed variation within the United States for degrees of skin pigmentation, proportions of admixture, and the distribution of various mitochondrial haplogroups, indicating the U.S. Black population is more heterogeneous than is typically attributed within academic research or historical

documentation. Similarly, Klimentidis et al. (2008) assessed self-reported ethnicity (which the authors define as cultural affiliation) in comparison to skin pigmentation and AIMs among Hispanic and Native Americans. The authors observed discordant results between self-perceived cultural identity, skin color, self-perceived genetic admixture and estimated genetic admixture. More still, Lee et al. (2010) explored self-reported race and AIMs for multi-ethnic communities in New York, contending that practices established for self-reporting race in study design are often limiting because they may not allow people to report more than one parameter, forcing participants to choose one aspect of their identity. Finally, Banda et al. (2015) examined the genetic "admixture" of participants who self-reported one or more race, ethnicity, or nationality category. In their study, approximately 80% of participants reported their race singularly as White, but genetically their results demonstrate "extensive mixing among European nationalities" within that broad category.

These studies represent only a small fraction of the literature exploring the complexities of inferring social race from ancestry components estimated by genetic markers; however, each provides a different example in which the correlation between social parameters surrounding social race and biogeographically-structured ancestry inference are complicated by the human variation inherent within each study population. Each of these studies consider heterogeneity in individuals, who report multiple social parameters of race, ethnicity, or nationality categories, as something that complicates "concordant" or "accurate" genetic biogeographic classifications.

The 1940s historical context and associated prescribed racial typologies for WWII USMC losses may obscure complex aspects of social identity in historical personnel records that are then partially revealed in the biogeographic trends of genetic data. While it is not the place nor purview of anthropologists to prescribe how an individual did or did not identify themselves,

in the pursuit of identification, scientific methodology may reveal aspects of human variation that must be reconciled with conflicting official documentation. In this G2a4 haplogroup example, questions of nationality were rectified by associated family reference samples, and other case information, while simultaneously revealing the complex relationship between reported and/or self-perceived social race and genetically derived biogeographic ancestry inference.

Case Study 3: Material Evidence and Ethnicity

Material culture's relationship to prescribed and self-perceived identity, as defined in part by the artifacts associated with human remains, can assist forensic identifications. These artifacts, considered material evidence by the DPAA, are defined as any probative item(s) recovered at an incident location that can aid in advancing casualty resolution. In this context, the material evidence becomes just as important as the skeletal analysis during the identification process at the DPAA because it can provide evidence that moves beyond the homogeneity of WWII personnel records and indicates different aspects of a service member's social identity (e.g., ethnicity).

Remains recovered in the 1940s, as part of the U.S. efforts to repatriate WWII war dead, were accompanied by a wide-variety of material evidence as indicated in the historical personnel records. These items ranged from standard military-issued gear and ration items to personal effects that service members deemed important enough to carry with them. Documented personal effects include wallets, a "Navajo blanket", rings, religious medallions, and identification media, and were often used to assist the 1940s identification efforts. Recent forensic archaeological

excavations on Betio Island demonstrated a similar diversity in the material evidence associated with recovered remains and confirmed what is included in the available historical records.

During these recent forensic archaeological excavations, a well-preserved set of remains was recovered from a burial trench feature on Betio Island. Several items of material evidence were found in direct association with the remains. Following the laboratory's standard operating procedures and standard forensic anthropological practice, anthropologists at the DPAA analyzed the remains and material evidence separately to preserve scientific blindness and produce unbiased conclusions for the case (Dirkmaat 2012; Matheson 2015; Mozayani and Noziglia 2011; Passalacqua and Pilloud 2018). At the conclusion of analyses, Tarawa Project anthropologists merged the objective and technical aspects of the science with the demographic data from available personnel records to facilitate identification. The biological profile for the remains indicated a 16 to 19-year-old male of European ancestry, who stood 65.4 to 70.4 inches in life. Associated material evidence included New Zealand coins (possibly indicative of a prior duty station), shoes, a belt buckle, load bearing equipment components, and a religious medallion. The religious medallion was further defined as a Star of David pendant (**Figure 3**).

Carrying or displaying objects, like religious medallions, are relatively common among U.S. service members and, likewise, are common to recover during excavation of sites (George 2013). During the World Wars, military members would carry religious medallions and "lucky charms" as protective amulets against physical danger or sickness (George 2013; Wallrich 1960). In WWII, most recovered medallions reflected Christian or Catholic faiths; medallions representing the Jewish faith were uncommon. Moreover, the recovery of a Star of David pendant was unexpected because military records do not indicate that any Jewish Marines fought in the Battle of Tarawa. Given that the Marines were one of the last military branches to

desegregate, and knowing that prior to WWII being Jewish was considered a distinct social race, the historical personnel records were not questioned for their accuracy when it came to religious preference (Brodkin 1998; Goldstein 2005; Jacobson 1999; MacGregor 1981).

Through a matching biological profile, dental and chest radiograph comparisons, as well as corresponding battlefield and internment documentation, the remains were associated with a service member whose records indicate he was a White male, aged 19 years, who stood 66.5 inches tall, and had a Protestant religious preference. The presence of a Star of David pendant and the lack of documentation indicating Jewish affiliation for this service member prompted further research by the DPAA anthropologists and historians. The War Department's Jewish Registry was reviewed, and it was discovered that it contained the name of this individual, along with multiple other Battle of Tarawa U.S. Marines of Jewish faith. Prior to this discovery no DNA family reference sample on file matched the remains. This additional information enabled the DPAA to contact the family and obtain the needed DNA family reference sample, which was consistent with the remains, to meet the burden of proof required and make the forensic identification.

Approximately 550,000 Jewish Americans served during World War II, as indicated by the WWII registry for all Jewish military service members that was maintained by the United States War Department (Moore 2006). Due to the context of WWII, it was recommended that these service members not disclose they were Jewish on official documentation for their health and welfare. A 1947 letter to the National Jewish Board Rabbi stating "...many Jewish soldiers had their religious preference removed...for fear that they would be particularly mistreated if they were taken prisoners…" highlights the recommendation to remove indicators of religious affiliation. This is also seen in the service records. To date, there is documentation indicating at

least four of the Battle of Tarawa service members were Jewish. All four of these service members' military records list Protestant as their religious preference. The lack of Jewish religious preference in these historical records may be related to antisemitic stereotypes suggesting that Jewish military members are not good soldiers (Goldstein 2005) and/or the prejudiced recommendation to not disclose this religious preference to maintain unit cohesion and personal welfare (Bagci and Celebi 2018; Cardenas and de la Sablonneire 2020; Smaldino 2019; Levin 2004). Nevertheless, Jewish Americans served in all branches of the military in WWII and comprised a part of the "fighting faiths of democracy" (Moore 2006).

Because ethnicity is an aspect of culture and an individual's social identity, evidence of ethnicity can be alluded to from the scientific analysis of skeletal remains, the burial environment of the remains, and the associated material culture (Buikstra and Beck 2009; Grauer and Buikstra 2019; Knudson and Stojanowski 2008; 2020). The material signatures of ethnicity can be significant for the identification of WWII service members due to the relative biological homogeneity of the Battle of Tarawa casualties, as indicated by the previously discussed USMC demographic and genetic data. In this particular example, ethnicity was displayed through associated personal items (material evidence) and speaks to how an individual may have identified themselves (Hodder 2013). Therefore, recovered personal items can aid in the successful identification of a decedent if antemortem documentation indicating the meaning of these objects is available and consistent.

Material evidence represents aspects of the political, social, and cultural climate of a specific time and space so it can help elucidate aspects of an individual's social identity within that context. The use of material evidence to identify groups in the archaeological record has a long history (Brumfiel 2003; Hicks and Beaudry 2010), but material evidence has also been

utilized to better understand individual personhood by symbolically representing aspects of social identity (Diaz-Andreau et al. 2005; Fowler 2004). Moreover, material evidence can augment forensic identification investigations in terms of identity (Anderson 2008; Birkby et al. 2008; Komar 2003; Spradley and Gocha 2020) because it has the ability to move beyond physical identity, in terms of the biological human variation of remains, and towards other aspects of social identity (Fowler 2010, Hodder 2013). Specifically, personal artifacts can aid in establishing ethnicity (Birkby et al. 2008; Komar and Lathrop 2008). Komar and Lathrop (2008), for example, demonstrate how differences in language, nationality, and religious affiliation may be determined through the examination of the personal items of autopsied individuals. Similarly, several human rights investigators have shown the importance of establishing identity, whether that is individual or group ethnic identity, for the purpose of demonstrating human rights violations through the presence or absence of material evidence (Djuric et al. 2007; Ferllini 2007; Komar 2003). Personal items are visual badges of social identity, expressions of political allegiance, and symbols of communal value (Thompson and Puxley 2007), and so are vital in the contextualization of identity when dealing with under-represented and marginalized groups (Kimmerle et al. 2010).

The discovery of a Star of David pendant with a WWII-era set of remains suggested an aspect of social identity that was not available through the morphological and genetic biological affinity assessments. This personal artifact prompted additional research for documents that anthropologists would not have known to look for, aided in obtaining a DNA family reference sample, and alternately supported the identification of this service member. The 1940s experienced more rigid definitions of what social identities could be conveyed publicly, as the census data and USMC documentation highlight. Therefore, other lines of evidence (e.g.,

material evidence) that contribute to the contextualized understanding of social identity can and should be used to aid forensic identifications when available. The recovery and subsequent identification of the service member in this case, with the assistance of the material evidence, illuminated an aspect of their social identity that was reduced through the culturally-prescribed social race and ethnic identities of the 1940s.

During WWII, the military was adjusting to the diversity of recruits. The simplification of identity was viewed as a way of integrating the racially and ethnically diverse into one fighting force or group identity. The material evidence in this case study serves to demonstrate the importance of integrating all lines of evidence available (e.g., burial context, material evidence, genetics, and skeletal analyses) to establish a forensic identification. This biosocial synthesis, a concept more commonly utilized in bioarchaeology and biocultural anthropology (Goodman 2013; Hoke and Schell 2020), is important to anthropologists working in contexts where the derivation of ethnicity could be important to individual and/or group identification (Agarwal and Glencross 2011; Kimmerle 2014; Olivieri et al. 2018; Soler and Beatrice 2018).

Did the recovery of the Star of David pendant help support the identification of this particular service member? Yes. However, the idea of the Star of David pendant plays a more significant role in a discussion of the multidimensional nature of social identity. It highlights that there is a portion of identity that science alone cannot determine. For anthropologists involved in disaster victim identification, human rights violations, and medico-legal contexts, where the purpose is to aid in the identification of the individual, consideration of the material evidence can be as vital as genetic testing. These additional lines of evidence, though considered circumstantial by the medical examiner, can help reconcile discrepancies in records available and/or aid in locating families of the missing.

Conclusions

The case studies presented here, focusing on how biological and social identity are utilized in the identifications of unaccounted-for U.S. service members at the DPAA, emphasize the need for contextualized analyses to fully understand how human variation is differently presented in this historical context. The DPAA anthropologists rely heavily on biological affinity to infer information for a decedent's social identity in order to locate the families of the missing and to support forensic identifications. As demonstrated in the first case study, sometimes this interpretation of biological affinity minimizes the human variation as expressed in the remains and can assume a simplistic correlation to social identity that is incongruent with 21st century perceptions of identity. As demonstrated by the second case study, genetic haplogroup data absent context is of little value in identification efforts and can lead to the wrong conclusions, but are informative for identity building when other data are available for consideration. Furthermore, the utility of adopting a holistic approach to understanding identity for the purpose of identification is expanded on in the third case study. The material evidence, when incorporated with all other lines of evidence available, allowed for the DPAA anthropologists to move beyond the homogeneity expressed in the demographics of the personnel records to define a possible social identity that, ultimately, aided in the identification of the service member.

Social identity is a complex social construction of human experience that represents the myriad of ways that people define themselves and others. Because of the complex relationship between biological and social identity, anthropologists need to consider the historical perspectives that constrain how identity is recorded, even if they are discordant with present-day, 21st century perspectives to overcome implicit cognitive biases. Anthropologists at the DPAA

are challenged by historical restrictions to identity, as expressed through personnel records, in the forensic identification of unaccounted-for U.S. service members, which can lead to bias in their analytical work. This implicit bias, even if unintentional, affects the objectivity of analyses, but can be mitigated by adhering to ISO and accreditation standards (Dror and Pierce 2020). Each of the commingled human remains projects at the DPAA face their own complications in terms of identity due to the different racial and ethnic composition of the U.S. military during a given conflict. For conflicts such as the Korean and Vietnam Wars, the desegregation of the United States military can make relying on historical records, for providing a more accurate view of service member diversity, slightly easier while also posing different challenges for the scientific assessment of biological affinity. However, during World War II, the U.S. military, and in particular, the USMC 2nd Marine Division, reflected a seemingly homogenous social identity where nearly everyone was documented as White and Protestant or Catholic. These individuals whose records listed them as White with a Protestant or Catholic religion, but who may not have identified as such, have had a piece of their identity disregarded in service to their country. And, for many people, the experiences and culture interwoven with their social identity make up a core component of who they are.

The standardized military personnel records, which mirror identity criteria found on contemporaneous census documents did not allow for the same expression of human variability that present-day records allow; though recent census categories still have their own inherent limitations. The 1940s documentation demonstrated the prevailing definitions of social identity from that time period based on how others perceived a person's physical appearance, as opposed to how an individual would have self-identified. Thus, information indicating a more complicated biological affinity and/or social identity are absent. Although the limitations of the

records may impact the social categorization used to describe remains, the integration of other lines of evidence into the identification process allow anthropologists to more fully appreciate the complexity of social identity.

Recent calls for a deep consideration of the utility, aim, and necessity of biological affinity assessments in biological anthropology and how it relates to social identity inferences (Bethard and DiGangi 2020; Fuentes 2020; Ifekwunigwe et al. 2017), as well as responses to these concerns (e.g., Stull et al. 2021), compel all anthropologists to continually re-evaluate how we utilize varying concepts of human variation in our work. In this paper, we utilized three case studies to demonstrate how objective biological affinity assessments and material evidence analyses provided information to suggest aspects of a social identity that were not reflected in the historical personnel records. When documentation is available to support a scientifically-derived inference regarding an individual's social identity, the reporting of this information can assist in the identification efforts. Through the synthesis of the interdisciplinary lines of evidence and contextualized analyses, aspects of an individual's social identity may be revealed that not only aid the forensic identification process (Ubelaker et al. 2019), but also allow for more transformative interpretations of the body in anthropological discourse (Casella and Fowler 2005; Torres-Rouff and Knudson 2017).

The case studies pulled from the DPAA's Tarawa Project are just a few examples of how anthropologists navigate between the 21st century concepts of identity, as defined through a variety of means beyond the physicality of the remains, and the morphological/genetic underpinnings of biological affinity assessments in forensic anthropology. First and foremost, as biological anthropologists, it is our responsibility to better contextualize human biological diversity, which requires moving beyond simply performing typological ancestry assessments,

and appreciate the possibilities of complex human variability. One way of advancing our field, is to understand the various definitions of biological affinity in the present-day context and how these relate to issues of social identity in historical contexts. When we fully engage with a more holistic conceptualization of identity, one that considers both human biological variation and culture, we can provide meaningful statements on social identity, especially when variation in personal identity is masked. Furthermore, applying 21st century definitions of identity, which we may believe are more inclusive or encapsulate human variation better, can unnecessarily complicate identification efforts in historical contexts. Therefore, it is recommended to understand identity in terms of the temporality and sociocultural context of the group or individuals being identified and to be cognizant of what a person would have self-identified as within that context when utilizing analytical conclusions for forensic identification.

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Table 1. Ancestry Composition for the Battle of Tarawa Casualties Based on Those with Available Military Records

Documented Race	Number and percentage of total
White	984/994 (99.0%)
White - Native American	1/994 (0.1%)
White - Puerto Rico	1/994 (0.1%)
White/Native American	1/994 (0.1%)
Native American	3/994 (0.3%)
Unable to Determine/Unknown	4/994 (0.3%)

Table 2. Age Breakdown for the Battle of Tarawa Casualties with Available Military Records

Age Range (years)	Number and percentage of total
17-20	250/994 (25.2%)
21-24	555/994 (55.8%)
25-29	131/994 (13.2%)
30-34	31/994 (3.1%)
35-39	6/994 (0.6%)
40+	4/994 (0.4%)
Unknown	18/994 (1.8%)

Table 3. Stature Breakdown for the Battle of Tarawa Casualties with Available Military Records

Stature Range (inches)	Number and percentage of total
55-59	1/994 (0.1%)
60-64	25/994 (2.5%)
65-69	558/994 (56.1%)
70-74	381/994 (38.3%)
75-79	4/994 (0.4%)
Unknown	25/994 (2.5%)

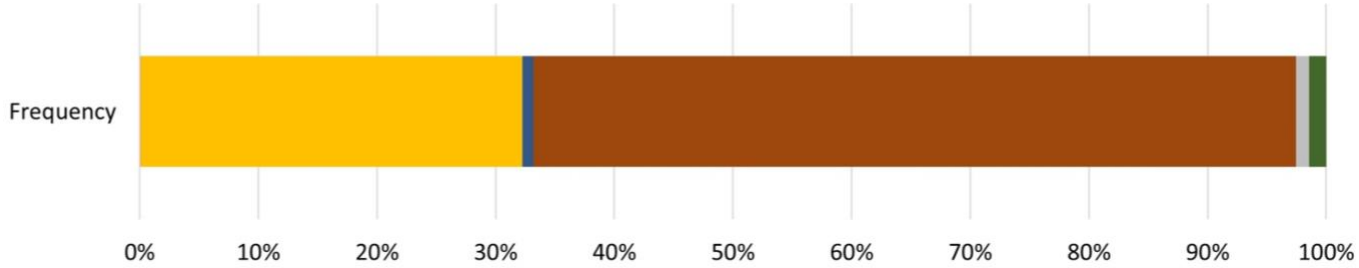
Figure Captions

Figure 1. Distribution of haplotypes in the Battle of Tarawa sample, as reported by Marshall et al. (2020).

Figure 2. The worldwide distribution of the G2a4 haplogroup from the EMPOP database, indicating the high prevalence of this haplogroup in Asia.

Figure 3. Representative example of the "Star of David" religious pendant, material evidence associated with a Battle of Tarawa loss. Scale is in cm.

Figure 1.



	Frequency	
African	0.097	(1)
Asian	32.132	(330)
Asian or Native American	0.974	(10)
European	64.265	(660)
Native American	1.071	(11)
Undetermined	1.461	(15)

Figure 2.

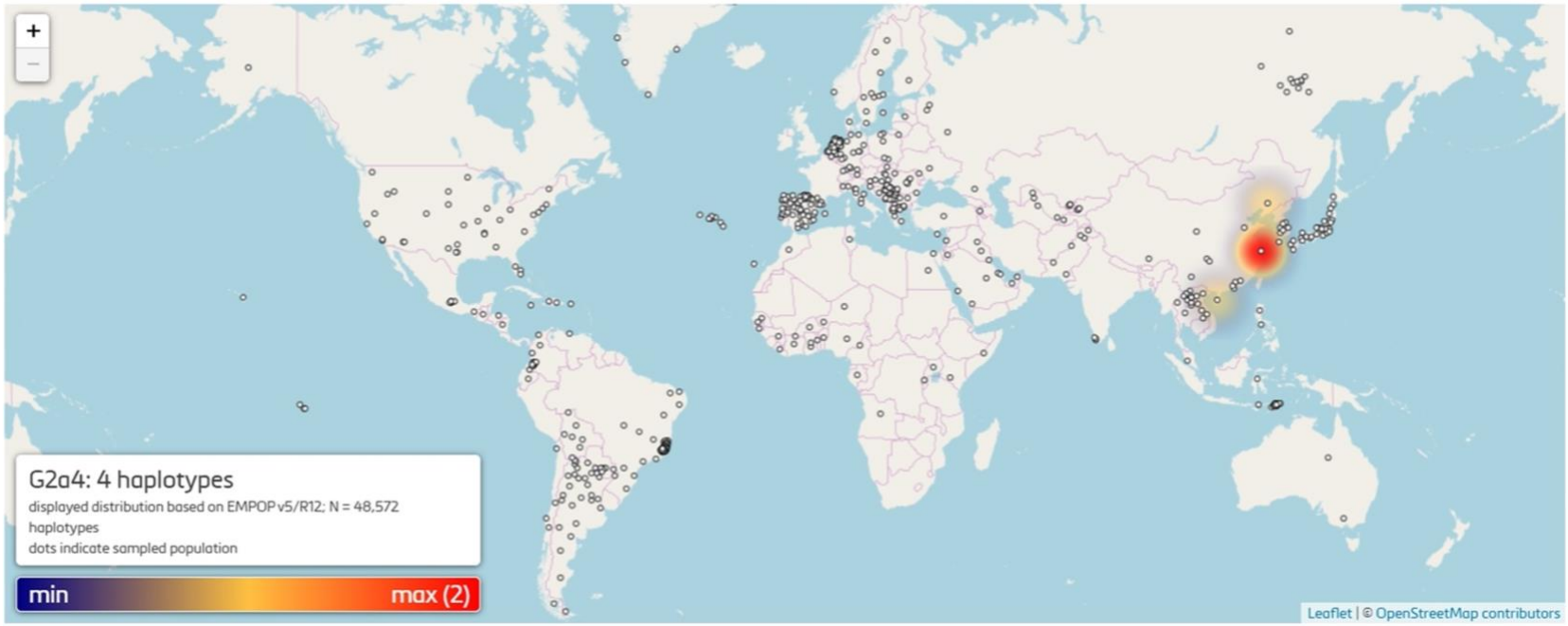

+
−
G2a4: 4 haplotypes
displayed distribution based on EMPOP v5/R12; N = 48,572
haplotypes
dots indicate sampled population
min
max (2)
Leaflet | © OpenStreetMap contributors

Figure 3.