

Imigaqo Yokuziphatha Kuphando Lwe-DNA Kwizidumbu Zabantu: Izikhokelo Ezihlanu Ezisebenzayo Kwihlabathi Liphela

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Isingeniso

Siliqela leenzululwazi zezinto zakudala (okanye ii-*archaeologist*), izazinzulu ngemvelaphi (ii-*anthropologist*), abagcini (abaziwa njengee-*curator*), kunye neengcali zemfuza (ii-*geneticist*) elimele uluntu olwahlukeneyo lwehlabathi namazwe angama-31. Eliqela ladibana ngeyeNkanga kunyaka u2020 kumasifundisane ojongene nemigaqo yokuziphatha kuphando olunokwenza ne-*DNA* yamandulo. Kwaba kho isivumelwano sokuba izikhokelo zokuziphatha ezisebenzayo kwi-hlabathi liphela ziyafuneka, kodwa iingcebiso zamva nje ezisekwe kwingxoxo malunga nophando kumathambo abantu avela eMntla Melika azisoloko zisebenziseka kwilizwe jikelele. Emveni kokuqwalaselwa imixholo eyahlukeneyo, sicebisa ezi zikhokelo zilandelayo ezisebenza kulo lonke ihlabathi. Ezizikhokelo zicebisa ukuba: 1) abaphandi mabaqinisekise ukuba ilandelwe yonke imiqathango elandelwa kwiindawo abasebenza kuzo nalapho zithatyathwe khona izidumbu zabantu; 2) abaphandi kufuneka balungise isicwangciso esineenkukacha ngaphambi kokuqala nasiphi na isifundo; 3) abaphandi kufuneka banciphise umonakalo kwimizimba yabo bangasekhoyo; 4) abaphandi mabaqinisekise ukuba iinkukacha zophando ziyafumaneka emva kopapasho lwesifundo ukuvumela ukuphononongwa ngokutsha kweziphumo zenzululwazi; okokugqibela 5) abaphandi kufuneka banxulumane nabanye abathathi-nxaxheba kwasekuqaleni kwesifundo kwaye baqinisekise intlonipho nobuntu kwiimbono zabachaphazelekayo. Siyazibophelela ekuthobeleni ezi zikhokelo kwaye silindele ukuba ziya kukhuthaza umgangatho ophezulu wokuziphatha ukuya phambili.

Intshayelelo

Uhlalutyo lwee-*genomes* zabantu bamandulo ziye zavela njengendlela enamandla yokuphanda ubudlelwane phakathi kwabantu ababephila kudala kunye nabantu abaphila kulemihla. Okucacayo xa kuqwalaselwa abantu nakuliphi na ixesha nendawo kukuba baba kulondawo ngokweziphumo zokumane behamba kunye nokunxibelelana. Kule minyaka ilishumi idlulileyo, i-*DNA* yamandulo iveze ubungqina obutsha – ukongeza koko kusuka kwezinye iinkalo – iphikisana nobuvuvu ‘bokucoeka’ kwalo naliphi na iqela labantu kunye namabali obuhlanga nalawo agxile ebuzweni. Ngelixa abanye sebekhe bafuna ukusebenzisa gwenxa imfuza njengesixhobo sokohlula amaqela wabantu, ngokoluvo lwethu akulunganga ukuba ulwazi lwemfuza lusetyenziswe njengesithethi sokugqibela malunga nesazisi sabantu¹.

Ukonyuka okukhawulezayo kuphando olupapashiweyo malunga nogcino-lwazi (okanye idatha) olubanzi lwemfuza esuka kubantu bamandulo – ukusuka kokungabikho kwayo kwaphela ngo-2009 ukuza kufika kwesisigaba apho kukho ugcino-lwazi lwabantu abangaphezulu kwamawaka amahlanu – kuhamba kunye neengxoxo ezikhulayo malunga nendlela yokuqhuba uphando lwe-*DNA* yamandulo ngokuziphatha²⁻¹⁶. Oku kwakhela phezu kweentetho esezikhe zakho ngaphambili³⁻²⁴. Imigaqo yokuziphatha kuphando lwe-*DNA* inokungxamiseka okuthile ngenxa yokukhula ngokukhawuleza kwenkalo lle, iimpembelelo kwezintlalo nezopolitiko zokufunda ngemvelaphi, kunye nolwazi lokuba umsebenzi onokwenza ne-*DNA* yamandula uhlalutya abantu ababekhe baphila yaye ekufuneka behlonitshwe.

Izikhokelo zamaziko okanye zikarhulumente zokufumana imvume yokuhlalutya abantu bakudala ziyahluka kwaye azisoloko ziqinisekisa uphando olunempatho-ntle. Abaphandi banoxanduva

lokufikelela kumgangatho ophakamileyo kunoko kunokufunwa ngamanye amabhunga olawulo, kodwa akukho mvumelwano malunga nokuchazwa yilentetha^{11,25-27}. Ngokwandayo, upapasho lweDNA yakudala luya luquka iingxelo ezichaza ukuba iqela lophando liye lajongena njani nemiba yokuziphatha²⁸⁻³⁸. Olo luphuhliso esiluxhasayo. Imibutho yezobungcali nayo seyiqalisa ukuchaza izikhokelo ezilandelayo^{15,39}, kwaye sikhona isibonelelo semali esinye (ebuncinanini) esinikezelwe ukuphonononga lemiba kuphando lwabantu bamandulo baseMntla Melika⁴⁰. Ukunqongophala okuphawuleka kakhulu ibiyingxelo enokwenza nokuziphatha etyikitywe liqela labaphengululi abaphanda nge-DNA yamandulo, abamele amazwe ohlukileyo.

Sidibanise ii-archaeologists, ii-anthropologists, ii-curators, kunye nee-geneticists ezingapha kwamashumi amathandathu ezimele amazwe angapha kwamashumi amathathu kunye noluntu olwahlukeneyo kwi-hlabathi liphela kwi-workshop ejongene nendlela efanelekileyo yokuziphatha, ukusuka kweyeNkanga 4-5, 2020. Bonke abathathi-nxaxheba bazibophelele ekwenzeni uphando kwi-DNA kwizidumbu zabantu ngokuziphatha kunye novakalelo kwimibono eyahlukeneyo esuka kwabo bachaphazelekayo (abantu abanoxibelelwano kwisifundo, ukuquka izizukulwana zololuntu, abo banoxanduva lokugcina izidumbu zabantu, kunye nabaphandi). Apha sibonisa ngezifundo ezivela kwiimeko ezahlukeneyo zehlabathi ukubonisa ububanzi bemicimbi ejikeleze uluntu kunye namaqela eMveli. Ngoko sibonisa indlela imiba esinomdla kuyo eyahluka ngayo kwi-hlabathi liphela. Emva koko sinikezela ngezikhokelo ezisebenza kwi-hlabathi liphela malunga nophando lwe-DNA olubandakanya izidumbu zabantu (ibhokisi 1).

Ukubandakanyeka kokuziphatha kunye noluntu kungqamene nomxholo

Uninzi loncwadi malunga nokuziphatha kuphando lwe-DNA yabantu bamandulo lujolise eMelika (eyaziwa nge-United States – US)^{3,4,13,15}. Ezi ngxoxo zivelise iingcebiso zokukhuthaza intsebenziswano phakathi kwabaphandi kunye noluntu lweMveli. Oku kushwankathelwe kwiSikhokelo soPhando esapapashwa yi-American Society of Human Genetics icebisa ukuba zonke izifundo ezinokwenza neDNA yamandulo kufuneka zibe nothethathethwano olusesikweni, zijongane nemiba yokuziphatha esekelwe kwinkcubeko, zinxibelelane noluntu kunye nokuxhasa ukuxhotyiswa ngezakhono, ziphuhlise izicwangciso zokunika ingxelo nokulawula idatha, zibe seziphuhlisa izicwangciso zoxanduva lwexesha elide kunye nobugosa bogcino-lwazi¹⁵.

Ukuxatyiswa kweembono zoMthonyama kubaluleke kakhulu kwimimandla eneembali zolawulo lwamathanga (okanye ikoloniyalizim), ukuhluthwa komhlaba weMveli kunye nezinto zobugcisa zakudala, kunye nocinezelo olusaqhubekayo lwamalungelo abantu baseMthonyama; ukungathetha-thethani noluntu kunokubangela ingozi kwezi meko^{5,6}. EMelika, zonke izidumbu zabemi beMveli yaseMelika ezigcinwe kumaziko afumana inkxaso-mali eburhulumenteni ziphantsi komthetho woKhuseleko lwaMangcwaba aseMelika kunye noMthetho wokuBuyiselwa eLizweni (okanye i-Native American Graves Protection and Repatriation Act – NAGPRA). Oku kunyanzelisa ukuba amaziko abonisane kwaye afune imvume yokuhambisa izidumbu zabantu bakudala (nokuba inxulumene nenkcubeko okanye hayi) kumaqela eMveli. E-Ostreliya, imithetho efana nale ifuna ukubuyisa imizimba yabantu bamandulo (eminye yayo ineminyaka engama-40,000 ubudala⁴¹) eyasuswa kuluntu lwama-Aboriginal nolwama-Torres Strait

Islander^{42,43}. Ingxaki iba sekubeni xa kusenziwa uphando malunga nezidumbu zabantu bakudala apho kukho izinto ezimbalwa kakhulu (uba zikhona) ezinxibelelana namaqela anamhlanje, okanye apho ukukhuthazwa koluvo lokuba amanye amaqela anobunini belifa leMveli lenkcubeko kunabanye lunokuba negalelo kungqzulwano kwezentlalo, inkqubo-sikhokelo yokuziphatha egxile kwaboMthonyama egunyazisa ukuba umntu ngamnye wakudala azimanye neqela langoku ayifanekelanga.

Ngamanye amaxesha amaziko karhulumente ayindlela esebenzayo yokumela izimvo zoMthonyama

Kumazwe amaninzi eMelika, Ilifa leMveli lilele kubume besizwe kwaye lithungelwe kumaziko enkcubeko karhulumente. Umzekelo, ukulandela ukuzimela kwe-*Mexico*, ii-*mestizo* (abantu bohlanga oluxubekileyo), ezenza uninzi labemi besizwe, zamkela amafa avela kwaba ababesaziwa njengee-*Nahua* (ii-*Aztec*), ii-*Maya*, ii-*Zapotec*, nakwamanye amaqela eMveli njengexalenye yesazisi sabo (ii-*mestizo*)⁴⁴⁻⁴⁶. E*Peru*, iSebe Lezenkcubeko eburhulumenteni lakhiwa kumxholo we-*indigenismo*, intshukumo enenjongo yokukhuthaza inkcubeko yeMveli kunye nokulwa ucalucalulo⁴⁷⁻⁴⁹. Kwiimeko ezinje, inkqubo yokufuna imvume kurhulumente okanye kwimibutho yelifa lemveli yohlalutyo lwamathambo omntu inokuba yindlela efanelekileyo yonxibelelwano, kwaye ukwamkela indlela yaseMelika yokwenza inokuba neziphumo ezingafanelekanga. Ababhali beli nqaku banamava amaninzi wokubhala amaphepha malunga ne-*DNA* yamandulo evela kuMbindi nase Mzantsi Melika kunye nokufumana uphononongo oluchaza ukuba umsebenzi wabo awuhambelani nemigangatho yokuzibandakanya koMthonyama ephuhliswe e-*US*^{3,4}. Abo kuthi abavela e*Mexico*, kuMbindi nase Mzantsi Melika babona uphononongo olunjalo lunyemba, ingakumbi ngenxa yokuba iindawo ezininzi seziye zamkela amafa weMveli kwaye zawathungela kwiinkqubo zemvume zikarhulumente kunye namaziko enkcubeko ngephuzulu kunokwenziwa e-*US*.

Kukho umahluko omkhulu kuhlobo lobudlelwane phakathi koorhulumente kunye nabemi boMthonyama kumazwe aseMelika, kwaye abaphandi kufuneka bajonge imeko nganye xa kufuneka uthethwano olongezelelweyo. E*Peru* nase*Mexico*, amaqela anelifa leMveli eliyinxalenye ebalulekileyo yesazisi sabo amelwe kumanqanaba ohlukileyo woburhulumente. E*Brazil*, abahlali boMthonyama banamalungelo acinezelweyo, kwaye akukho ndlela isemthethweni yokuba amaqela oMthonyama avakalise ilizwi malunga nesiphelo sezinto zakudala ezinxulumene nookhokho babo⁵⁰. E-*Argentina*, umthetho wokuba kufuneka kufunyanwe imvume yoluntu yokwenza nawuphi na umsebenzi obandakanya ilifa leMveli awuhlali ulandelwa. E-*Guatemala*, ama-*Maya* kunye namanye amaqela oMthonyama enza phantse isiqingatha sabemi ahlala ecalucalulwa. Kwimeko eziloluhlobo luxanduva lwamalungu eqela lophando lwe-*DNA* yamandulo ukuziphatha kakuhle nokongeza ukufikelela ngaphaya kokugunyazisiweyo ukubandakanya iimbono zaboMthonyama.

Umahluko kwihlabathi liphela ngentsingiselo yegama u-*Indigeneity*

Intsingiselo ka-*Indigeneity* iyahluka kwihlabathi liphela. E-Afrika, inzala yamaqela ayesakuphila ngaphantsi kolawulo lwamathanga (ikoloniyalizim) lusemagunyeni olawulo ngoku, kwaye u-*Indigeneity* udla ngokubhekisa ngakumbi kucalu-calulo kwezopolitiko okanye kwezentlalo ngenxa yesazisi ngaphezulu kwesiqhelo socalu-calulo oligxile ekubeni iqela seliphile ixesha

elingakanani engingqini⁵¹. Amalungu weendawo ezininzi eAfrika anonxibelelwano oluntsonkothileyo namazwe abahlala kuwo, ukuquka neembali zokufuduswa nokuphazamiseka kwamaxesha wolawulo lwamathanga kunye namaxesha alandela lawo. Kweminye imimandla, abantu ababoni abantu ababesakuhlala kulonginqi ngamaxesha adlulileyo njengezihlobo zabo. Oku kusenokubangelwa ziinkolo zeli xesha okanye iinkqubo zenkolelo yenkcubeko ezahlukeyo kwezadlulayo⁵², iinkumbulo ngokudibeneyo zemfuduko yokusuka kwenye indawo, uloyiko lokohlwaywa ngokunxulumana namanye amaqela, kunye nokuqhubeka kweziphumo zezigqibo ezithathiweyo ngexesha lobukoloni baseYurophu olwaqhekeza imo yezopolitiko nezentlalo esaqhubeka ukuba negalelo kubundlobongela nemfuduko eqhubayo e-Afrika. Kwezi meko, ukubonisana ngononophelo phakathi kwabachaphazelekayo kuyafuneka, ukusuka kumaqela engingqi ukuya kubameli bakarhulumente, ukuqinisekisa ukuba igunya lokuthabatha izigqibo malunga nelifa lenkcubeko alikhulisi ungquzulwano lwasentlalweni. Kwiimeko ezinjalo, ukugxila kwi-*Indigeneity* njengomgaqo wokuvumela uhlalutyo lwe-DNA yakudala kunokuba yingozi.

Umcimbi ongxamisekileyo ngakumbi malunga nophando lwe-DNA yakudala e-Afrika (nakweminye imimandla emininzi) kukujongana nelifa lobukoloni lezidumbu zabantu ezaqokelelwa ngeendlela ezingekho mthethweni zithunyelwa phesheya kwamalwandle amaxesha amaninzi^{53,54}. Abaphandi kufuneka basebenzisane neziko eligcinayo kunye nezifundiswa zelolizwe xa befuna iimvume zokuphanda ngezidumbu zabantu bakudala balondawo, kwaye bathathe inxaxheba kwiingxoxo malunga nemvelaphi, inkohlakalo yakudala, kunye neendlela zokwenza ubulungisa kwelolizwe njengenxalenye yomsebenzi wabo⁵⁵⁻⁵⁸. Enye into enzima yimbali yophando olungalinganiyo nolusoloko luxhaphaza abemi be-Afrika kakhulu zizazinzulu zaseYurophu naseMntla Melika, kunye nokubandakanyeka okuncinci kwabemi bengingqi²⁵⁻²⁷. Abaphandi basenzini kufuneka babeke phambili ukuseka ukusebenzisana okulinganayo, okunokubandakanya uqeqesho kunye nolunye ulwakhiwo lwezakhono oluxhobisa abo bachaphazelekayo ukwenza imibuzo nokwakhiwa kophando⁵⁹.

Ukugxininisa kwisazisi seqela kunokubangela ingozi kwezinye iimeko zehlabathi

Zininzi iindawo emhlabeni apho iingxoxo malunga nokuba ngubani uMthonyama ziye zanegalelo kubundlobongela obijoliswe kwabasenzini kunye nezimvo ezigxile ebuzweni. Kwezi ndawo, ukusebenzisa isazisi sendabuko ukumisela ukuba ngubani onokuvumela uphando lwe-DNA yakudala kunokuba yingozi, njengoko kunokuba negalelo localucalulo nengxabano phakathi kwamaqela.

E-India, umzekelo, abantu abaninzi bayakuphepha ukubuza malunga ne-*caste* kunye nemvelaphi yenkolo ngenxa yembali ende yokuxhatshazwa esekwe kwisazisi, kwaye ngokwenene ucalucalulo olusekwe kwi-*caste* aluvumelekanga. Ukuzama ukufumanisa ukuba ngawaphi amaqela namhlanje anebango kwilifa lemveli yakudala kunamanye akanagalelo kungxwabangxwaba qha, kodwa yenziwe phantse ayaba nantsingiselo kuninzi lwe-Mzantsi Asia, ngenxa yokuba uninzi lwamaqela namhlanje yimixube yabemi abafanayo ookhokho babo babehlala kwelilizwekazi kangangesithuba seminyaka eliwaka^{60,61}; nangona kunjalo, kukho iimeko apho kucacile ukuba ngubani uMthonyama, njengakwii-*Andaman Islands*⁶². Kukho urhulumente ophucukileyo kwiindawo ezininzi zoMzantsi Asia zokukhusela ilifa lenkcubeko, kwaye ukusebenza kwesi sikhokelo yindlela ebalulekileyo yokukhusela uluntu kwingozi.

ENtshona *Eurasia*, umbono wokuba amaqela abanga imvelaphi yendawo kufuneka abe nenqanaba elikhethekileyo unegalelo kucalucalulo ngokobuzwe kunye nembubhiso. Abaxhasi bemibono yobuzwe ababekhuthaza uluvo "lwegazi nomhlaba" ngexesha lamaNazi bajija uphando lwezinto zakudala (i-*archaeology*, ukutsho) ukuze kuqinisekise ukuthinjwa komhlaba ngokuthi amathambo agrunjwe eMpuma Yurophu anemilo e-"*Germanic*"⁶³. Abemi bezinto zakudala baseYurophu basebenze amashumi eminyaka behlaziya iingxelo ezibanga ubunini belifa lenkcubeko ngamaqela athile. Imigaqo yokuziphatha kuphando lwe-DNA yakudala kumixholo yaseNtshona ye-*Eurasia* kufuneka ilandele le ntshukumo yokuhambela kude ekusebenziseni imibono yabantu yokuzinxibelelanisa namazwe athile ngokobuzukulwana⁶³, ngelixa kwangaxeshanye beqinisekisa ukuhlonitshwa kwezimvo zamaqela anamalungu ambalwa ngokwenani esizweni ebekhe calucalulwa ngaphambili. Umngcipheko weenkokheli zikarhulumente ezikhankanya uphando lwezinto zakudala kunye ne-DNA yamandulo ukuxhasa iingxelo ezithandwayo zesazisi seqela ezinokusetyenziselwa ukuthethelela imigaqo-nkqubo yocalu-calulo ayisiyongcamango nje kuphela, yingxaki eqhubekayo kwamanye amazwe eNtshona *Eurasia* namhlanje, ukuquka iHungary ne-*Israel*⁶⁷.

Izikhokelo ezintlanu ezisebenzayo kwiilabathi zophando lwe-DNA yakudala ngokulungileyo

Sibonisa izikhokelo ezintlanu zokukhuthaza imigangatho eyomeleleyo yokuziphatha kuphando lwe-DNA yakudala esebenza kububanzi bemiba yophando ekuxoxwe ngayo ngasentla, kunye neminye imimandla ephambili yehlabathi esingakhange sixoxe ngayo ngenxa yokuncipha kwendawo, ukuquka uMbindi we-*Asia*, i-*Siberia*, iMpuma ye-*Asia*, iMpuma-mzantsi ye-*Asia*, kunye ne-*Oceania* (Ibhokisi 1). Siqala ngezikhokelo ezijongana nemicimbi yendlela yokuziphatha kwezenzululwazi emva koko sibuyele kumxholo wokuqinisekisa uvakalelo lophando kwiimbono zoluntu, ukuquka namaqela eMveli.

(1) Abaphandi mabaqinisekise ukuba yonke imigaqo ilandelwe kwiindawo abasebenza kuzo nalapho imizimba yabantu ivela khona. Abaphandi kufuneka bazibuze ukuba ingaba kulungile na ukwenza uphando lwe-DNA yamandulo ngokuqwalasela imeko-bume kwindawo apho bathatha khona amathambo abantu. Xa sebewuqalile umsebenzi, abaphandi kufuneka bathobele yonke imimiselo yendawo. Ngelixa oku kunokubonakala kucacile, amava abanye ababhali-mbumba achaza ukuba abaphandi be-DNA yakudala abasoloko belandela zonke izivumelwano. Umzekelo, kunokuba yimfuneko ukufumana amanqanaba amaninzi emvume yohlalutyo lwenzululwazi okanye ukuthunyelwa kwezinto zebhayoloji (okanye *biological*) kumaziko, ekuhlaleni, engingqini okanye amaqumrhu esizwe, kunye nokunikezela ngeengxelo kumaziko okonga ngokwexesha ekuvunyelwene ngalo. Apho imigaqo yengingqi ingonelanga⁶⁸, abaphandi kufuneka babambelele kwimigangatho ephezulu elandela le mithetho ingezantsi.

(2) Abaphandi kufuneka balungise isicwangciso esineenkcukacha ngaphambi kokuqala kophando. Oku kufuneka kubandakanye ukuvakaliswa kwemibuzo yophando; inkcazo yobuchule obuza kusetyenziswa kunye nefuthe elilindelweyo kwimizimba yabantu (ukuquka amathambo azakufundwa kunye nenani lalawo azakusetyenziswa); inkcazo yohlobo lwedatha ye-DNA eya kwenziwa; izicwangciso zokwabelana ngezinto kunye neelebhu zokusebenzisana; ixesha lokubuyiselwa kwezinto ezingasetyenziswanga nokwabelana ngeziphumo; isicwangciso

sokuba ziya kusasazwa njani, phi, nangubani iziphumo; isicwangciso sokwakha amandla okanye uqeqesho kwiindawo apho oku kunokuba nexabiso; kunye nesicwangciso sokugcinwa kwedatha nokwabelana ekuvunyelwene ngako ngabachaphazelekayo nokuthobela imigaqo yedatha evulekileyo esidlangalaleni⁶⁹. Isicwangciso kufuneka sichaze ubungakanani bophando kwaye sichaze ngokunyanisekileyo neziphumo ezinokubakho, ngokuqonda ukuba uhlalutyo lwedatha yemfuza lunokukhokelela kumkhomba-ndlela ongalindelwanga. Isicwangciso esinjalo senza irekhodi lophando ekunojongwa kulo ukuba kunokubakho ukuphambuka kuso. Uhlehlengiso kokwakhiwa kwesifundo kufuneka lwenzeke kuphela ngenkxaso yabo babandakanyeka kwisivumelwano sokuqala: abaphandi kufuneka baqonde ukuba xa imvume inikiwe yokufunda amathambo abantu bakudala, baba ngamagosa aloomathambo ngenjongo ekwakukufunyenwe ngayo imvume, kodwa 'ubunini' abugqithiselwa⁷⁰. Luxanduva lwabaphandi ukuba babelane ngesicwangciso sabo nabo banoxanduva lokugcina izidumbu zabantu kunye namanye amaqela aneembono ezifuna ukubonakaliswa; kananjalo, kufanele ukuba ibhalwe ngendlela efikelelekayo kwabo bangenabungcali. Ukuba kufanelekile kwaye kuvunyelwene ngawo onke amaqela afanelekileyo, indlela eya ekubuyiseleni izidumbu zabantu ekhuselwe ngaphandle kwendawo abavela kuyo inokuchazwa kwisicwangciso sophando.

(3) Abaphandi kufuneka banciphise umonakalo kwizidumbu zabantu. Ukucutha ifuthe lophando kwingqokelela ye-*anthropology* kubaluleke ngakumbi xa kujongwa kutshanje kwinto enye yamathambo – ithambo le-*petrous* – elihlala livelisa uninzi lwedatha yemfuza yobuntu kunezinye iindawo zamathambo⁷¹⁻⁷⁴. Abaphandi kufuneka baphuhlise isicwangciso ngokubonisana nabanye abachaphazelekayo ukulinganisa iinkxalabo malunga nokhuseleko lwemizimba kunye nohlalutyo lwabo lwenzululwazi. Abaphandi akufuneki baqokelele amathambo abantu ngaphandle koqeqesho kweyona ndlela isebenzayo yokunciphisa umonakalo ngelixa benyusa isivuno sedatha esebenzayo^{11,12,75-78}. Abaphandi akufuneki bathathe isampulu engaphezulu kokuyimfuneko ukuze bakwazi ukuphendula imibuzo yophando lwabo, kufuneka banikezele ngamaxwebhu kwabo banoxanduva lokugcina izidumbu achazayo ukuba iisampuli zithathwe nini, kwaye kufuneka banike ingxelo ngeziphumo ezibi ukuthintela uhlalutyo oluphindaphindiweyo kusetyenziswa iindlela ezifanayo zohlalutyo kwimizimba enolondolozo olusezantsi lwe-*DNA*. Ngaphambi kokuthathwa kwesampuli, imilo kufanele ukuba irekhodwe ngemifanekiso ekuqidi oluphezulu (ecacileyo) kunye novavanyo olu-*bioarchaeological*. Ebuncinanini kubantu bakudala kakhulu okanye abo bavela kwimixholo eyahlukileyo, izikeni ze-*micro-CT* okanye ii-*casts* kufuneka zenziwe, kwaye kufanele ukuba kubekho ingxoxo malunga nokuba ngaba uhlalutyo lwezidumbu ezingachongekiyo kufuneka lwenziwe kuqala ukuvavanya ulondolozo lwe-*DNA* kulondawo.

Emveni kokuthathwa kweesampulu, impatho elungileyo yezidumbu ingakhuthazwa ngokwabelana ngezinto kunye neemveliso zeemolekyuli ezinjengezicatshulwa ze-*DNA* kunye neelayibrari ezinciphisa isidingo sokongezwa kweesampulu kwizifundo ezilandelayo. Abaphandi banoxanduva lokugcina iimveliso zeemolekyuli ezifumanekayo ngeenjongo zokuphindaphinda isifundo. Siyabakhuthaza abaphandi ukuba bafune imvume yokwabelana nezinye iilebhu ngeesampulu ezisuka ebantwini kunye neemveliso zazo. Oku kuncedisana nophononongo olukutsha lwemibuzo ebhekiswe kwisifundo sokuqala, kunye nohlalutyo olongezelelekileyo ngaphaya komda wesifundo sokuqala, ukuba nje ukusetyenziswa okunjalo kuyahambelana nesicwangciso esivunyiweyo sophando.

(4) Abaphandi kufuneka baqinisekise ukuba idatha iyafumaneka emva kopapasho ukuvumela ukuphononongwa ngokutsha kweziphumo zenzululwazi. Idatha yakudala ye-DNA kufuneka ipapashwe ngexesha elifanelekileyo kwaye emva koko yenziwe ifumaneke ngenjongo yokuphinda kuvavanywe iziphumo^{79,80}. Izazinzulu azinakho ukuthatha inxaxheba kuphando ukuba akukho siqinisekiso sokuba idatha izakufumaneka ubuncinci ngenjongo yokuqinisekisa ukuchaneka kweziphumo ezipapashiweyo, kwaye esi siqinisekiso kufuneka sibandakanywe kwiimvume zokuqala zophando. Oku kubalulekile ukunqanda ukusasazeka kwengcaciso engeyiyo, kunye nokuvumela uhlalutyo lwexesha elizayo olufuna ukuphinda kuvavanywe imibuzo efanayo.

Ngowona mkhwa ulungileyo ukwenza ukuba idatha ifumaneke ngokupheleleyo emva kopapasho, kwaye eneneni phantse zonke iinkcukacha zakudala ze-genomic datha zipapashwe ngale ndlela kwindawo zolondolozo lwedatha ezisamileyo, leyo ekuyindlela yokwenza efanelekileyo kweli sebe lenzululwazi⁸¹. Ngaphandle kwegalelo kwinkqubela-phambili yolwazi lwenzululwazi, ukwenza idatha ifumaneke ngokupheleleyo kunegalelo kuxanduva lokugcina izidumbu zabantu, kuba ukuba nakho ukusebenzisa kwakhona idatha ekhoyo kunciphisa isidingo sokuqhubeka kosampulo. Nangona kunjalo, sinokucinga iimeko apho iingxoxo phakathi kwabachaphazelekayo zityhila ukuba kuya kuba kukuziphatha okuhle ukunciphisa iindlela enokuthi isetyenziswe ngayo idatha yakudala ye-DNA, njenge xa ukunika ingxelo yeziphumo ezivela kuhlobo oluthile lohlahutyo kunokwenzakalisa abo bachaphazelekayo. Oko kunokugqitha izibonelelo zedatha efikelelekayo ngokupheleleyo^{6,10,82}. Kwezi iimeko – ekufuneka zichongiwe ngexesha lenkqubo yothethathethwano phambi kokuqala kophononongo – unciphiso lokusasazwa kwedatha kubaphandi abaqeqeshiweyo abavuma ukuhlalutya idatha ngenjongo yokuphinda kuvavanywe iziphumo zophando kufuneka zibe yinxalenye yesicwangciso sasekuqaleni kophando.

Xa idatha ingenziwanga ukuba ifumaneke ngokupheleleyo ngumntu wonke, ulawulo kunye nokuhanjiswa kwedatha ngenjongo yokuphononongwa ngokutsha kweziphumo kufuneka kwenziwe ngumbutho onobuchule bokuthintela ukusetyenziswa gwenxa kwedatha kwaye ingabi nomdla kwiziphumo zophando. Kucetyiswa ukuba abathathi-nxaxheba abafana neemyuziyam okanye amaqela oMthonyama banokuba noxanduva lokulawula ukuhanjiswa kwedatha emva kokupapashwa kubaphandi^{10,13,15,83}. Nangona kunjalo, ayihambelani neendlela zokuziphatha zobungcali ukuba abaphandi bathathe inxaxheba kuphononongo apho abo banesabelo kwiziphumo zophando banokwalela ukwabiwa kwedatha kubaphandi abaqeqeshekileyo abanenjongo yokujonga ngokutsha imibuzo egutyungelwe sisivumelwano sokuqala sophando. Kukho iindlela ezimiseliweyo zokuqinisekisa ukuhanjiswa kwedatha engekho sesidlangalaleni kubaphandi abafaka isicelo sokuyisebenzisa ngeenjongo zokuphinda bavavanywe kwakhona. Oku kuyenziwa ngamanye amaxesha kwi-genomic datha yalemihla ukujongana neenkxalabo zokhuseleko ngeendlela ezinje nge-dbGaP okanye i-EGA repositories^{84,85}, nangona into esilelayo kukuba inkqubo yokufumana idatha inokuhamba kancinci⁷⁸. Indawo yokugcina idatha evela kubemi boMthonyama nayo iyaqala ukwenziwa ebandakanya uluntu ekugcinweni nasekuhanjisweni kwedatha^{10,13,81,86,87}. Ngelixa kungekho qela labachaphazelekayo – ukuquka abaphandi, abameli boluntu, okanye abagcini – elilungele kuba lilawule ukuhanjiswa kwedatha kubaphandi abanqwenela ukuphinda bavavanywe ngokunzulu imibuzo ebuzwe kwisivumelwano sophando sokuqala, oovimba beenkcukacha zemveli banokuba nendima ebalulekileyo

ekugcineni nasekusasazeni idatha ngeenjongo ezingaphaya kwezo zigutyungelwe sisivumelwano sokuqala sophando.

(5) Abaphandi kufuneka bathethathethane nabanye abathathi-nxaxheba kwasekuqaleni kwesifundo kwaye baqinisekise intlonipho kunye novakalelo kwizimvo zabachaphazelekayo. Iprojekthi yokuvelisa idatha entsha ye-DNA yamandulo inokuqaliswa ngabantu abahlukeneyo, ukuquka kodwa kungaphelelanga kuluntu lwasekhaya, iinzululwazi zezinto zakudala, izazinzulu ngemvelaphi, iingcali zemfuza, okanye abagcini, nabaphi na okanye bonke abanokuba ngamalungu eqela lophando ukuba banegalelo lolwazi kuphando. Abanye abathathi-nxaxheba ekuye kwathethwa nabo kufuneka babulelwe kumacandelo okubonga ngamaphepha ukuba bayavuma ukubizwa. Abachaphazelekayo – ukuquka amaqela asuka kwindawo apho amathambo afundwayo omntu asuka khona – kufuneka babandakanyeke kwiingxoxo malunga noyilo lwesifundo, imibuzo yophando, nokuba ingaba iprojekthi yenzululwazi kufuneka iqhubeke na. Abaphandi kufuneka bamkele impendulo eyalayo ukuba abathathi-nxaxheba abaxhasi ngokuhlangeneyo umsebenzi owenziwayo¹⁵.

Nje ukuba kufikelelwe kwisivumelwano sokuqhubeka, imigaqo yokuziphatha yenzululwazi iyabavumela ukuba abaphandi bakwazi ukuqhubeka nomsebenzi wabo ukuya kuthi ga kwinqanaba lokupapashwa ngaphandle kokufuna imvume eyongezelelweyo. Isiphakamiso sokuba kufanele kubekho imfuneko yokuba imibhalo ivunywe ngamaqela achaphazelekayo angengawo amalungu eqela lophando ngaphambi kokupapashwa^{15,83} ayinakwenzeka, njengoko abaphandi bengenakho ukuthatha inxaxheba kuphando apho oku kugunyazisiwe. Imfuneko yenkululeko yenzululwazi nje ukuba isifundo siqale ayithethi ukuba abaphandi kufuneka bapapashe iziphumo ngaphandle kokujonga izimvo zabachaphazelekayo malunga nefuthe ledatha. Kubalulekile ukumema abachaphazelekayo ukuba bathathe inxaxheba yokuhlaziya iziphumo zophando baze bongeze iimbono zabo okanye ngokunika ingxelo ebaluleke kakhulu ngaphambi kopapasho, ingakumbi xa iziphumo zimangalisa kwaye zicel'umngeni kwiingcinga zangaphambili. Ukuqhubekeka kokuzibandakanya nabanye abathathi-nxaxheba emva kokuqala kofundo kuyindlela esebenzayo apho abaphandi banokuthi baqwalasele uxanduva lwabo lokuziphatha ngendlela ngokuqonda ukuba ngaba ukunika ingxelo ngendlela ethile kunokubangela ingozi. Ukuba ezi ngxoxo zibonisa ukuba iziphumo azinakwabelwana ngazo ngendlela ethintela ukwenzakala okukhulu kwiqela labachaphazelekayo, abaphandi akufuneki bapapashe ezo ziphumo.

Abaphandi kufuneka babekhona ukuze bazonika ingxelo ngohlaziyo rhoqo kwaye kufuneka bazibophelele ekubuyiseleni iziphumo kwincopho yeprojekthi. Kuya kufuneka icace kwasekuqaleni ukuba yintoni enokuthi ifunyanwe sisifundo, ukuba idatha yemfuza isenokungahambelani nezinye iintlobo zolwazi, kwaye ngelixa iziphumo zohlalutyo lwenzululwazi zichazwa njengeziphumo zabafundileyo, azideleli, zinyembe, okanye zinciphise ukubaluleka kobuchule beMveli kunye neenkolelo ezigcinwe nzulu. Umahluko phakathi kweziphumo ezivela kuhlalutyo lwemfuza kunye nobunye ubungqina kufuneka uxelwe njengendlela entsokothilyeo yokuqonda ixesha elidlulileyo.

Abaphandi kufuneka bazibophelele ekusebenzeni nabachaphazelekayo kwimizamo yokufikelela edala iziphumo ezongezelelekileyo zifikeleleke eluntwini. Oku kunokubandakanya ukusebenzisana nabathathi-nxaxheba basekuhlaleni ukuguqulela iziphumo zamaphepha kulwimi

Iwasekhaya^{30,35,36,88,89}, ukuphuhlisa izixhobo zemfundo yabantwana⁹⁰⁻⁹³, ukuvelisa iincwadana zamathala eencwadi okanye amanye amaziko oluntu, okanye ukusebenza neemyuziyam ukuyila imiboniso. Xa kufanelekile, abaphandi kufuneka benze igalelo kuqeqesho nakwimfundo, ingakumbi kumalungu amaqela achaphazelekayo noluntu lwasekhaya^{4,15}, kwaye kufuneka bacinge ngeendlela zokuphucula imeko yengqokelela nogcino¹¹. Oku kungabandakanya ukubonelela ngezixhobo eziyimfuneko ekuthatheni inxaxheba ekuveliseni, ekutolikeneni, nasekusasazeni idatha, umzekelo uqeqesho ekuthatheni isampulu yamathambo omntu okanye ubuchule baselebhu, kunye nenkxaso yemali yokuqhubeka noqeqesho okanye ukuya kwiintlanganiso zobungcali. Kubalulekile ukuba ii-arhente ezinikezelayo ziqinisekise ukuba kwabiwa inkxaso-mali eyaneleyo kumaphulo okuxhotyiswa ngezakhono.

Ukukhuthaza ukuziphatha ngendlela kuphando lwe-DNA yemizimba yabantu bakudala

Njengengxenywe yomsebenzi wabo, abaphengululi banesibophelelo esibanzi sokulungisa ukugqwethwa kweziphumo zophando. Ukulandela ukubonakaliswa kwedatha kupapasho lwezifundo, uninzi lwezifundo lushwankathelwa ziintatheli zenzululwazi okanye ootitshala ngenjongo yokunxibelelana nabaphulaphuli ababanzi. Sekukhe kwabakho iimeko zokuchazwa gwenxa kweziphumo zophando ngonoonoondaba kunye noorhulumente ngezizathu zopolitiko, kwaye izazinzulu zinoxanduva lokusebenzela ukulungisa ukutolikwa gwenxa xa kufanelekile⁶⁶. Ukufikelela eluntwini kungabandakanya iincoko zokubhala kunye neencwadi, kunye negalelo kumajelo asekuhlaleni kunye namaxwebhu omabonakude⁹⁴⁻¹⁰².

Ngenxa yenkxaso enkulu yezi zikhokelo phakathi kwabathathi-nxaxheba abahlukeneyo kumasifundisane wethu, silindele ukuba uluntu ngokubanzi olubandakanyekayo kuphando lwe-DNA yamandulo luyakuxhasa le migaqo, kwaye sicebisa ukuba zinokwenza isiseko sezikhokelo ezisemthethweni ezivela kwiijenali, imibutho yobungcali, kunye nee-arhente ezinikelezela ngenkxaso-mali ukuya phambili.

Ibhokisi 1 – Izikhokelo Ezilhanu Ezisebenzayo Kwilizwe Liphela Zophando lwe-DNA Kwizidumbu Zabantu

- (1) Abaphandi mabaqinisekise ukuba yonke imigaqo ilandelwe kwiindawo abasebenza kuzo nalapho iimizimba yabantu ivela khona.
- (2) Abaphandi kufuneka balungise isicwangciso esineenkcukacha ngaphambi kokuqala kophando.
- (3) Abaphandi kufuneka bancedise umonakalo kwizidumbu zabantu.
- (4) Abaphandi kufuneka baqinisekise ukuba idatha iyafumaneka emva kopapasho ukuvumela ukuphononongwa ngokutsha kweziphumo zenzululwazi.
- (5) Abaphandi kufuneka bathethathethane nabanye abathathi-nxaxheba kwasekuqaleni kwesifundo kwaye baqinisekise intlonipho kunye novakalelo kwizimvo zabachaphazelekayo.

Ukuguqulelwa kweli nqaku kwiilwimi ezingaphezulu kwamashumi amabini

Eli nqaku liphononongwe ngesiNgesi kwaye liyafumaneka ngaphandle kwesithintelo. Ababhali balungiselele uguqulelo olupheleleyo kwiilwimi ezingaphezulu kwamashumi amabini, ukuquka isiBhulu, isi-Arabhu, isi-Catalan, isiTshayina, isi-Croatia, isiFrentshi, isiJamani, isiHebhere, isiHindi, isi-Hungary, isi-Japhani, isiPhuthukezi, isiRashiya, isiNhala, i-Spanish, isiSwahili, isi-Swedish, isi-Tamil, isi-Turkey, isi-Urdu, nesiXhosa, kwaye bazenze zafumaneka ku-figshare.com.

Imibulelo

Abathathi-nxaxheba kumasifundisane malunga nemigaqo yokuziphatha kuphando lwe-DNA yakudala aba ngababhali babulela uninzi lwabalingane abongezelelekileyo abaphucule eli nqaku ngeengxoxo kunye nezimvo ezibalulekileyo. Ukuqinisekisa ukufikelela ngokupheleleyo, ababhali basebenzise iphepha-mvume le-CC BY public copyright nakowuphi na uMbhalo Ovunyelweyo nguMbhalo ovela kolu ngeniso. U-C.J.F. ubulela inkxaso esuka kwi-Australian Research Council Discovery i-DP160100811. U-V.G. ubulela inkxaso evela kwi-National Research Foundation (NRF) yaseMzantsi Afrika; izimvo ezivakaliswe apha, kunye nezigqibo ezithatyathiweyo, zezo zababhali kwaye ayizizo ezo ze-NRF. U-M.O. ubulela inkxaso evela ku-Conselho Nacional de Desenvolvimento Científico e Tecnológico, isibonelelo 302163/2017-4 nakwisibonelelo se-Fundação de Amparo e Pesquisa do Estado de São Paulo, isibonelelo 2018 / 23282-5. U-P.S. ubulela inkxaso-mali engundoqo ye-Francis Crick Institute (FC001595) evela kuPhando loMhlaza e-UK, iBhunga loPhando lwezoNyango e-UK, kunye ne-Wellcome Trust. U-V.S. ubulela inkxaso-mali kwi-Alon Fellowship. U-M.S. ubulela inkxaso evela kwisibonelelo seBhunga loPhando laseDatshi VI.C.191.070. U-A.S.-N. ubulela inkxaso evela kwi-János Bolyai Research Scholarship ye-Hungary Academy of Sciences. U-K.T. uxhaswe yi-JC Bose Fellowship, i-SERB, kunye ne-CSIR, Icandelo loMphathiswa wezeNzululwazi kunye neTekhnoloji, uRhulumente wase-India. U-C.W. ubulela inkxaso evela kwi-European Research Council (ERC-2017-StG 804844- DAIRYCULTURES) kunye ne-Werner Siemens Stiftung. Ababhali abavela kwi-Harvard Medical School babulela inkxaso evela kwi-John Templeton Foundation (6122) nakwiziko lezonyango i-Howard Hughes. Ababhali abavela kwi-MPI Leipzig kunye ne-MPI Jena baxhaswa ngemali ye-Max Planck Society kunye ne-Max Planck Harvard Research Centre for the Archaeoscience of the Ancient Mediterranean.

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Imidla engquzulanyo

Ababhali baxela ukuba akukho midla ingquzulanyo.

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