RAPORT STIINTIFIC

Programul: Parteneriate in domenii prioritare

Domeniul: 9: Cercetare socio-economica si umanista

Contract nr: 227/2012

Cod proiect: PCCA_1153/2011, proiect tip 1

Titlul proiectului: „Genetic Evolution: New Evidences for the Study of Interconnected Structures. A Biomolecular Journey around the Carpathians from Ancient to Medieval Times"

Acronim proiect: GENESIS

Director de proiect: Acad. Prof. Dr. Octavian POPESCU

Semnatura:

Obiective si activitati

Etapa I: 2012, unica

Perioada: 01.10.2012-15.12.2012

Obiectiv: Documentare, teste si selectia probelor

Activitati:
- I.1. Documentare si schimburi stiintifice
- I.2. Investigatii paleo-osteologice preliminare
- I.3. Analize complementare (SEM, spectroscopie etc.)
- I.4. Procesarea inventarului material
- I.5. Studii de arhiva

In aceasta prima faza a proiectului, echipa extinsa a acestuia a urmarit:

1. actualizarea informatiilor privind metodologia de lucru: tehnici de analiza, protocoale de lucru, standardizarea si optimizarea acestora in laboratoarele de analiza antropologica, laboaratoarele de bioarheologie molecular si laboratoarele de analize fizice complementare. In cadrul acestui pachet de lucru sunt incluse activitatile I.1. – I.4.

2. selectia probelor biologice si materiale pentru teste (in anul 2012) si analize (in anul 2013). In cadrul acestui pachet de lucru sunt incluse activitatile I.1., I.4. si I.5.

I.1. Documentare si schimburi stiintifice:

Deplasari si schimburi stiintifice:

In perioada 11-21 noiembrie 2012, cercetatorii Radu Bajenaru, Adrian Ionita, Alexandru Simon si Vlad Zirra (echipa CO – Academia Romana) s-au deplasat in Bulgaria pentru cercetari de teren la Sofia (Academia Bulgara de Stiinte, Institutele de Arheologie si Antropologie) si la principalele santiere arheologice de epoca medievala (secolele VII-XIII) coordonate de Academia Bulgara de Stiinte (la Preslav si Plişka). Deplasarea a avut ca scop dezvoltarea legaturilor existente cu colegii din Bulgaria si conturarea unui orizont relevant de probe pentru analizele ADN (ADN-ul bulgar „de Bulgaria" urmand a fi comparat si cu ADN-ul extras din osemintele identificate ca fiind bulgare, de secol VIII-IX, descoperite la Alba Iulia si Aiud). Totodata, in cadrul deplasarii au fost explorate posibilitatile prelevarii de probe din osemintele de epoca bronzului si epoca fierului (perioada La Tène), descoperite la linia Dunarii de Jos. In urma vizitei, au fost identificati de comun acord cu colegii bulgari, un numar de 30 de indivizi medievali (secolele IX-XII), pentru analiza ADN. Extragerea ADN-ului va avea loc in urmatoarea etapa a proiectului (2013), cu implicarea echipei Partenerului 1 din proiectul Genesis (Universitatea *Babeş-Bolyai*, Cluj-Napoca), specializata pe aceste proceduri stiintifice.

In perioada 23 noiembrie-2 decembrie, cercetatorii Radu Bajenaru, Tudor Salagean si Vlad Zirra (echipa CO – Academia Romana) au efectuat o deplasare in Ungaria la Budapesta, Szeged si Pécs pentru cercetari de teren si de arhiva (activitatea I.5.) la Arhiva Naţionala Maghiara, la Institutul de Arheologie al Academiei Ungare de Stiinte si la principalele santiere arheologice coordonate de catre acesta (cu accent pe aria Kunság-ului dintre Gyula si Szeged). Scopul deplasarii este identificarea surselor pentru recoltare de material biologic in vederea compunerii unui lot extins (acoperind – de preferinta prin minimum 20 de probe distincte pentru fiecare epoca studiata – epoca celtica, romana, huno-avara si maghiara timpurie de pe teritoriul Ungariei de astazi) pentru posibile probe ADN. De asemenea, prin aceasta deplasare se urmareste un schimb de bune practici cu colegii maghiari, care au inceput deja analize de acest tip. In acest context, un rol important il va juca discutarea si eventuala cooperare in jurul descoperirilor de la Alba Iulia (precum ar fi cea mai veche biserica de zid de rit grec de la nord de Dunare) realizate de catre Daniela Marcu Istrate, membră a echipei proiectului Genesis (partener CO – Academia Romana).

Documentare bibliografica:

In cadrul acestei activitati a fost desfasurata o intensa activitate de interogare a bazelor de date bibliografice internationale si identificarea ultimelor descoperiri metodologice de interes pentru activitatile practice ale acestui proiect. In urma acestui efort, prezentam urmatoarea bibliografie (selectiva) continand cele mai relevante articole stiintifice in domeniile abordate in cadrul proiectului: paleodemografie (ADN vechi), antropologie biologica (atribuirea sexului, determinarea varstei la momentul mortii, estimarea staturii, patologii si traumatisme), reconstructia dietei cu ajutorul izotopilor stabili, tafonomie (procese de diageneza) etc.

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Imbunatatirea continua a tehnicilor de analiza transforma rapid bioarheologia. Un volum impresionant de noi informatii este publicat in fiecare an, in toate subdomeniile acestei stiinte. Acest aspect induce nevoia unei constante monitorizari a ultimelor publicatii aparute in revistele de specialitate, de aici, si nevoia unui obiectiv dedicat documentarii continue.

I.2. Investigatii paleo-osteologice preliminare,

I.3. Analize complementare (SEM, spectroscopie etc.)

si I.4. Procesarea inventarului material

Anticipand analizele propriu-zise ale loturilor de studiu propuse in cadrul acestui proiect, in aceasta prima faza au fost investigate resturi umane arheologice din cateva regiuni si din diverse perioade istorice, in vederea standardizarii si optimizarii protocoalelor de lucru (atat intra cat si intre laboratoare), a identificarii celor mai adecvate tehnici de analiza in vederea caracterizarii diferitelor tipuri de resturi bioarheologice si anticiparii potentialelor probleme de natura metodologica ce pot aparea pe parcursul studiului.

Loturile experimentale implicate in aceasta etapa sunt:

1. Necropola I BC – I AC din Hunedoara, Gradina Castelului Platou

Este vorba despre o necropola birituala cu indivizi incinerati (adulti) si inhumati (copii si adulti) reunind aproximativ 40 de subiecti cu varste cuprinse intre nou-nascuti si adulti de varsta mijlocie, acest sit a permis testarea metodelor fizice complementare in vederea caracterizarii procesului de incinerare in contextul in care izvoarele istorice nu transmit nici un fel de detalii despre acesta (tipul de rug, temperaturile de ardere etc.).

Analize ca XRD (X-Ray Diffraction), FT-IR (Fourier Transform Infrared Spectroscopy) si SEM (Scanning Electron Microscopy) permit evaluarea temperaturii si duratei procesului de incinerare (XRD), gradul de supravietuire a materiei organice in resturile incinerate (FT-IR), observarea modificarilor structurale suferite de resturile osoase in timpul procesului de ardere (SEM – modificarea observata la nivelul suprafetelor; FT-IR – modificari observate la nivel molecular). In plus, teste de incinerare efectuate pe oase de porc ofera posibilitatea compararii rezultatelor obtinute prin metodele de analiza enumerate mai sus, pentru diferite intervale de temperatura, ajutand la extrapolari privind incinerarile resturilor umane. Prin aceste metode, vom incerca de asemenea sa decelam modificarile de structura ale oaselor induse de crematie si cele induse de diageneza osului dupa depozitare in sol, apoi stocarea in depozite arheologice. Estimarea gradului de supravietuire a materiei organize in oasele de analizat, va contribui la selectia probelor pentru analize ulterioare mai costisitoare cum sunt analizele de ADN si de izotopi stabili.

Tot in cazul acestei necropole, dominate de resturi osoase apartinand unor copii de varste mici, s-a testat importanta utilizarii radiografiilor dentare in vederea stabilirii cat mai precise a varstei la

momentul decesului, precum si utilizarea lor in vederea sporirii gradului de siguranta la atribuirea sexului (proces cunoscut ca fiind dificil in cazul copiilor).

2. Resturi umane arheologice provenite de sub pavimentul Bisericii Ortodoxe din Feleac, Cluj

Acest lot experimental contine exclusiv resturi umane inhumate din intervalul sec 13 – secol 18. Si in acest grup au fost descoperite resturi de copii si adolescenti ceea ce a contribuit la standardizarea metodelor de inregistrare a datelor de antropologie fizica pentru aceste clase de varsta. Au fost selectate cele mai relevante caractere non-metrice ce trebuiesc urmarite pentru stabilirea sexului si varstei la momentul mortii, iar pentru caracterele metrice au fost alcatuite tabele unice ce vor fi utilizate pe parcursul studiului, atat pentru copii, cat si pentru adulti.

Starea proasta de conservare a resturilor umane din acest sit a reprezentat o provocare pentru investigatiile prin metode de antropologie fizica, dar prin teste fizice complementare (FT-IR, XRD, RAMAN) permit caracterizarea proceselor de diageneza in conditii de mediu diferite (comparatii cu celelalte loturi).

Din cadrul acestui lot experimental au fost datate cu ^{14}C 5 probe, ce vor fi descrise in continuarea acestui raport. Concomitent cu datarea cu radiocarbon au fost efectuate si masuratori pentru izotopii stabili de C si N in vederea reconstructiilor dietare pentru indivizii analizati. Rezultatele preliminare sunt incurajatoare. Datarile rafineaza concluziile privind perioadele in care pavimentul lacasului mai sus amintit a fost folosit pentru inhumari, iar datele furnizate de analiza izotopilor stabili sugereaza atat distinctia dintre dieta copiilor si adultilor, dar si cea dintre alimentatia femeilor si barbatilor si a indivizilor din perioade istorice diferite.

Subiecti suplimentari analizati cu ajutorul unora sau tuturor metodelor descrise mai sus sunt:

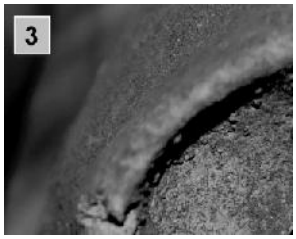
- Copii si adulti de secol X din Capidava (*extra murros*), Constanta
    - Analize de antropologie fizica, radiografii dentare, XRD, FT-IR;
- Scheletul izolat al unei femei apartinand intervalului I BD – I AD din Miercurea Sibiului
    - Analize de antropologie fizica, radiografii ale scheletului postcranian, XRD, FT-IR;
- Resturi umane de sec XIV – XV din Coconi, Calarasi
    - Analize de antropologie fizica;
- Scheletul din mormantul din interiorul Bisericii Domnesti din Curtea de Arges

- Analize de antropologie fizica (pentru comparatie cu datele anterior publicate), datare cu ^{14}C, analize de izotopi stabili, analize privind compozitia elementala a obiectelor de inventar;

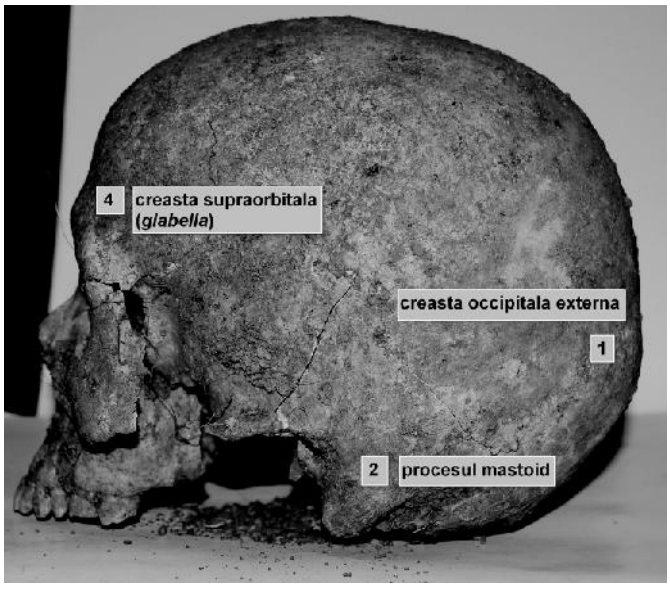
Rezultate preliminare:

Documentarea caracterelor morfometrice observate in cadrul analizei antropologice fizice:

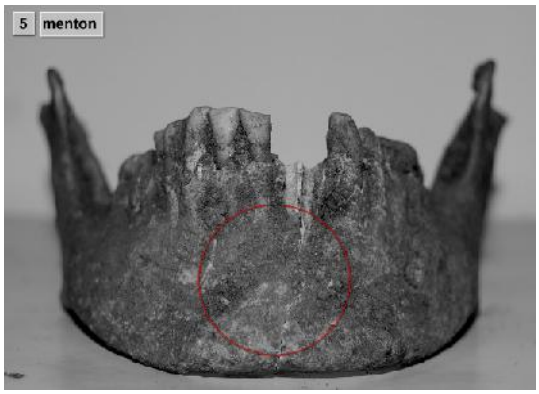
- **Exemple pentru atribuirea sexului:**
  - Diversi markeri morfometrici primesc scoruri intre 1-5 pe baza analizei vizuale efectuate de minim doi observatori.
  - Scorurile mici indica sexul feminin, iar scorurile mari pe cel masculin
  - Un scor intermediar de 3 nu permite identificarea sexului



Marginea supraorbitala (scor 1)



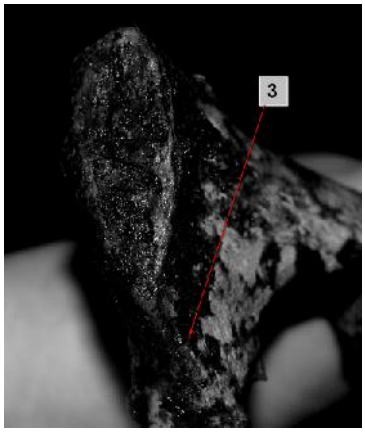
Glabella (scor 1), creasta occipitala externa (scor 1) si procesul mastoid (scor 2)



Mentonul (scor 1)

Arcul ventral, concavitatea subpubiana, documentarea traumelor

(fractura antemortem de ram ischiopubic drept)

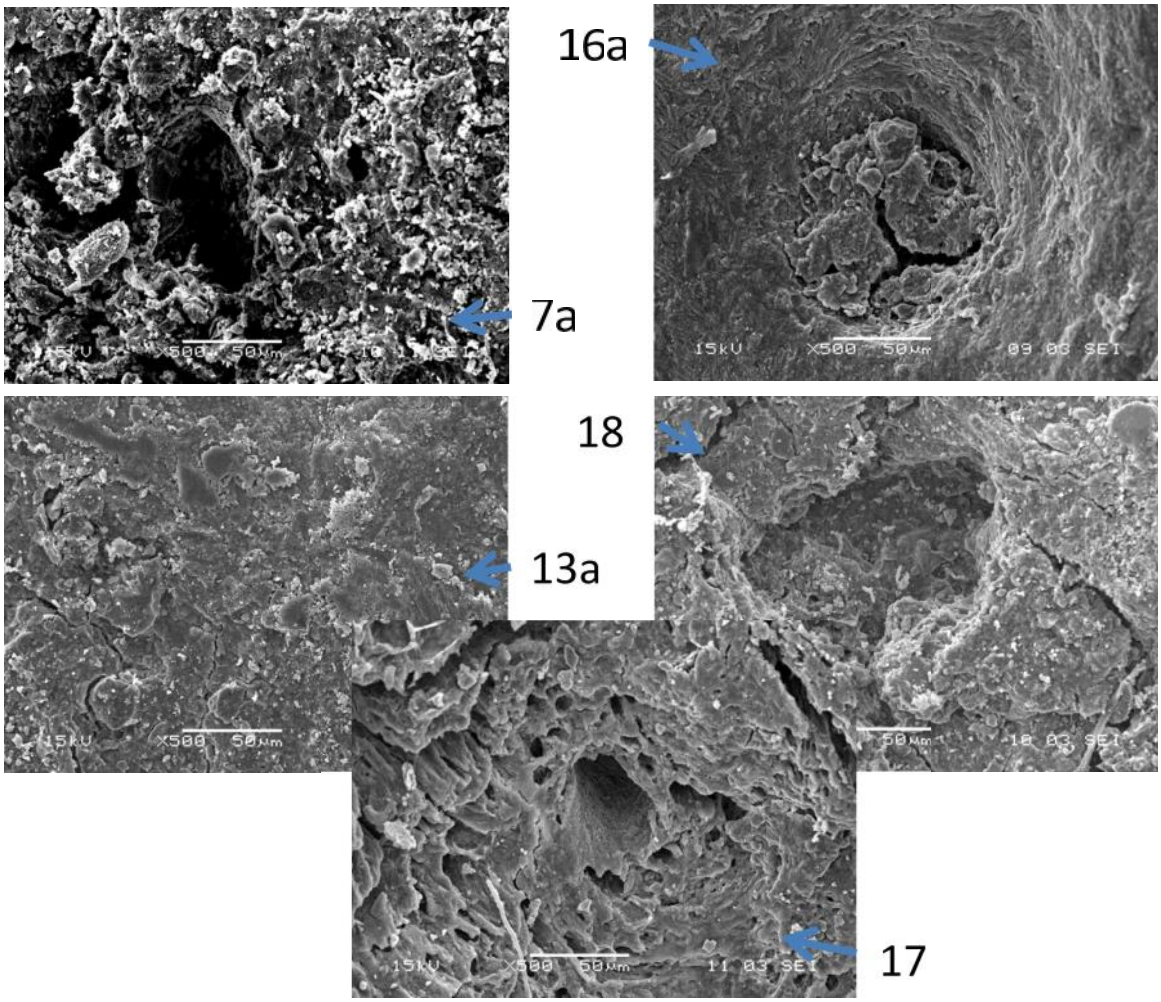


Creasta ramurii ischiopubiene (scor 1)

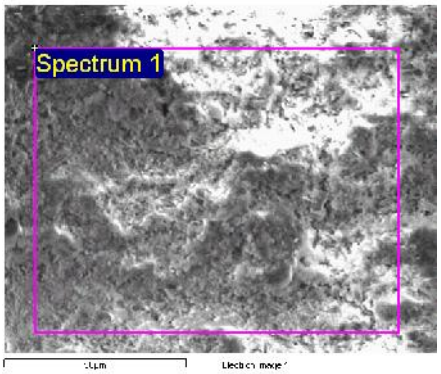
Marea scobitura sciatica, larga (scor 1)

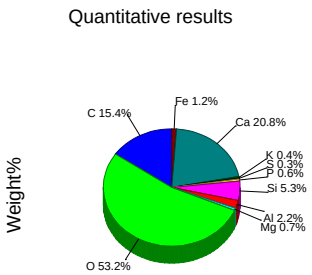
Radiografii dentare: - contribuie la rafinarea datelor privind varsta la momentul decesului

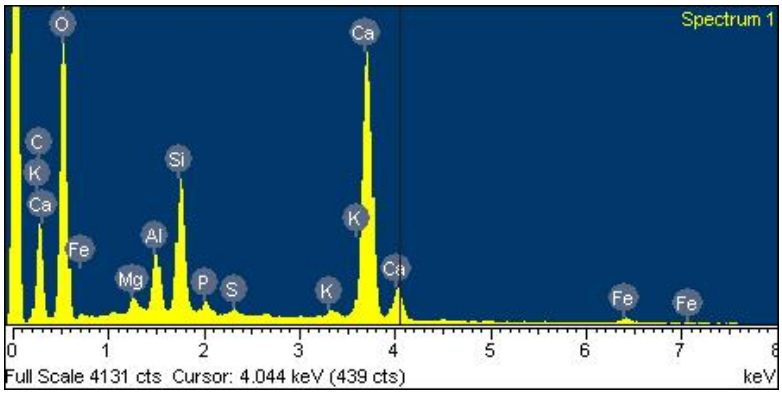
Analizele SEM/EDX permit investigarea imagistica a suprafetelor si analiza elementala a acestora. Pot contribui la caracterizarea modificarilor oaselor in timpul procesului de incinerare, pot da detalii despre structura unor materiale (textile, metale) cu implicatii in caracterizarea structurii acestora si proceselor lor de prelucrare.

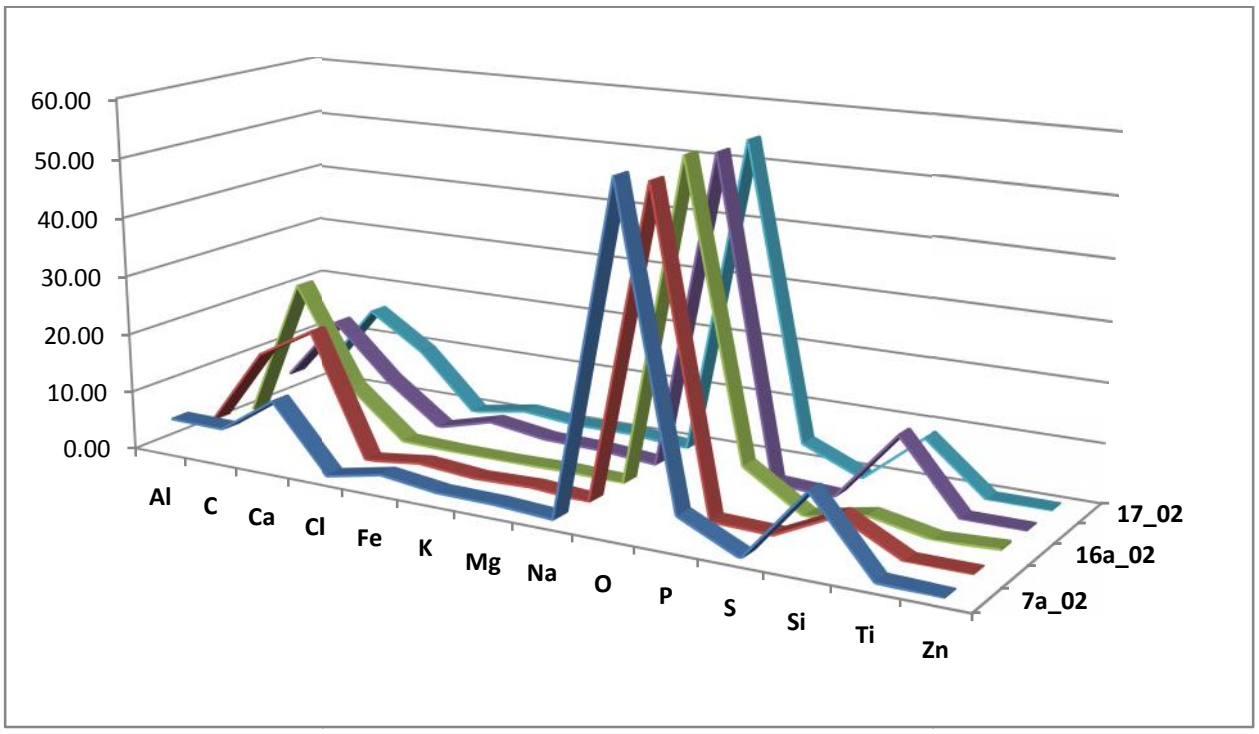


Suprafata unor oase arheologice inhumate (17) si incinerate la diverse temperaturi (7a si 13a – temperaturi mari; 16a si 18 – temperaturi sub 600° C).



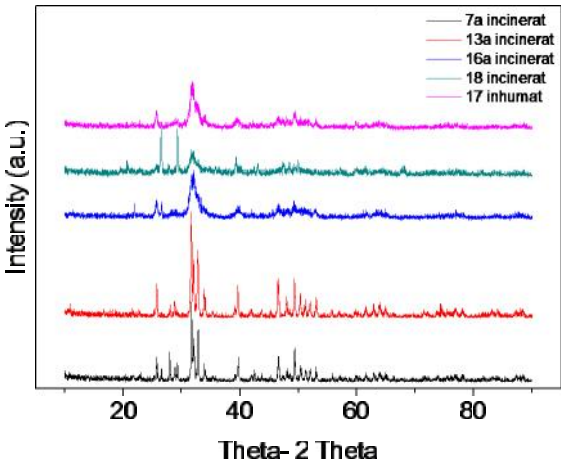






Analiza elementala SEM/EDX a unui fragment osos incinerat (permite estimarea semicantitativa preliminara a raportului Ca/P, si concluzii privind procesul de diageneza osoasa corelata cu incinerarea).

Analiza XRD - permite identificarea substantelor cristaline din fractiunea minerala a osului si determinarea dimensiunilor cristalitelor care la randul ei permite estimarea temperaturilor de ardere.



Determinarea temperaturilor de ardere prin XRD (7a si 13 a – temperaturi ridicate de ardere; 16a, 18 – temperaturi scazute de ardere; 17 – inhumat)

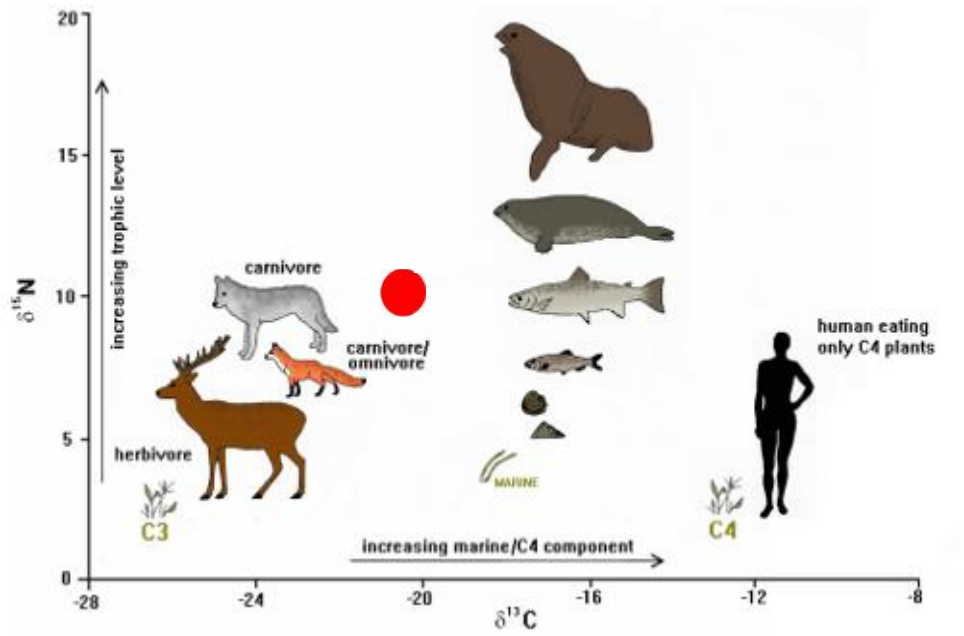
Datare cu ^{14}C si reconstructia dietei cu ajutorul analizelor de fractionare a izotopilor stabili de C si N

Probele analizate:

Proba	Locatie	Sex	Varsta biologica (ani)	Varsta conventionala +/- 30 ani	C	N
"Vlaicu"	Curtea de Arges	barbat	adult	610	-18.90	11.00
M7	Feleac	femeie	copil	580	-19.60	9.40
M9	Feleac	barbat	copil	330	-19.30	8.90
M10	Feleac	femeie	adult	670	-19.00	10.20
M11	Feleac	nedeterminat	copil	340	-19.50	9.10
M15	Feleac	barbat	adult	210	-19.40	11.00

Rezultatele analizelor de izotopi stabili de C si N permit estimarea dietei indivizilor analizati. Fractionarea izotopilor stabili de C indica ponderea de sursa vegetala cu fotosinteza de tip C3 si C4 in

alimentatie, in timp ce valoarea raportului dintre izotopii stabili de N indica nivelul trofic al individului pentru care au fost obtinute masuratori.

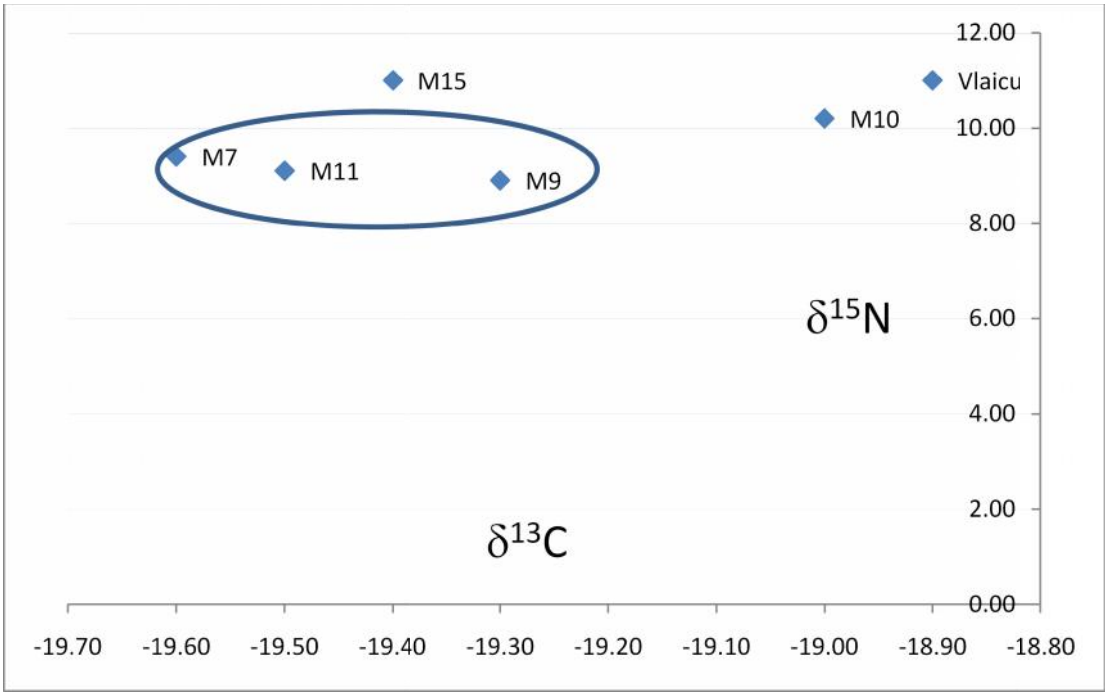


Area colorata indica pozitia trofica a probelor analizate in acest studiu preliminar

Proba	an calculat +/- 30	interval
"Vlaicu"	1340	1310-1370
M7	1370	1340-1400
M9	1620	1590-1650
M10	1280	1250-1310
M11	1610	1580-1640
M15	1740	1710-1770

Datarea probelor si intervalul probabil in care a survenit decesul

Intervalele temporare obtinute pentru resturile datate sugereaza ca sub pavimentul Bisericii Ortodoxe din Feleac s-au efectuat inhumari incepand cu sfarsitul secolului XIII pana in secolului XVIII. Numarul mic de probe analizate, specific unui studiu preliminar nu permite enuntarea unor concluzii mai amanuntite.



Tipare alimentare pentru probele analizate

Se observa aportul mai scazut de carne la copii (M7, M9, M11) comparativ cu adultii si la femei (M10) comparativ cu barbatii (M15 si Vlaicu). Indivizii mai vechi din punct de vedere istoric prezinta un aport crescut de plante cu fotosinteza de tip C4 (mei) comparativ cu adultii mai recenti si copiii.

CONCLUZII:

- **Obiectivele si activitatile propuse pentru aceasta etapa au fost realizate in totalitate si permit continuarea desfasurarii proiectului in parametri asumati la contractare.**