

**Scientific report for 2014**  
**of the project PN-II-ID-PCE-2011-3-0881 Geoscientific view of ceramic**  
**technology: evolution from Neolithic to Byzantine times within Romanian**  
**territory (O perspectiva geostiintifica asupra tehnologiei ceramicii: evolutia din**  
**Neolitic pana in timpurile Bizantine pe teritoriul Romaniei)**

Materialul colectat si prelucrat pana in prezent acopera toate epocile majore preistorice si respectiv istorice prevazute in propunerea de proiect: Neolithic, Bronz, Fier (de la celti la daci), Roman si Bizantin. Epoca Bronzului, Epoca Fierului, Romanul si Bizantinul sunt acoperite de suficiente date (situri) incat sa permita concluzii majore privind tehnologia de obtinere a ceramicii. In continuare activitatea proiectului se va concentra pe Neolitic (toate cele trei faze, Timpuriu, Mediu si Tarziu) pentru a completa imaginea evolutiei tehnologiei de obtinere a materialelor ceramice. Primii doi ani ai proiectului s-au axat pe:

- Documentare de teren si bibliografica
- Colectare si prelucrare de probe de ceramica
- Colectare si prelucrare probe de materii prime (argile) din zona siturilor
- Prelucrare (spalare) probe de argile din zona siturilor
- Executare de sectiuni subtiri pentru investigatii mineralogice si petrografice
- Executare de sectiuni subtiri pentru analize de microsonda electronica
- Executare de fotografii la microscopul polarizant
- Analize de difractie de raze X pe pulberi
- Mojarare de probe pentru analize geochimice
- Executare de analize geochimice prin ICP-ES si ICP-MS
- Executare de analize SEM-EDS
- Experimente de ardere pe argile din zona siturilor
- Investigatii de EPR pentru calibrare termica a arheoceramicii
- Analize de FT-IR pe ceramica si argile din zona sitului
- Participare la manifestari stiintifice internationale si nationale si comunicarea rezultatelor (oral, poster)
- Organizare de sesiuni stiintifice specifice (ceramica arheologica, arheometrie) la manifestari stiintifice internationale
- Publicare de rezultate finale (articole ISI, BDI, capitole in carti, editare volum)

Materialul colectat si prelucrat pana in prezent acopera toate epocile majore preistorice si respectiv istorice prevazute in propunerea de proiect: Neolithic, Bronz, Fier (de la celti la daci), Roman si Bizantin. Epoca Bronzului, Epoca Fierului, Romanul si Bizantinul sunt acoperite de suficiente date (situri) incat sa permita concluzii majore privind tehnologia de obtinere a ceramicii. In continuare activitatea proiectului se va concentra pe Neolitic (toate cele trei faze, Timpuriu, Mediu si Tarziu) pentru a completa imaginea evolutiei tehnologiei de obtinere a materialelor ceramice.

**A. Documentare de teren si bibliografica**

A cuprins vizitarea siturilor inclusiv cartare de teren pentru identificarea si probarea potentialelor materii prime (argile, marne, nisipuri) si colectare de material bibliografic pentru siturile cercetate, inclusiv material de referinta publicat international. Colectia de articole in domeniul arheometriei cu cuprinde peste 800 de titluri (tiparit si varianta electronica).

## **B. Colectare si prelucrarea de probe de ceramica si materii prime**

Au fost prelucrate (sectiuni subtiri si lustruite, mojarare) si partial investigate siturile:

- Neolitic: Targu Frumos-Baza Patule (25 probe), Cucuteni-Ruginoasa (50 probe), Poienesti (Cucuteni) (33 probe), Magura (10 probe), Poroschia (15 probe), Beciu (7 probe), Vitanesti (10 probe)
- Epoca Bronzului: Lapus (115 probe); Dersida (10 probe), Palatca (7 probe), Silistea-Neamt (13 probe), Copaceni (7 probe)
- Epoca Fierului (Celtic; jud. Mures): Fantanele (35 probe), Arandul Nou (5 probe), Moresti (5 probe)
- Epoca Fierului (Dacic): Sarmizegetusa Regia Dacica (30 probe)
- Roman: Micasasa (Roman; 25 probe), Sarmizegetusa Regia Dacica (30 probe), Sarmizegetusa Regia Romana (30 probe), Carnic/Alburnus Major (25 probe), Histria (20 probe)
- Roman/Bizantin: Ibida (41 probe), Novodinum (37 probe), Argamum (47 probe)

## **C. Experimente (Arheometri experimentală)**

Au continuat experimentele cu probe de argila care sunt folosite in prezent pentru obtinerea de ceramica traditionala. Experimentele sunt deosebit de importante in studiile arheometrice dar nu au fost aplicate pana acum in Romania. Experimentele au urmarit: a) sa descifreze cum au fost modelate vasele (de exemplu cum se reflecta stilul de modelare nu numai in interiorul peretelui ceramic dar si la suprafata lui; b) sa gaseasca o metoda (ex. Interferometria, SEM) care sa permita stabilirea, chiar pe fragmente mici, a tipului de modelare; c) gasirea unui „termometru” e.g. rezonanta electronica paramagnetica si spectroscopia in infrarosu care sa fie folosit in determinarea cu cat mai putina aproximatie a temperaturii de ardere. Primele rezultate s-au concretizat in doua lucrari deja publicate (2014) in revistele cele mai prestigioase din domeniul arheometriei: Archaeometry (Universitatea Oxford) si Applied Clay Science (Elsevier).

## **D. Efectuarea de analize mineralogice/petrografice, XRD, SEM, EMPA, EPR si analize chimice (ICPMS)**

Investigatiile au inclus pentru toate probele documentare fotografica a aspectelor macroscopice, analize mineralogice si petrografice pe sectiuni subtiri inclusiv efectuarea de fotografii la microscopul cu lumina polarizata si difractie de raze X pe pulberi. Pentru probele reprezentative s-au efectuat masuratori la microsonda electronica (pe sectiuni lustruite) si la microscopul electronic de scanning (in spartura). Probele care au cantarit mai mult de 25 g au fost analizate chimic pentru 60 de elemente majore, minore, urma, inclusiv terre rare (prin ICP-MS). Pe materiile prime (argile) s-au efectuat experimente termice, documentate prin difractie de raze X si prin rezonanta electronica de spin.

## **E. Publicarea si comunicarea rezultatelor:**

### **D.1. Lucrari ISI** (numele membrilor echipei, in bold)

1. **Ionescu C., Hoeck V., Crandell O.N., Šaric K.** (2013) Burnishing versus smoothing in ceramic surface: A SEM study. *Archaeometry*. ISI Journal, I.F. = 1.287; Scor de infl. = 1,620. doi: 10.1111/arc.12089. **Lucrare trimisa in 2013, aparuta in 2014.**  
<http://onlinelibrary.wiley.com/doi/10.1111/arc.12089/full>
2. **Ionescu C., Hoeck V., Gruian C., Simon V.** (2014) Insights into the EPR characteristics of heated carbonate-rich illitic clay. *Applied Clay Science*, **97-98**, 138-145. ISI Journal, I.F. = 2,342; Scor de infl.= 1,551. **Lucrare trimisa in 2013, aparuta in 2014.**  
<http://dx.doi.org/10.1016/j.clay.2014.05.023>;
3. **Ionescu C., Berecki S., Hoeck V., Giurgiu A.** (2014) Optical and XRD study of Celtic pottery from Transylvania (Romania): Inferring raw materials and technological constraints. *Journal of Cultural Heritage* (manuscris no. CULHER-S-14-00446 ; in evaluare). Elsevier, ISI Journal, I.F. = 1,111; Scor de infl. = 1,551. <http://www.journals.elsevier.com/journal-of-cultural-heritage/>
4. **Benea M., Diaconu V., Dumitroaia Gh.** (2014) Preliminary data on Bronze Age pottery from Savesti (Neamt county, Romania). *Studia Universitatis babes-Bolyai Seria Chemia*, ISI journal, I.F. = 0.39. (in evaluare). <http://chem.ubbcluj.ro/~studiachemia/>
5. **Ionescu et al FTIR (2014)**

## **D.2. Lucrari in reviste din BDI** (numele membrilor echipei, in bold)

1. **C.-M. Lazarovici, S. Țau, C. Tarcan** (2014) Așezarea Starčevo-Criș de la Munteni – Broscărie (Tecuci). *Arheologia Moldovei*, 37, 181-197. Revista din categoria B (CNCS).

BDI:

Index Copernicus Journals Master List

<http://journals.indexcopernicus.com/masterlist.php?q=Arheologia+Moldovei>

World Cat (<http://www.worldcat.org/title/arheologia-moldovei/oclc/2444967>),

Genamics Journal Seek (<http://journalseek.net/index.htm>)

2. **Crandell O.N.** (2014) Stone tools used in the ceramics production industry. *Journal of Lithic Studies* (manuscript no. 1134/2014).(under review).

<http://journals.ed.ac.uk/lithicstudies/login?source=%2Flithicstudies%2Fauthor>

BDI:

Geoscience e-Journals <http://www.univ-brest.fr/geosciences/e-journals/index0-JLS.php>

Open Science Directory (EBSCO)

<https://atoz.ebsco.com/titles/searchresults/8623?GetResourcesBy=TitleNameSearch&Find=journal+of+lithic+studies&SearchType=Contains>

CrossRef

<http://search.crossref.org/?q=%22journal+of+lithic+studies%22&publication=Journal+of+Lithic+Studies>

## **D.3. Carti:** numele membrilor echipei, in bold)

1. Beqiraj A., **Ionescu C.**, Christofides G., Uta A., Beqiraj Goga E., Marku S. (Eds.) (2014): Proceedings XX Congress of the Carpathian-Balkan Geological Association, Sept. 24-26 2014 Tirana. *Buletini i Shekencave Gjeologjike*, Sp. Iss., vol. 1 Special Sessions, 481 pp.

<http://www.cbga2014.org/doc/PCBGASSAV1.pdf>

2. Beqiraj A., Ionescu C., Christofides G., Uta A., Beqiraj Goga E., Marku S. (Eds.) (2014): proceedings XX Congress of the Carpathian-Balkan Geological Association, Sept. 24-26 2014 Tirana. *Buletini i Shekencave Gjeologjike*, Sp. Iss., vol. 2 General Sessions, 488 pp. <http://www.cbga2014.org/doc/PCBGASSAV2.pdf>

#### **D.4. Capitole in carti** (numele membrilor echipei, in bold)

1. Ionescu C., Hoeck V., Simon V., Crandell O. (2014) Ceramic sherds from *Sarmizegetusa Regia* (1<sup>st</sup> century C.E.): An archaeometric study. In: *Sarmizegetusa Regia. Cercetari arheologice recente* (Gelu Florea, ed.), 43 p., *Editura Mega Cluj-Napoca* (sub tipar). ISBN: 978-606-543-395-3.
2. Ionescu C., Hoeck V. (2014) Electron microprobe analysis (EMPA). In: *The Oxford Handbook for Archeological Ceramic Analysis*. (Alice Hunt, ed.), 20 pages, *Oxford University Press*, ISBN: 978-019-968-153-2.

#### **E. Comunicarea rezultatelor la manifestari stiintifice internationale si nationale** (numele membrilor echipei, in bold)

##### **E.1. CENTRAL EUROPEAN MINERALOGICAL CONFERENCE – CEMC 2014, Skalsky Dvur (Republica Ceha), aprilie 2014.**

1. Ionescu C., Hoeck V. (2014) Application of geosciences in the study of archaeoceramics: Archaeometric studies in Romania. In Macek I. (Ed.), *Proceedings of the International Symposium CEMC 2014*, pp. 52. ORAL  
<http://www.mineralogickaspolocnost.sk/data/Proceedings%20CEMC%202014%20print.pdf>

##### **E.2. 21<sup>st</sup> MEETING OF INTERNATIONAL MINERALOGICAL ASSOCIATION, 1-5 SEPTEMBER 2014, JOHANNESBURG, SOUTH AFRICA**

1. Ionescu C., Hoeck V., Crandell O., Šarić K. (2014) Insights into the smoothing and burnishing of ceramic surfaces. pp. 355. ORAL.
2. Ionescu C., Hoeck V. (2014): Geochemical modelling of ancient ceramics: in search of technology and sources. pp. 357, POSTER.
3. Ionescu C., Hoeck V. Gruian C., Simon V. (2014) EPR study of heated carbonate-rich illitic clay. pp. 358. POSTER.
4. Branzanic A.M.V., Benea M., Gorea M., Har N. (2014) Archaeometric studies on ancient ceramics from Șimleu-Silvaniei, NW Romania. POSTER.
5. Benea M., Gorea M., Har N. (2014) Roman tegula and brick materials from Sarmizegetusa (Romania). POSTER.

##### **E.3. Congresul XX al CBGA (Carpathian-Balkan Geological Association), 23-26 Septembrie 2014, Tirana (Albania)**

1. Giurgiu A., Ionescu C., Tamas T. (2014) Copper Age pottery from the Southern Carpathians: an archaeometric study. In: Beqiraj A., Ionescu C., Christofides G., Uta A., Beqiraj Goga E., Marku S. (Eds.) *Proceedings of the XX Congress of the Carpathian-Balkan Geological Association*, Sept. 24-26 2014 Tirana. *Buletini i Shekencave Gjeologjike*, Sp. Iss., vol. 1 Special Sessions, p. 58, POSTER.  
<http://www.cbga2014.org/doc/PCBGASSAV1.pdf>

2. Goga Beqiraj E., **Ionescu C.**, **Hoeck V.**, Muka B. (2014) Mineralogical characteristics of ancient ceramics from Daute Hill (Albania). In: Beqiraj A., Ionescu C., Christofides G., Uta A., Beqiraj Goga E., Marku S. (Eds.), Proceedings of the XX Congress of the Carpathian-Balkan Geological Association, Sept. 24-26 2014 Tirana. *Buletini i Shekencave Gjeologjike*, Sp. Iss., vol. 1 Special Sessions, p. 59, POSTER. <http://www.cbga2014.org/doc/PCBGASSAV1.pdf>
3. **Hoeck V.**, **Ionescu C.**, **Simon V.**, **Crandell O.N.**, Florea G. (2014) Ceramic potsherds from Dacian Sarmizegetusa Regia (Ist c. AD): composition, chemistry and provenance. In: Beqiraj A., Ionescu C., Christofides G., Uta A., Beqiraj Goga E., Marku S. (Eds.), Proceedings of the XX Congress of the Carpathian-Balkan Geological Association, Sept. 24-26 2014 Tirana. *Buletini i Shekencave Gjeologjike*, Sp. Iss., vol. 1 Special Sessions, p. 60, ORAL. <http://www.cbga2014.org/doc/PCBGASSAV1.pdf>
4. **Ionescu C.**, **Hoeck V.**, **Simon V.**, Rusu-Bolindet V. (2014) Moulds for *Terra sigillata* ceramics produced at Micăsasa, in Roman Dacia (2nd-3rd c. A.D.). In: Beqiraj A., Ionescu C., Christofides G., Uta A., Beqiraj Goga E., Marku S. (Eds.), Proceedings of the XX Congress of the Carpathian-Balkan Geological Association, Sept. 24-26 2014 Tirana. *Buletini i Shekencave Gjeologjike*, Sp. Iss., vol. 1 Special Sessions, p. 61, ORAL. <http://www.cbga2014.org/doc/PCBGASSAV1.pdf>
5. **Crandell O.N.** (2014) Selection of lithic raw materials at Neolithic and Chalcolithic sites in southern Romania. In: Beqiraj A., Ionescu C., Christofides G., Uta A., Beqiraj Goga E., Marku S. (Eds.), Proceedings of the XX Congress of the Carpathian-Balkan Geological Association, Sept. 24–26 2014 Tirana. *Buletini i Shekencave Gjeologjike*, Sp. Iss., vol. 1 Special Sessions, p. 55, ORAL. <http://www.cbga2014.org/doc/PCBGASSAV1.pdf>

**E.4. International Colloquium CUCUTENI CULTURE WITHIN EUROPEAN NEO-ENEOLITHIC CONTEXT – Colocviul Intrenational CUCUTENI 130 (CULTURA CUCUTENI IN CONTEXTUL NEO-ENEOLITICULUI EUROPEAN), Piatra Neamt, 15-17 octombrie 2014.** <http://www.ziarpiatraneamt.ro/wp-content/uploads/2014/10/CUCUTENI-130-PROGRAM.pdf>

1. Gh. Lazarovici, **C.-M. Lazarovici** (2014) Mask in the Cultural Complex Cucuteni-Tripolye. Similarities and differences with other cultures. Program and abstracts, p.163–164.

**F. EDITARE DE MANUSCRISE PENTRU PUBLICARE:**

1. **Hoeck V.**, **Ionescu C.**, **Simon V.**, Sourcing the raw materials for ancient ceramics based on geochemistry. *Journal of Archaeological Science*.
2. **Ionescu C.**, **Hoeck V.**, Rusu-Bolindet V. The Micasasa workshop for *terra sigillata* imitations: a mineralogical and chemical study. *Journal of Archaeological Science*.
3. **Ionescu C.**, **Hoeck V.**, **Lazarovici C.M.**, Lazarovici Gh., Ca-Al-Si-Fe phases formed in the Copper Age ceramics from Cucuteni-Ruginoasa (Romania). *European Journal of Mineralogy*.

**G. ALTE REALIZARI:**

- G.1. Ionescu C.:** Curs “Introduction into the mineralogy and petrography of ancient ceramics”, Paris Lodron University, Salzburg (Austria), Curs no. 101.104, Noiembrie 2014.

- G.2. Ionescu C.:** Chairperson archaeometry session at Central European Mineralogical Conference – CEMC 2014, Aprilie 2014, Skalsky Dvur (Republica Ceha).
- G.3. Ionescu C.:** Organizarea sesiunii “Archaeometry and Geosciences: Facing the Cultural Heritage Challenges” (Convener, chair) la 21<sup>st</sup> Meeting of International Mineralogical Association IMA-2014, Sept. 2014 Johannesburg (South Africa).  
<http://www.ima2014.co.za/index.php/programme/themes-and-sessions/11-accepted-session-proposals/81-minerals-museums-culture-and-history>
- G.4. Ionescu C.:** Organizarea sesiunii SS02 “Geosciences and Cultural Heritage” (convener, chairperson) at XX Congress of Carpathian-Balkan Geological Association-CBGA 2014, Sept. 2014 Tirana (Albania).
- G.5. Ionescu C.:** Curs compact (curs invitat), “Mineralogy and petrography of ancient ceramics”, Kazan (Volga Region) federal University and Archaeological Institute of Tatarstan Academy of Science: 27-31 oct. 2014.

5.12.2014

**DIRECTOR PROIECT  
PROF.DR. CORINA IONESCU**