HIDROTHERMAL CONTRIBUTION IN ORE GENESIS OF THE ÚRKÚT MANGANESE ORE FORMATION

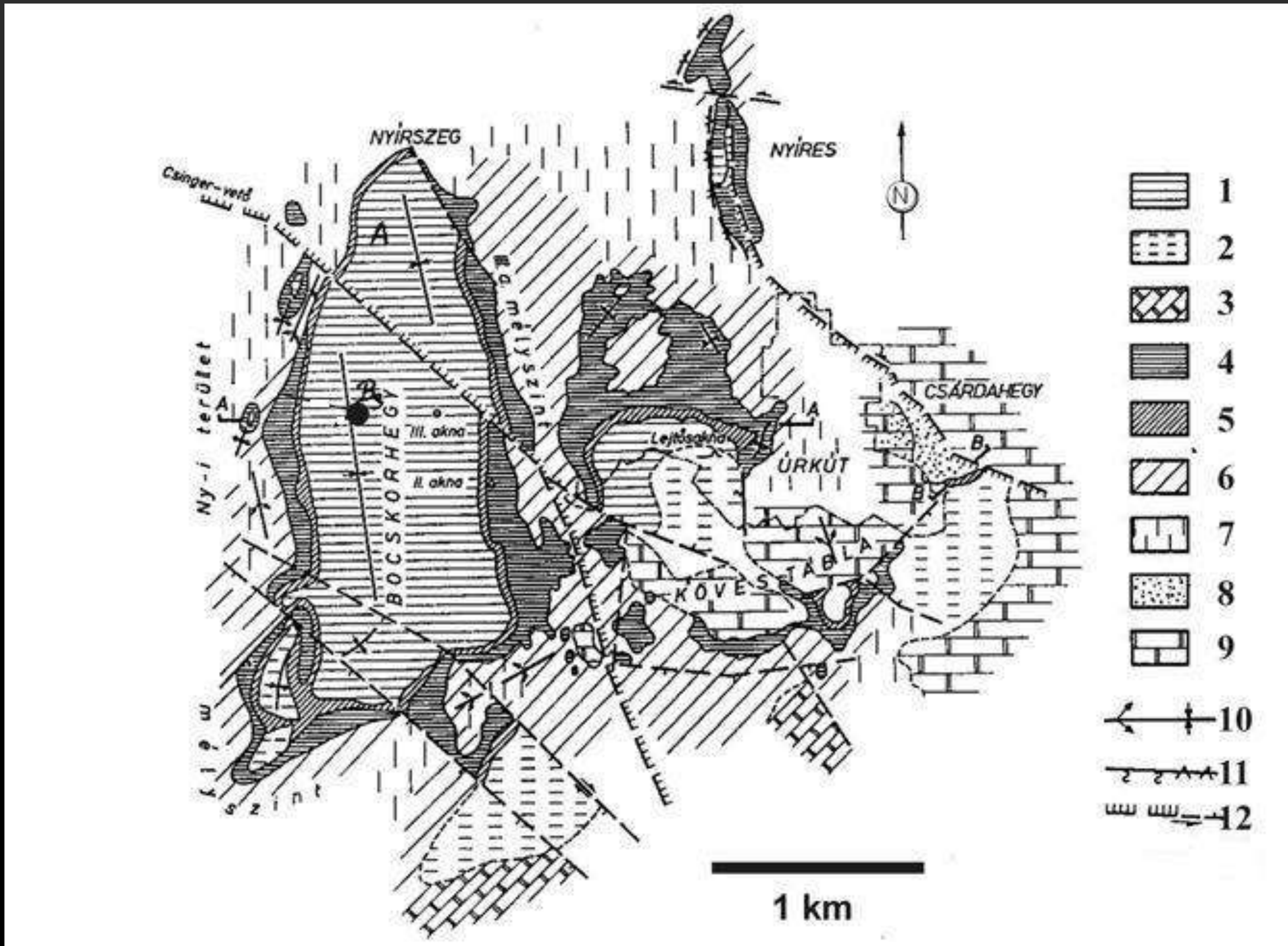
Attila Horváth[1], Norbert Zajzon[1], Tamás Vígh[2]

[1]University of Miskolc, [2]Mangán Ltd.

HIDROTHERMAL CONTRIBUTION IN ORE GENESIS OF THE ÚRKÚT MANGANESE ORE FORMATION

Contents

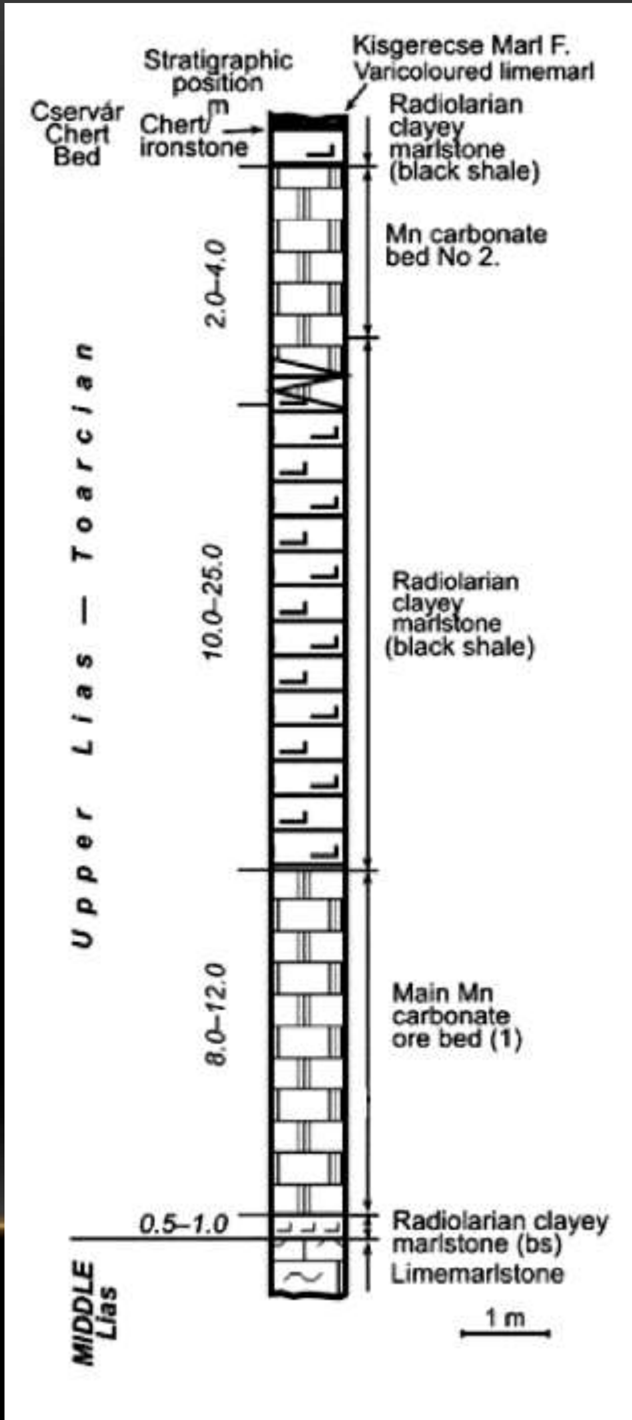
1. GEOLOGICAL SETTING



Legend: 1: carbonate ore sequence, complete. 2: carbonate ore sequence, incomplete. 3: hiatus 4: oxidised manganese ore. 5: transitional zone of carbonate and oxidised ores. 6: redeposited Mn-ore sequence. 7: abraded areas. 8: Mn-ore (oxide) of Csárdahegy. 9: underlying rocks. 10: anticline, syncline. 11: flexure, reverse fault. 12: fault, horizontal displacement

Geologic map of the Úrkút manganese ore deposit. After Polgári et al. (2000).

Stratigraphic succession of the black shale-hosted deposit. After Polgári et al. (2012)



2. SAMPLES

- Total number of analized samples: 71
- 40 samples are analised for 47 trace and 13 main elements
- 19 samples are analised for 23 trace and 2 main elements
- The analysis of 12 samples is not complete yet, only REE data is available

1. Mn-carbonate ore: 41 (Ore Bed Nr. II samples: 7)
2. Black shale: 10
3. Manganese clay: 9
4. Eplény Limestone: 5
5. Isztimér Limestone: 4
6. Cservár Flintstone: 2
7. „Kornél”: 1

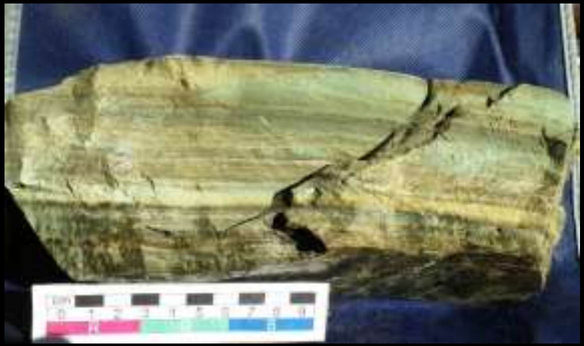
2. SAMPLES

Sample analysis:

ICP-MS (38 trace elements)

ICP-OES (14 trace and 13 main elements)

XRD (mineral phases)



Mn-carbonate ore

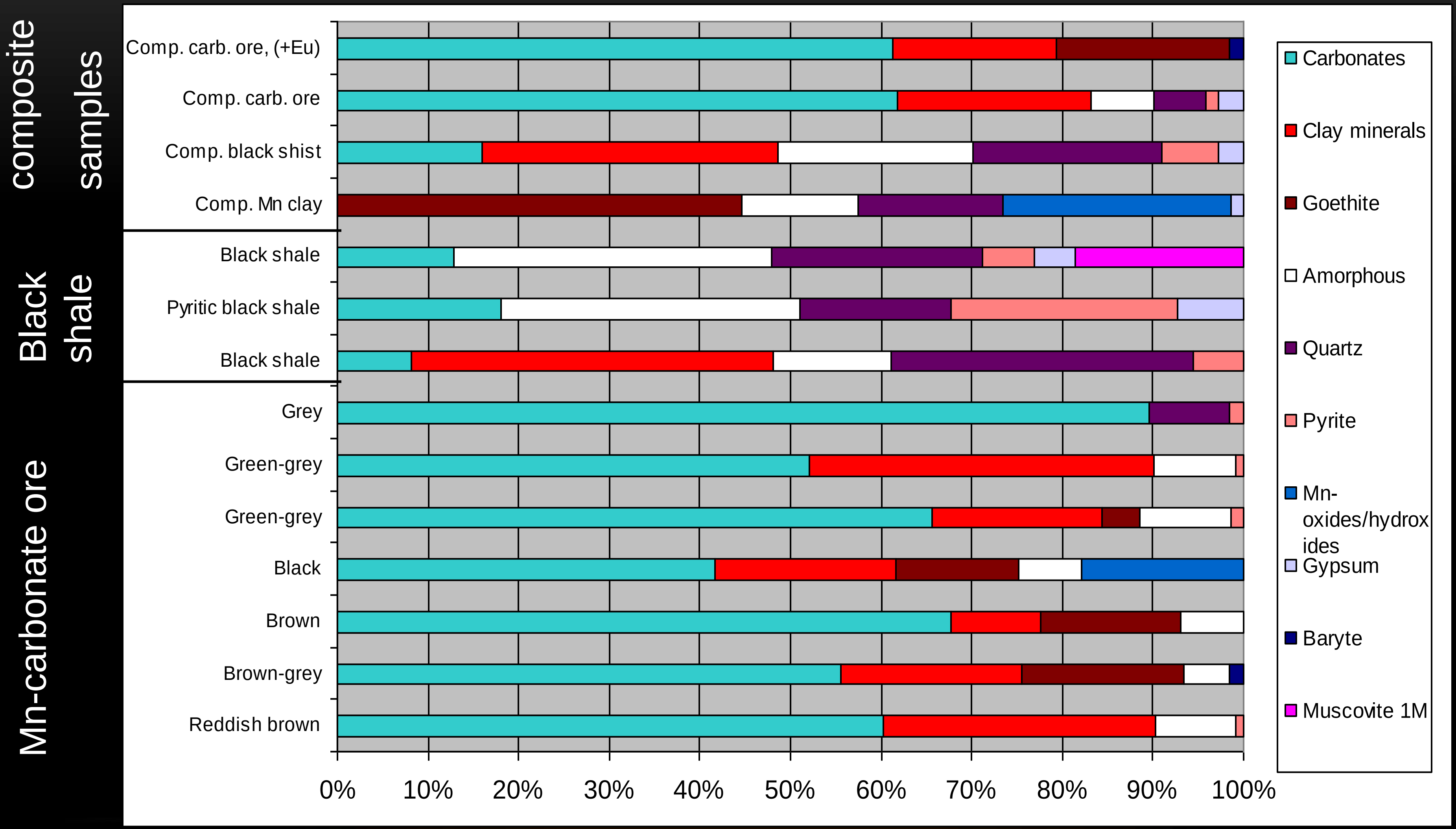
Black shale

Cservár Flintstone and Kisgerecse Marl

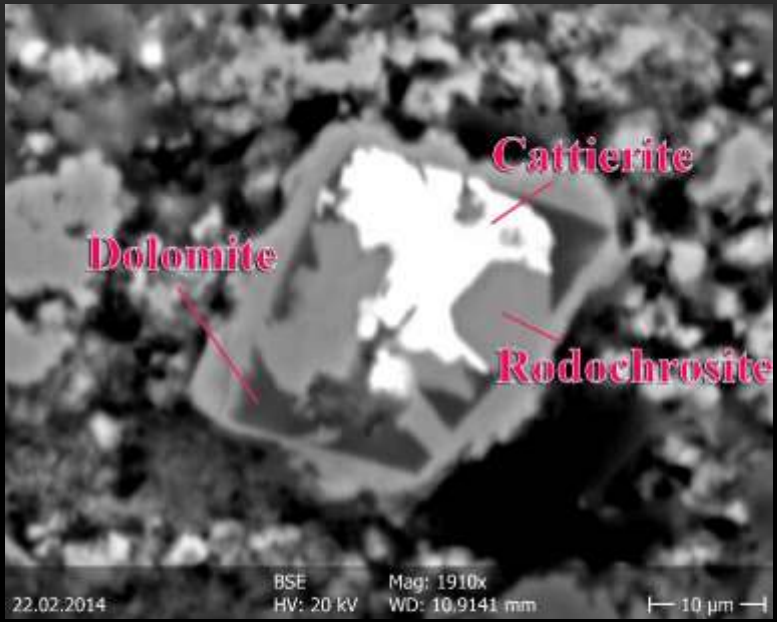
Isztimér Limestone with pyrite nodule

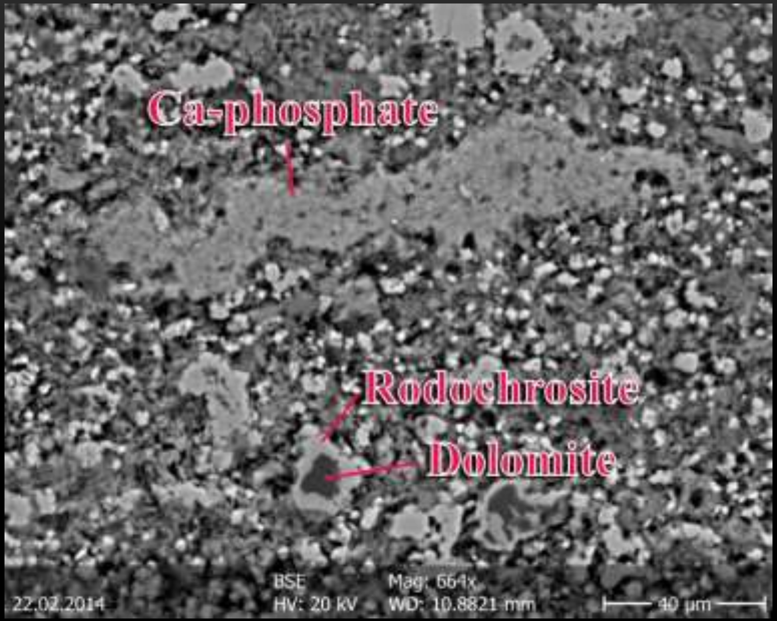
2. SAMPLES

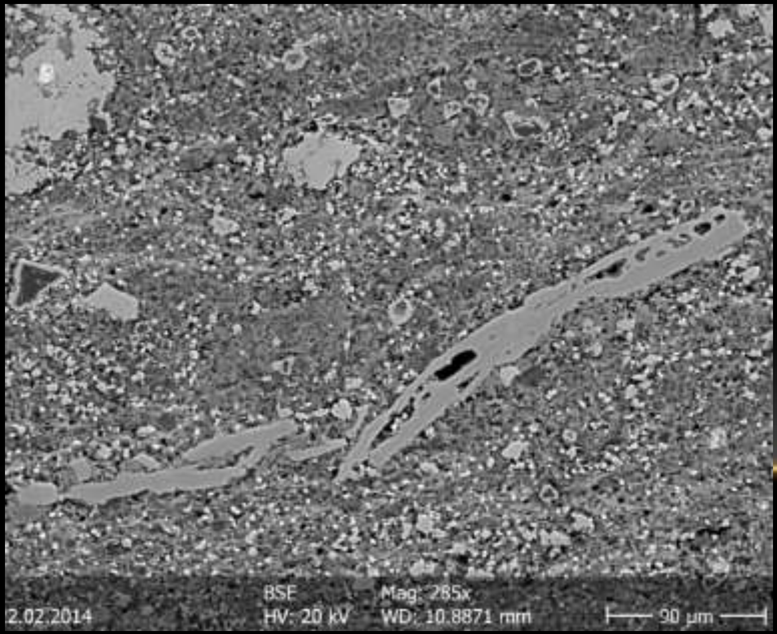
3. MINERALOGY

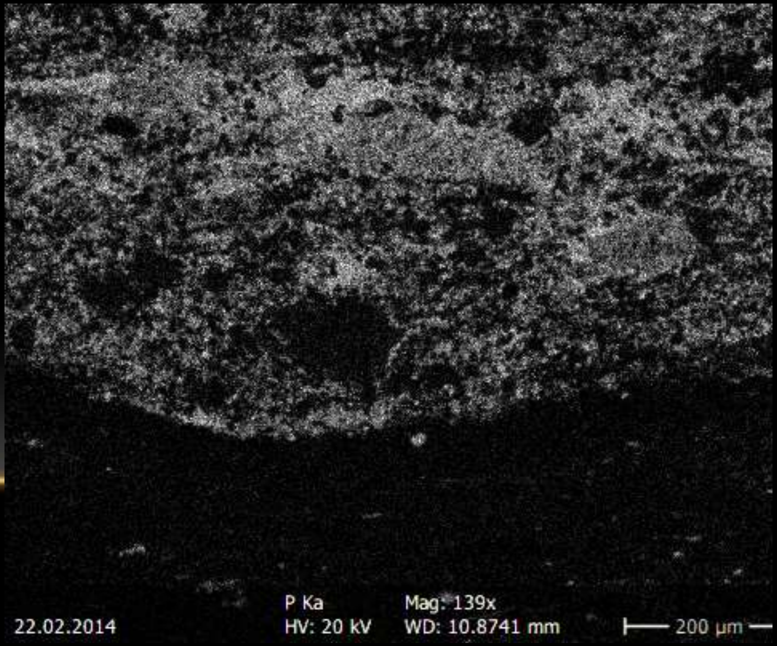


3. MINERALOGY

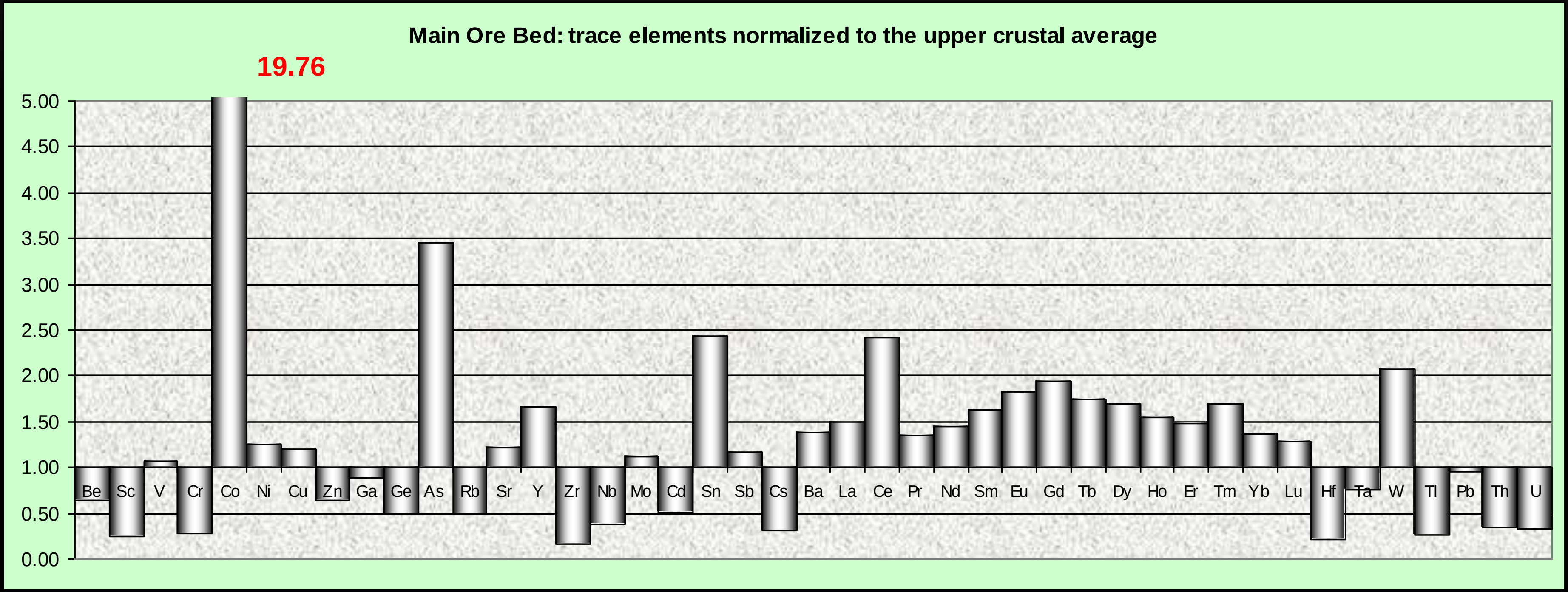




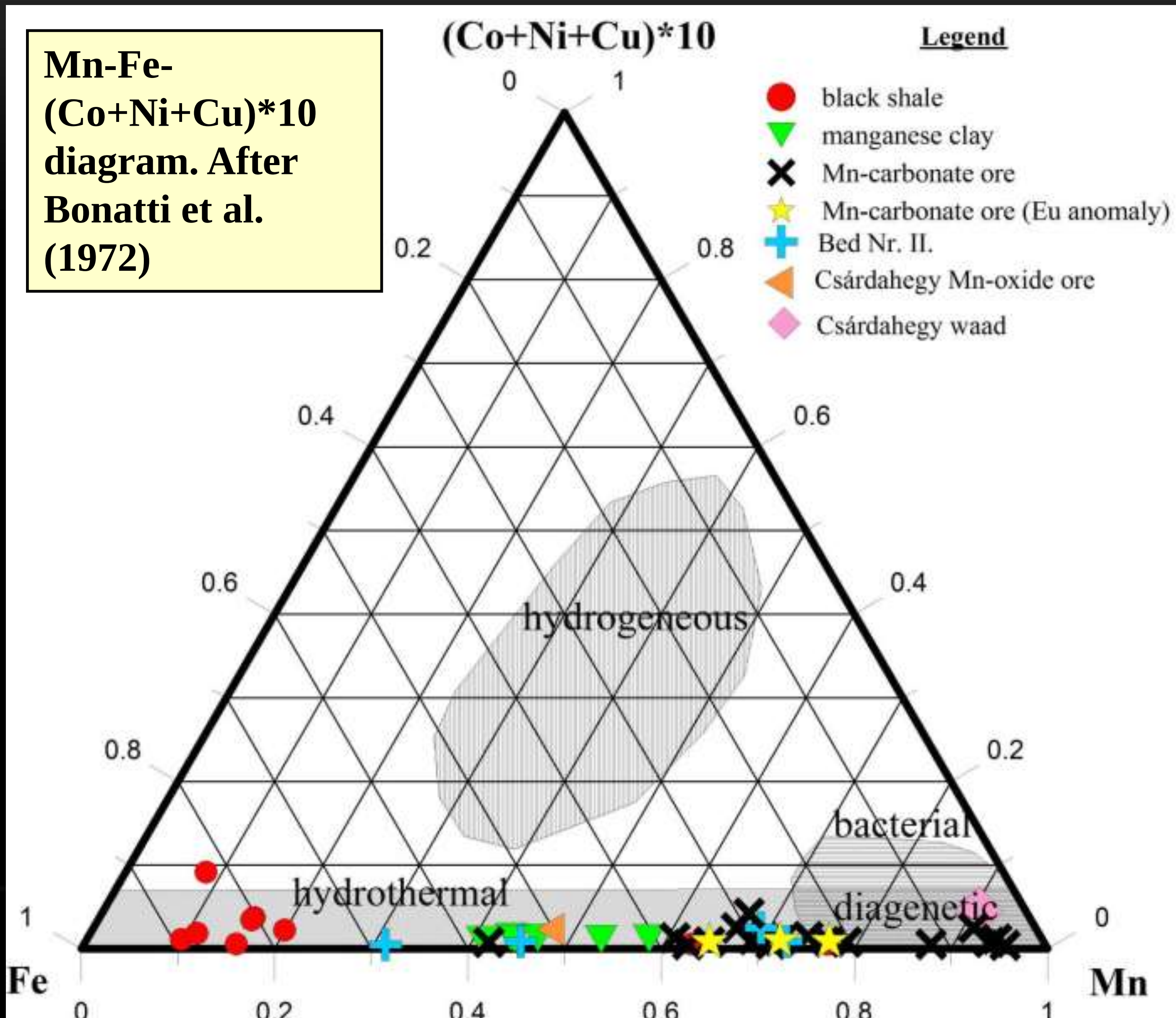




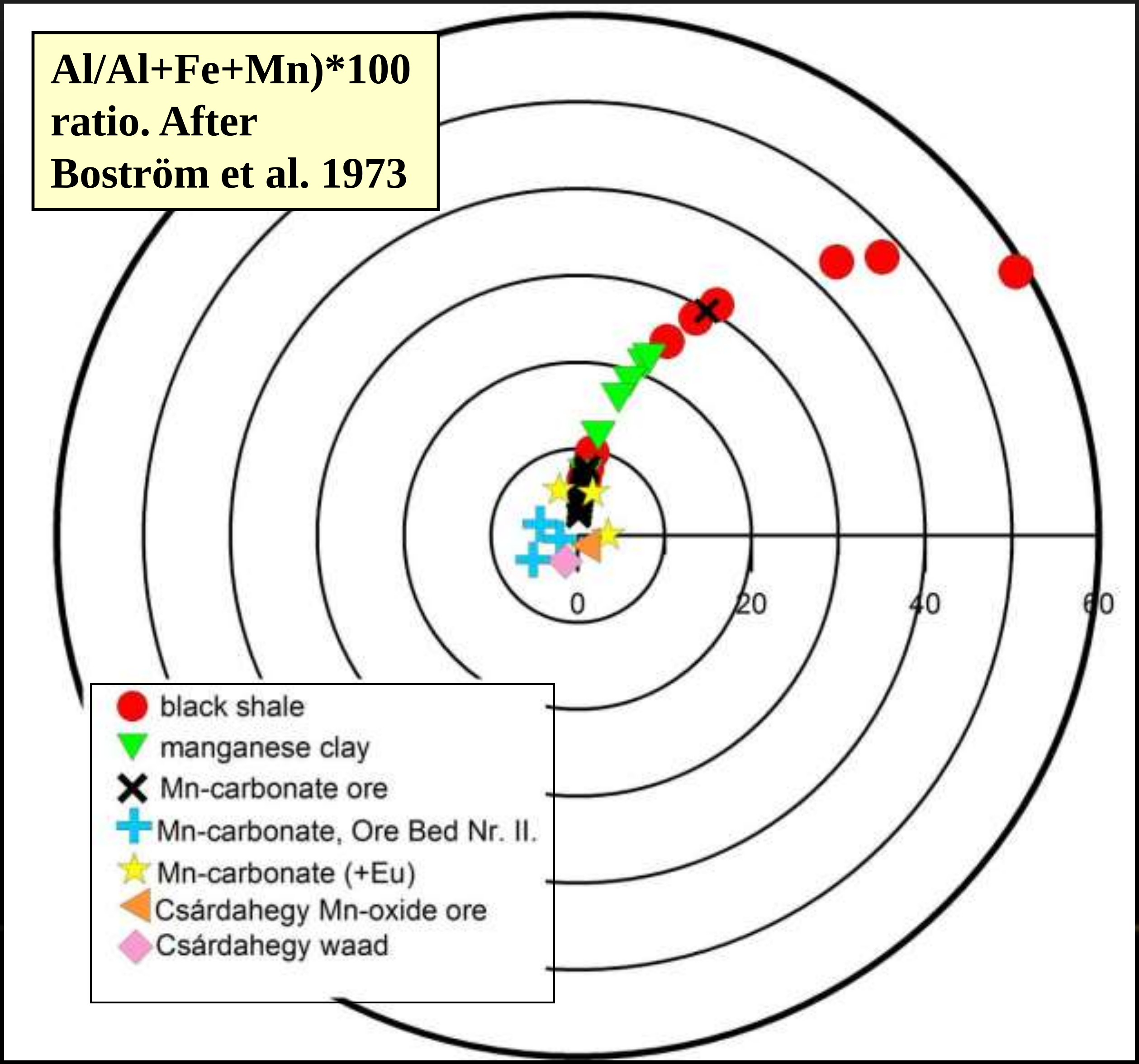
4. GEOCHEMISTRY- HYDROTHERMAL CHARACTERISTICS



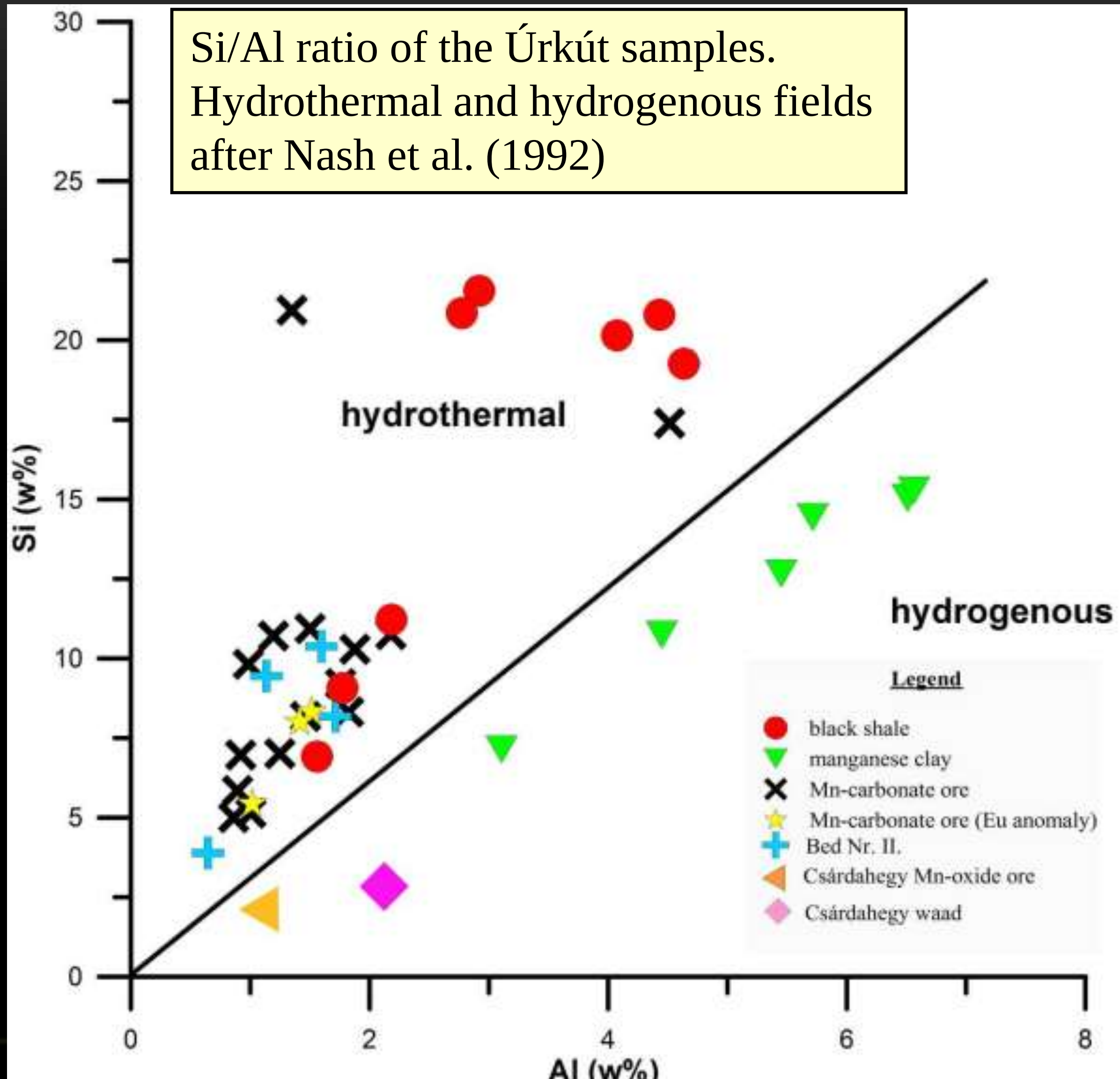
4. GEOCHEMISTRY- HYDROTHERMAL CHARACTERISTICS



4. GEOCHEMISTRY- HYDROTHERMAL CHARACTERISTICS

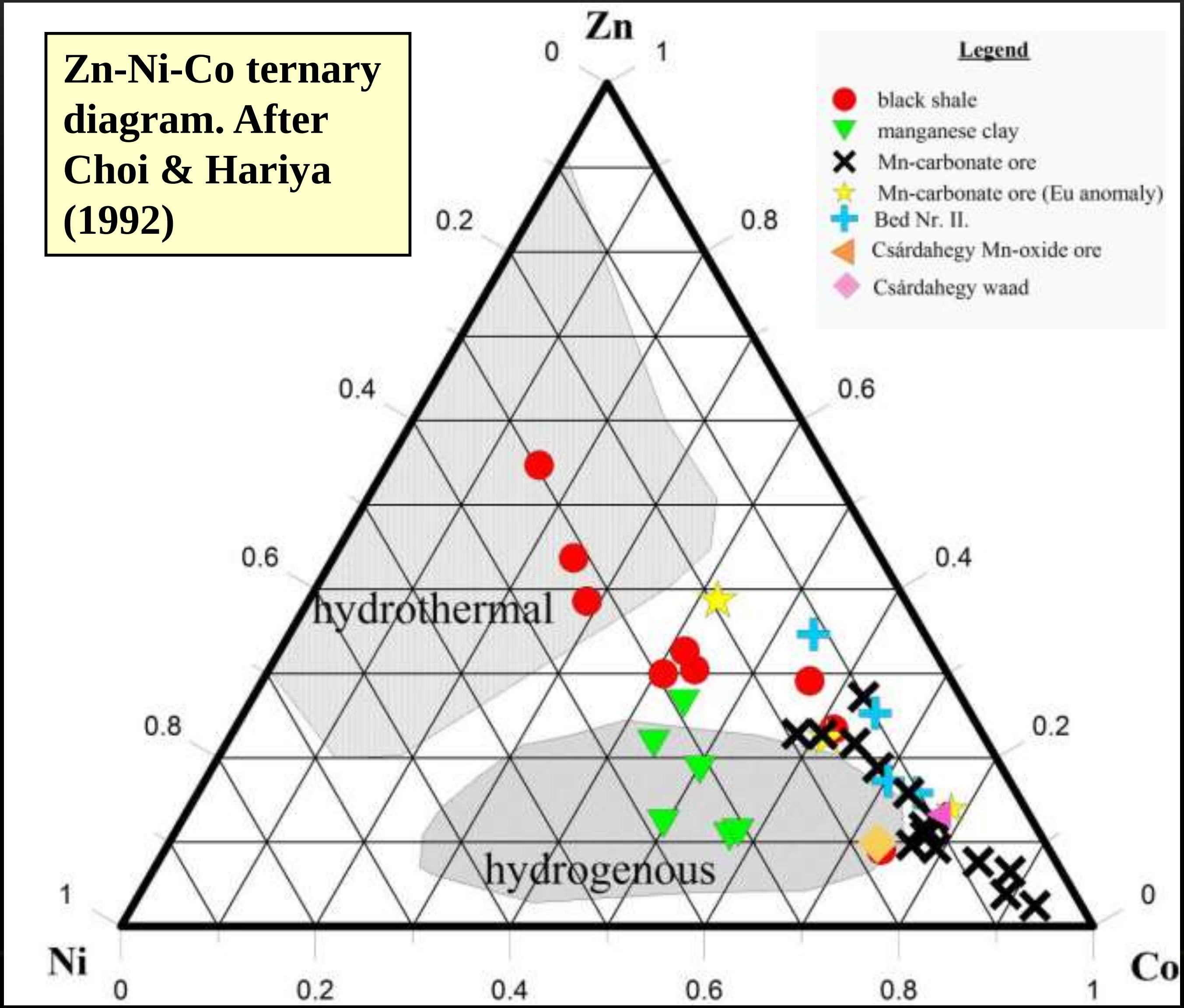


4. GEOCHEMISTRY- HYDROTHERMAL CHARACTERISTICS

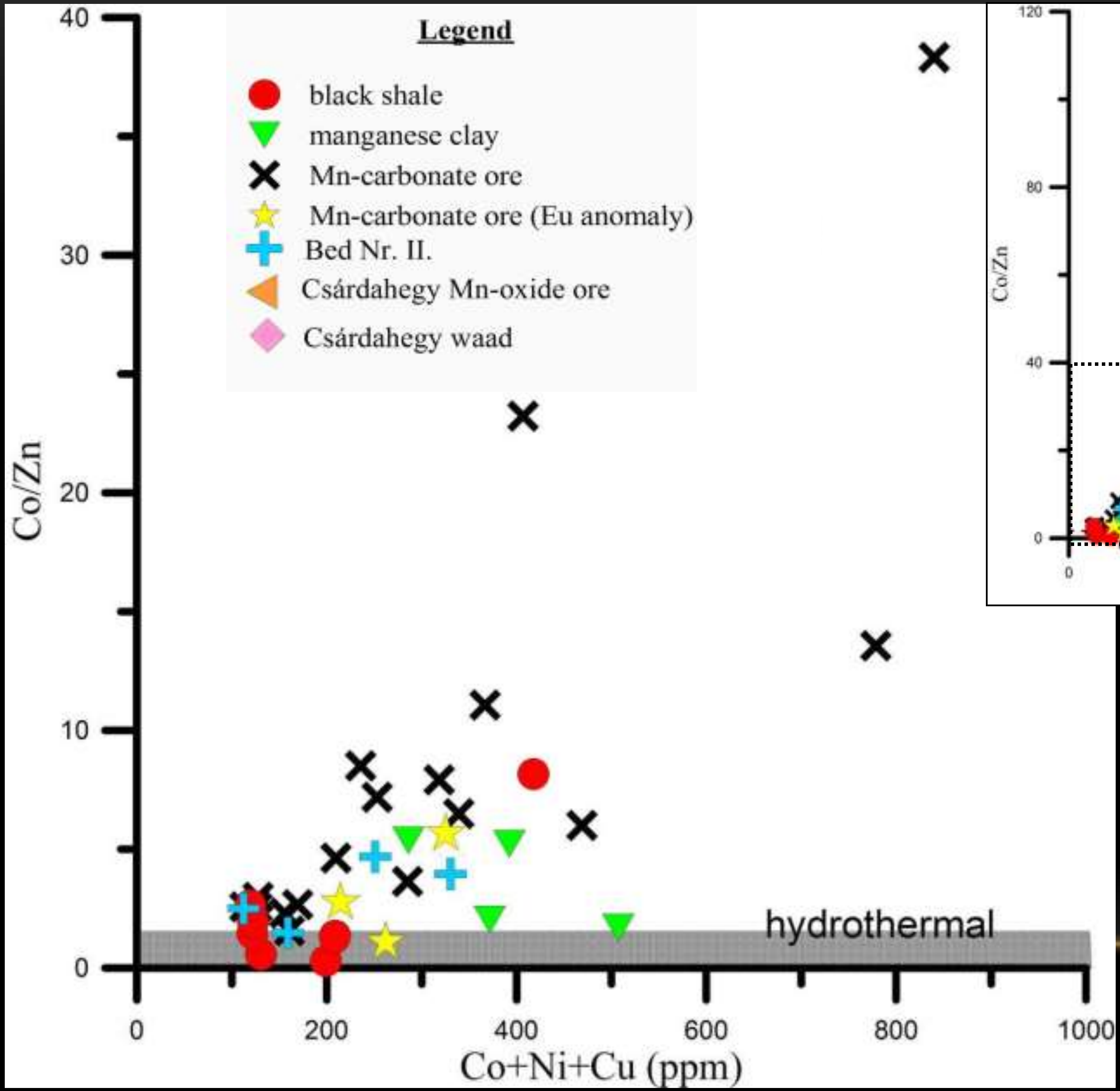


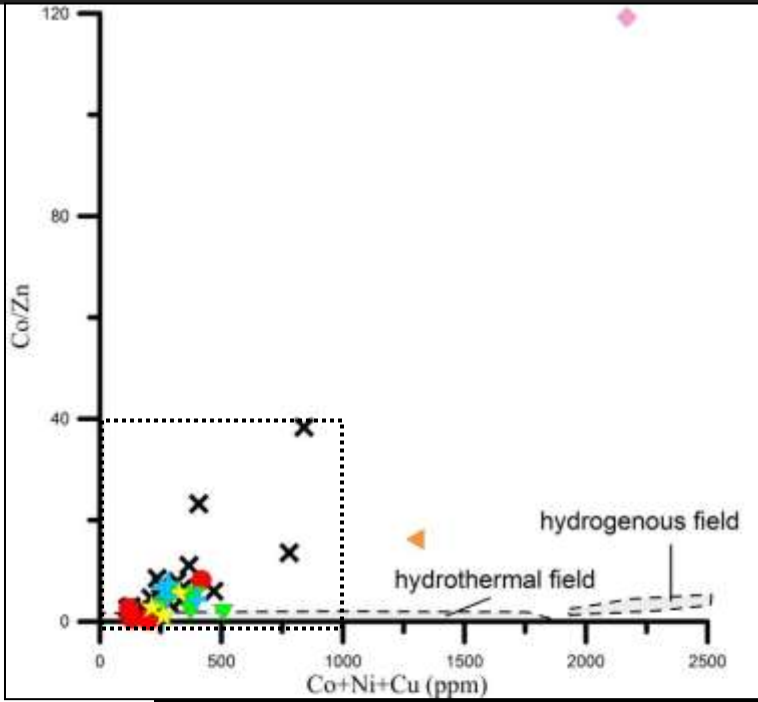
4. GEOCHEMISTRY- HYDROTHERMAL CHARACTERISTICS

Zn-Ni-Co ternary diagram. After Choi & Hariya (1992)



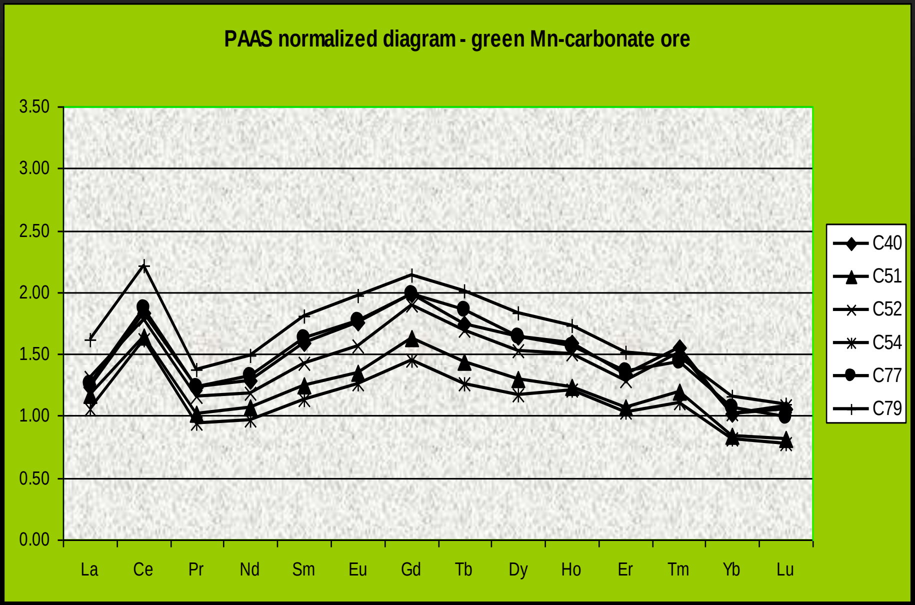
4. GEOCHEMISTRY- HYDROTHERMAL CHARACTERISTICS

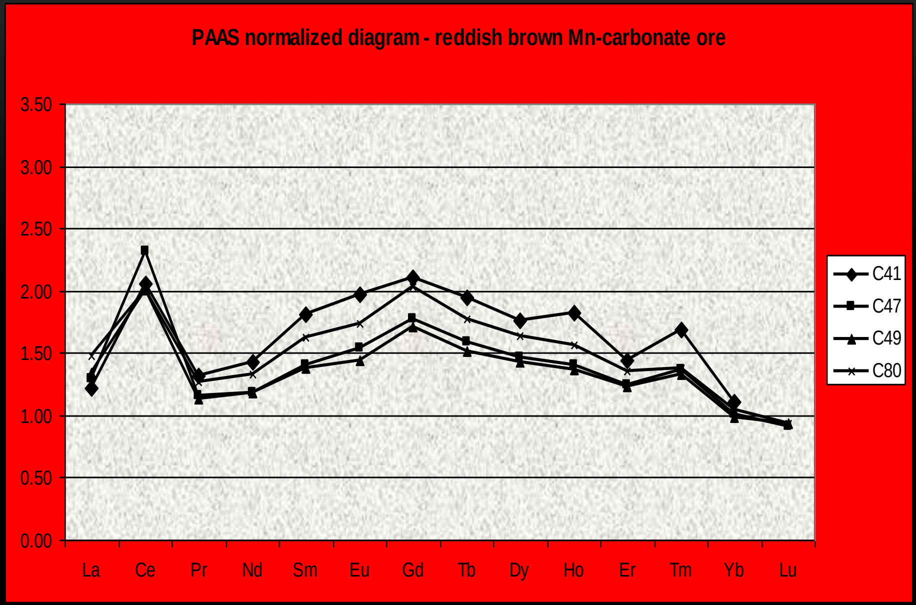


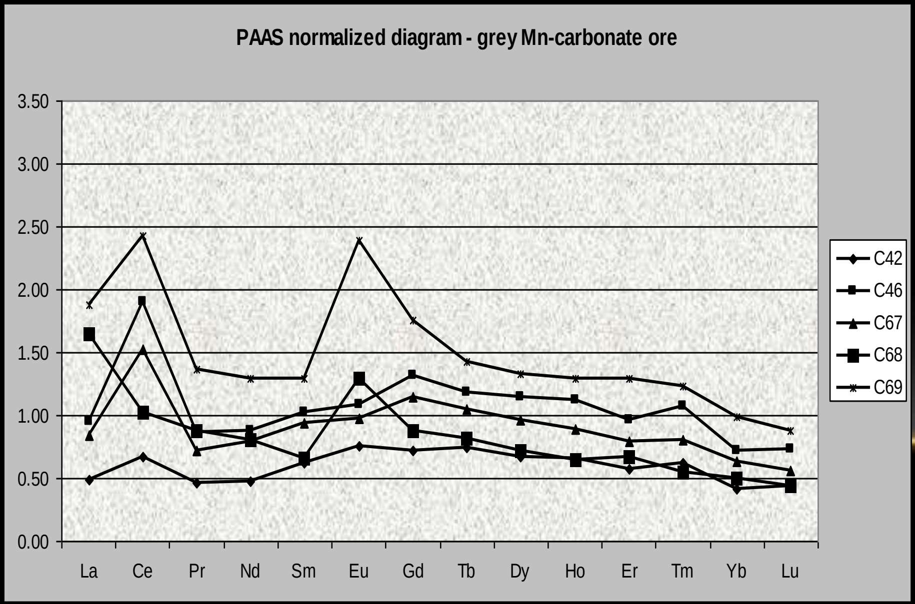


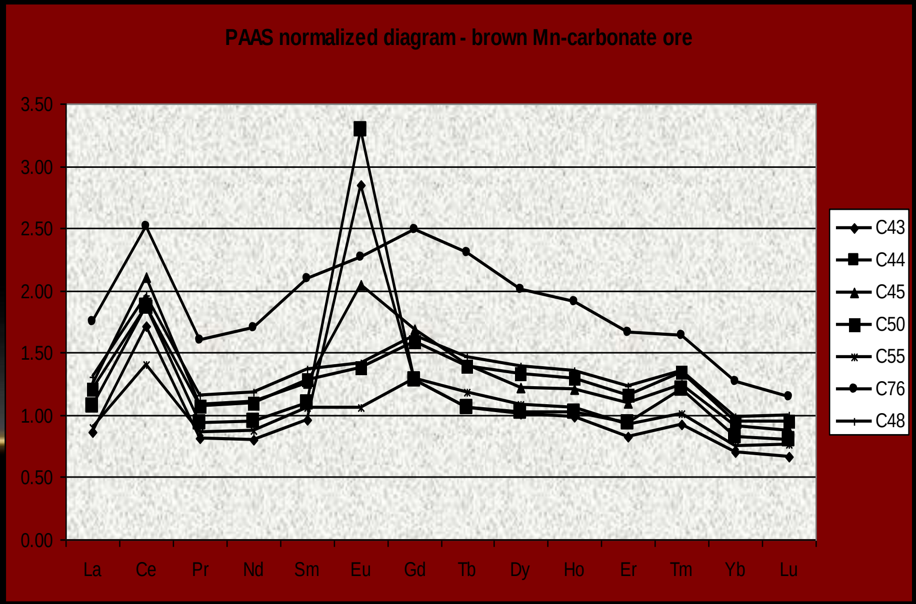
Co/Zn vs. Co+Ni+Cu diagram. After Toth (1980)

4. GEOCHEMISTRY- HYDROTHERMAL CHARACTERISTICS









5. CONCLUSIONS

- Further data supporting hydrothermal contribution in ore genesis
- In some stratigraphic levels hydrothermal effects are more pronounced →Eu-anomaly, Ba, (Ga, W)
- Hydrothermal waad sample shows very high Co-content (1729 ppm!), which supports the hydrothermal origin of Co in Mn-carbonate ore
- Csárdahegy Mn-oxide ore has also very high Co-concentration→hydrothermal contribution?

6. REFERENCES

- Bonatti E., Kraemer T., Rydell H. 1972: Classification and genesis of submarine iron-manganese deposits of the ocean floor. In: Horn D.R. (Ed.): Ferromanganese deposits of the ocean floor. Aren House, Harriman, 473-489
- Boström K., Kraemer T., Gartner S. 1973: Provenance and accumulationn rates of opaline silica Al, Ti, Fe, Mn, Cu, Ni and Co in pelagic sediments. Chemical Geology, **11**, 123-148
- Choi, J.H., Y. Hariya, 1992. Geochemistry and depositional environment of Mn oxide deposits in Tokoro belt, northeastern Hokkaido, Japan. Economic Geology, 87: 1265-1274.
- Martinez-Ruiz F., Ortega-Huertas M., Palomo I. 1999: Positive Eu-anomaly development during diagenesis of the K/T boundary ejecta layer in the Agost section (SE Spain): implications for trace-element remobilization- *Terra Nova*, 11, 290-296
- Nath B.N., Plüger W.L., Roelandts I. 1997: Geochemical constraints on the hydrothermal origin of ferromanganese encrustations from the Rodrigez Triple Junction, Indian Ocean. In: Manganese Mineralization: Geochemistry and Mineralogy of Terrestrial and Marine Deposits. Geological Society London Special Publication. 199-213
- Peters, T., 1988. Geochemistry of manganese-bearing cherts associated with Alpine-ophiolites and the Hawasina formations in Oman. Marine Geology, 84: 229-238.
- Polgári, M., Bíró, L., Szabó, I. 2012a: The manganese ore of Eplény (in Hungarian). GeoLitera, SZTE TTIK Geographic and Geologic Department Group. 145 p.
- Polgári M., Hein J.R., Vigh T., Szabó-Drubina M., Fórizs I., Bíró L., Müller A., Tóth A.L. 2012b: Microbial processes and the origin of the Úrkút manganese deposit, Hungary - *Ore Geology Reviews* 47 (2012) 87–109
- Polgári, M., Szabó, Z., Szederkényi, T. (2000): Manganese ores in Hungary (in Hungarian with English summary). *Regional Committee of the Hungarian Academy of Sciences, Szeged*, 652 p.
- Toth J.R. 1980: Deposition of submarine crusts rich in manganese and iron. Geological Society of America Bulletin, **91**, 44-56
- Weiszburg T.G., Tóth E., Beran A. 2004: Celadonite, the 10-Å green clay mineral of the manganese carbonate ore, Úrkút, Hungary - *Acta Mineralogica-Petrographica, Szeged*, Vol. **45/1**, pp. 65–80.

7. ACKNOWLEDGEMENTS

This work was carried out as part of the TÁMOP-4.2.2.A-11/1/KONV -2012-0005 project as a work of Center of Excellence of Sustainable Resource Management, in the framework of the New Széchenyi Plan. The realization of this project is supported by the European Union, cofinanced by the European Social Fund.

MAGYARORSZÁG MEGÚJUL

A projekt az Európai Unió támogatásával, az Európai Szociális Alap társfinanszírozásával valósul meg.

CRITICEL

critical elements

SZÉCHENYI TERV

Thank you for your attention!