**Report on Self-Heating Working Group 2016**

Self-Heating Working Group was established during the 60th ICCP meeting in Oviedo in 2008 and the aim of the group was to establish a classification of transformed organic matter in coal (coal seam and coal heaps) and coal wastes that underwent self-heating processes. The information about establishing our working group was published in ICCP News Letter No. 45, 2008. Through all the years the Self-heating WG was active and we have carried out three Round Robin Exercises. In 2011, the material for discussion on various forms of thermally altered organic matter in coal wastes was prepared and discussed during the ICCP Meeting in Porto. It has to be reminded that during the 61st ICCP meeting in Gramado in 2009 it was decided that separate classifications have to be prepared for coal wastes dumps and coal heaps/seams.

The aim of this working group is to establish a classification of transformed organic particles in coal wastes that will reflect the conditions in the coal waste dumps. It is a very demanding task due to a number of factors, both internal (maceral composition and rank of organic matter) and external (heating history mostly heating rate, end temperature and time, access of air (the direction and strength of wind) and moisture (atmospheric precipitation)) which influence it.

In 2016 another Round Robin Exercise was prepared that was based on 30 photos and was sent as PowerPoint presentation. The photos were the same as in 2015 Round Robin Exercise. The reflectance of unaltered organic matter is 0.6%. Participants are asked to determine the form of organic matter in the square in accordance to the newly established classification and mark the answer in **all levels** in the attached Excel file (2016 Round Robin Exercise SHWG.xls). Two places were marked as examples. After discussion in 2015 during our meeting in Potsdam, the classification was changed and simplified. In description of the exercise we also presented the modified classification giving examples of the forms. This time, we suggested marking more than one columns in the last cathegory for altered particles

In case of unaltered particles, please mark **one** of four columns: huminite or vitrinite or liptinite or inertinite located at the back of the classification (behind the last column of the Level 3). In case of newly formed particles, please mark **one** of the following columns: bitumens, pyrolytic carbon, chars, graphite, coke located at the back of the classification (behind the last column of the Level 3). In case of altered particles, you can mark more than one of the following columns in Level 6: fractures, fissures, paler in colour oxidation rims, darker in colour oxidation rims, plasticised edges, bands, devolatilisation pores, paler in colour particle.

**Proposed modified classification of transformed organic particles in coal wastes**

Structure of the present classification of transformed organic matter is partially based on coal char classification in fly ashes (Suárez-Ruiz and Valentim, 2007; Suárez et al., 2007).

In the present newly established classification all organic particles are divided into six levels:

Level 1: determines the nature of the particle. Here two categories are distinguished: organic, mineral

Level 2: determines the degree of alteration of organic particles. Organic particles were divided into three types: non-altered, altered, newly formed

Level 3: determines the structure of particles.

* The non-altered particles are divided into: huminite, vitrinite, liptinite, inertinite.
* The altered particles that are divided into: porous, massive.
* The newly formed particles are divided into: bitumens, pyrolytic carbon, chars, graphite, coke.

Level 4: determines the optical properties of particles. That level applies only to altered particles. Both massive and porous particles were divided into two categories depending if they are: fluorescent, non-fluorescent.

Level 5: determines the texture of the particles. That level applies only to altered particles. In this level fluorescent particles are isotropic and non-fluorescent particles might be: isotropic, anisotropic

Level 6: determines associations linked with the particle. Various categories can be distinguished among altered particles: fractures, fissures; paler in colour oxidation rims; darker in colour oxidation rims; plasticised edges; bands; devolatilisation pores; paler in colour particle.

During this exercise: levels 1, 2 and 3 were for all particles; levels 4, 5 and 6 were for altered particles only (i.e., without non-altered and newly formed particles).

Sometimes one photo was used more than one time.

**Results of the exercise**

The deadline for sending the results was August 28 but many results were sent later.

**Comments from participants**

***Comments from Stavros:*** The isotropic vs anisotropic particles distinction was a bit confusing. You stated in the guidelines that only image 19 was anisotropic but in many particles we observed Min and Max differences; that points to anisotropy. So my question is it is anisotropy or perhaps homogeneity vs heterogeneity what actually meant to be? Also, I think that in order to have a view of anisotropy we need images in polarised light and rotated or Min/max R values.

***Comments from Manuela Marques:*** I would like to see new photos, namely of newly formed particles. In fact the photos correspond essentially to organic (massive and isotropic) altered particles which represent only part of the proposed classification.

***Comments from Nikki:***

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| There was not enough variety in the images to be able to really test the classification scheme. |
| Bands should fall under newley formed as it is not something normally present.  Devolatilisation pores are also newley formed rather than altered. |

The classification can be tested on greater variety of forms and that could be 2017 Round Robin Exercise.

I agree that bands can be included in the newly formed forms as they originate from very strong alteration of vitrinite that likely goes through the plastic stage. I disagree with including devolatilisation pores into the newly formed particles. Devolatilisation is, as we all know, a process caused by rapid heating and as such reflects the conditions with the coal waste dump related to the rate of heating.

***Comments from Paolo Martizzi:*** the classification scheme used this year was simpler than the previous one (2015).

***Comments from Manuela Marques:*** I would like to see new photos, namely of newly formed particles. In fact the photos correspond essentially to organic (massive and isotropic) altered particles which represent only part of the proposed classification.

***Comments from Walter Pickel:***

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| 1) somewhat confused with your claim that no sample other than 19 has anisotropic particles but frequent reflectance data wths differing Vmax and Vmin data - isn't that how anisotry is defined? |
| 2) maybe in future rround robins you want to replace VR by R, as you label reflectances of vitrinite and non-vitrinite equally with VR = vitrinite reflectance (I assume) |
| 3) semifusinite-fusinite and heat affected appears to be somewhat hard to distinguish as you basically would have to distinguish, when the heat effect (fire) happened - during self heating or coal deposition and I think, often you can't. |
| 4) image 17.: hard to sa from the image, looks like fusinite but reflectance appears to be rather high and it is anisotropic according to the reflextance data. Don't think, alteration can be identified on fusinite easily, and rather likely not on this image. |
| 5) image 18): couldn't say what's in the cell lumen from the image, gelinite/vitrinite, mineral, bitumen? |
| 6) I guess you want them all to be altered as the reflectance is higher than 'prescribed' in the guidelines - but they look like vitrinites t me, maybe from a contaminating coal. Wonder if highr reflectance alone is argument enough to assume them to be heat affected. - |

**Future activity:**

Another Round Robin Exercise in 2017 testing the classification on greater variety of forms and more pictures.