Corrosion environment approximation based on atmosphere type; does it need revision?

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The analysis of the corrosion products is the key for finding appropriate treatment both for corrosion of industrial objects and objects of cultural heritage as well. Corrosion product treatment varies for different materials. On constant conditions some corrosion products does serve as corrosion protection; such are goethite and magnetite layers. Some layers are prone to further corrosion and does not provide corrosion protection to the object at all. Several samples of corrosion products formed under real conditions for the period of time between 50 and 100 years was undertaken at CET. Analysis of these samples from different sources; both atmospheric corrosion and corrosion in soils; shows identical or nearly identical phase composition and similar morphology. Analysis of these corrosion product had been done by using metallography on cross sections; Raman spectroscopy and XRD.

On the contrary; approximations for corrosion environments are widely used in the literature. These approximation does suggest – under different conditions different corrosion products are formed. These works on topic of atmospheric corrosion suggest the results are different in general and thus it is believed (also in general) corrosion products formed in rural atmosphere are different from those formed in industrial or marine environment. And thus industrial; rural; marine atmospheres or environments are used to describe different corrosion conditions and further to propose results of corrosion processes resulting in different corrosion products.

As the analysis undertaken at CET is in disagreement with such approximation. Samples contains corrosion products formed under different conditions does produce same result. Conclusion is rather than macro scale process the processes on micro scale should be taken into account. However in literature was found such approximation of corrosion behaviour based on corrosion atmosphere and conditions is used not only to predict corrosion behaviour; it is further used to select corrosion product treatment and object restoration technique.

Based on analysis of corrosion product undertaken at CET is a conclusion – approximation might be used under specific conditions; but definitely may not be used in general. Additional research in future should be made to find boundary conditions where rough approximation might be applied. Such research should be the priority.

As the corrosion products of iron and steel are crystalline or semi-crystalline; the combination of Raman spectroscopy and XRD proven to be reliable method. Additional analysis is planed; by using nano-indentation and electrochemical impedance spectroscopy methods.