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Applied Symmetry - Medieval Floor Tiles Excavated at the Castle of Kronberg
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Kronberg castle, situated at the Taunus hills near Frankfurt/Main, consists of three parts according to the erection of buildings: a fortification on top of the rocky hill (~ 1200 AD), its extension with "high house" and church (~ 1340 AD), and the noble houses of the two main parts of the family of Kronberg knights (from ~1430–1475 AD). After the last knight died in 1704, the buildings were used in many ways by citizens and officers of the Mainz administration. When Empress Victoria (daughter of Queen Victoria, wife of the German Emperor Friedrich III and mother of Emperor Wilhelm II) received the castle, the buildings were rather damaged but she had them restored, using her private money. After she died in 1901, it was handed over to her daughter Margarete, who was married to the Landgraf of Hessen. Her greatgrandson, whose mother was Princess Mafalda of Savoyen, sold it to the city of Kronberg in 1989, and in 1992 it changed into the foundation "Stiftung Burg Kronberg im Taunus".

Countless remainders of earthen kitchenware and at least six different floor tiles containing various elementary cells have been found in the large areal. All tiles are designed to form patterns with fourfold rotations, with the plane group **p4m** most frequently occurring. The elementary cell may cover only parts of a single tile. The fragments have been used for filling materials of gardens and masonry of later buildings. They could originate from the "high house", as they were also found in vaults erected ~1470 AD.
Keywords: plane symmetry, medieval floor tiles, Kronberg

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A new Approach in studying Ancient Cu-Sn Artifacts: Measure of Crystal Orientation and Phase Distribution by EBSD Analysis
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Electron back-scattered diffraction (EBSD) is based on the acquisition of diffraction patterns from bulk samples in the scanning electron microscope (SEM) [1]. In this work EBSD has been applied to analyze crystal orientations and to identify phase distribution in ancient Cu-Sn alloys.

Samples are small fragments of finished artifacts found at the exceptional Final Bronze Age site of Frattesina di Fratta Polesine, in the Po delta area.

Using literature lattice parameters it was feasible to identify distribution of the α, β, ε Cu-Sn phases in selected areas of the samples. Since during manufacture external stresses influence microstructure and induce phase transformations particularly deformed areas were observed.

EBSD maps of strongly stressed zones clearly detected the alignment of predominant cubic α phase in the same direction with the length of the specimens.

EBSD features have been also correlated to grain boundaries previously resolved by optical micrographs in order to determine the relative misorientation of grains, the occurrence of annealing twins and the existence of intracrystalline microconstituents.

[1] Prior D.J., Boyle A.P., et al., *Am. Mineral.*, 1999, **84**, 1741-1759.
Keywords: EBSD, Cu-Sn alloy, phase distribution

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Stained Glass of Crystals
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This collage represents the frequency spectra (of crystals) of the phase transition. The frequency spectra was determined by adjusting the experimental data of the heat capacity of several materials with the data obtained from the theoretical equations derived from statistical thermodynamics.
Keywords: phase transitions, specific heat, spectrum analysis

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Crystallography and Art in Kiel, and elsewhere
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In the past few years we have striven for i) a popularization of the concepts of crystallography, and ii) fostering the dialogue between art and crystallography at Kiel. This happened in close cooperation between the University of Kiel and the Muthesius-Kunsthochschule.

One of the authors (WD) gave several public lectures at Kiel, Dresden and other places, thereby introducing the basic concepts of crystallography, pointing at its occurrence and importance in Nature, Science, daily life, technology – and Art. The other author (VE) has mainly been involved with the concepts, organisation and staging of various exhibitions to which she also contributes with own paintings. The exhibitions associate scientists – usually from crystallography or geosciences – and artists: painters, designers, sculptors, photographers. Some exhibitions of the past three years were: "Ecken & Kanten - Kristall zwischen Wissenschaft und Kunst" („Edges and Corners – Crystal between Science and Art"), Kiel, 2002; "Muster über Muster – Strukturen in Geowissenschaften und Kunst" ("Patterns on Patterns – Structures in Geosciences and Art"), Kiel, 2002; „Mineral(t)räume" ("Space of Minerals, Dreams of Minerals"), Kiel, 2003, "Geometrie und andere Ordnungen" ("Geometry and beyond"), München, 2004. We will present the key ideas of the project and give an account of our experiences.
Keywords: scientific popularization, art and science, science and art

P.28.02.3
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Knowledge and Art from Crystallography Images
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Colour, shape and space create suggestive and vibrational images.

The material world contains geometric elements that seem to be unreal images.

Nature creates works of art and like a goddess give them the breath of life.

We would like to show an imaginary journey in which crystallography joins art and knowledge [1]. A lot of images of inorganic and macromolecular crystals, such as DNA [2] and proteins are compared to the M.C. Escher pictures, in order to show how the painter focalised his attention on the relationship between geometry and imagination. In fact, the first Escher picture reveals the presence of symmetry in the natural elements: air, earth and water. The sunflower and the cauliflower images would like to show the important relationship between growth and shape. These pictures journey stops on the Gustave Dore' painting "La bella addormentata".

Maybe, the lack of science and of art brings to a sleepened society...

[1] D'Aprile F., *EIDOS. Scienza tra Arte & Design*, Cd-Rom, CNR, 2005. [2] Temperini C., Messori L., Orioli P., Di Bugno C., Animati F., and Ughetto G., *Nucleic Acids Res.*, 2003, **31**, 1464.
Keywords: crystals, symmetry, perfection