LIGHT IN ANCHI CRYSTALS

Dr. R. van Wijk
Dr. S. Bosman
Dr. Y. Yan

Meluna Research B.V.
Hoefseweg 1
3821 AE Amersfoort
Netherlands

Preface

Biophotonics deals with interactions between light and biological matter. It is an exciting frontier which involves a fusion of photonics and biology. It offers great hope for the detection of biological photonic fields vis-à-vis the living state and for new modalities of ultra-weak light-activated therapies.

In 2008, D. Zantinge requested Meluna Research to study photonic properties of Anchi crystals. Crystal healing is considered as traditional remedy which even today continues to find new ways in which minerals can help to restore a balance in a stressed nature. Changes felt by people (sometimes by using dowsing or related devices) have led to speculations on what happens in crystal healing. However, science has yet to find evidence for this sensing ability of humans.

A popular theory is that crystals actually vibrate and, by these vibrations, is sensed by people. Subsequently, it has been speculated that such vibrations can be used to restore unbalanced situations and relieve illness. The question to apply biophotonics technology on Anchi crystals to estimate vibration properties was followed by a two-years of actual research by Meluna Research. Meluna Research follows in its scientific approach the principle that “Life in its manifestations is vibration”.

The properties of Anchi crystals vis-à-vis light, their light emission and light storage capacity were analyzed utilizing different types of sensitive photomultiplier devices. In the later period, Meluna Research advised on extending the biophotonics equipment with a sensitive CCD camera. This addition was also helpful in part of the research.

This report encompasses the fundamental protocols and applications that were developed for the integration of photonics, crystals and human radiation. The two part, or chapters, focus on the non-biological (Chapter 1) and biological (Chapter 2) experiments. In each chapter, a description of the protocols and illustrations of outcome data are provided.

It must be noted that these protocols and corresponding data are the result of a journey in this field of research. Several parts of the journey did not lead to successful results and have not been mentioned. Only the data of the successful part of the journey are mentioned; mostly as illustrations, sometimes as tables. Tables are not always easy to read but for future developments, their content was considered as necessary and illustrative material.

The research on the phenomenon ‘that many people feel changes upon focusing on the crystals’ has not led to distinct results. Meluna Research has quite some experience and interest in this part of research. However, during the research only the limited number of blind and randomized experimental protocols were performed leading to the outcome that the feeling of materials does not correspond with the material objects and is more a plea for ‘the spirit in motion’. Therefore, these data are not incorporated in this report, but will certainly need future attention.

I express my sincere appreciation to my colleagues, Dr. Saskia Bosman and Dr. Yu Yan, for their valuable general support and technical help.

Dr. Roel van Wijk

Contents

Chapter 1

Anchi crystals: Light properties

1. A. INTRODUCTION

1. A.1. Why a study on light storage and delayed luminescence properties of minerals?

In biophotonics, the field of research in ultra weak photon emission is rapidly expanding. Apart from the classical field of bioluminescence which can be detected by the naked eye in firefly and luminescent bacteria, this field focuses on ultra weak photon emission of biological organisms which can be detected only with highly sensitive photomultiplier devices. These devices were developed in the 1960s. Since then, sensitivity of the technical devices has increased and concomitantly, weak photon emission was estimated in increasing numbers of species, from bacteria to man. Presently, biophoton researchers believe that all organisms emit low levels of photons. The photon emission is influenced by the metabolic state of the organism. The biophoton emission also is temporarily increased when the organism was exposed to an external light source and then, after this exposure, was placed back in full darkness. The increased photon emission gradually returns to the original strength with specific decay kinetics that suggests the existence of a long-term photon storage capacity. The kinetics of the decay can be used to characterize this photon storage capacity. The decay kinetics of light-induced photon emission is dependent on the type and developmental state of the organisms. Theoretical considerations have resulted in the hypothesis that photons not only play a regulatory role within organisms, but also in interactions between organisms.

This report deals with another, special, type of interaction, namely between the living organism and its non-living environment, in particular the interaction with minerals with the property of photon storage. Knowledge on the photon storage and emission of minerals is little. For our study on the interaction of photons from minerals in photonic regulation of organisms, two main questions must be primarily asked. Firstly, do minerals have a photon storage and emission at an order of magnitude similar to living organisms. Secondly, does this light show properties indicating the possibility of interaction?

1. A.2. Minerals, light storage and delayed luminescence

The interaction of light with minerals is commonly described by the properties of transmission, scattering, reflection, polarization and fluorescence of light. In mineralogy, the light properties, together with chemical (chemical analysis) and physical (hardness, etc) properties are regularly utilized to characterize minerals. Less commonly used is the property of light storage. This is estimated as delayed luminescence. It is essentially different from fluorescence. Fluorescence of crystals is the phenomenon of specific atomic structures to store light energy in the form of excited state of electrons in atoms. The kinetic energy of electrons increases and they move to a higher orbit around the nucleus. However, this state is mostly very unstable and the electron almost immediately (within microseconds) return to

their ground state (lower orbit). This property of fluorescence is utilized for mineral-typing by estimating the characteristic excitation and emission wavelength spectrum.

More rare and also more interesting is the property of some minerals to store light-energy for longer periods of time. Also in this case, the crystal lattice is able to store light in the form of excited states of the electrons of its atoms. However, they do not immediately fall back to their ground state. Instead, they are in special energetic state which requires some additional energy in order to bring these electrons into the state that they fall back to the, lower orbit of their ground state. Spontaneous intrinsic fluctuations in energy within the crystal lattice may be responsible for the local energy increase which then causes the phenomenon of delayed luminescence. Delayed luminescence, therefore, is completely different from fluorescence, and instead, contains information on the energetic state of the crystal lattice. The intrinsic fluctuations in energy in the lattice can be also induced by external conditions of energy input, such as temperature or vibrations. The energy emission, as photons, is indicated as thermoluminescence or vibration-induced luminescence, respectively. It provides additional information of the energy state of the crystal lattice.

It is essentially unknown to what extent the light storage and its subsequent release as delayed luminescence can be found in minerals, and do show similarities with that of living organisms. However, when evidence for these matters is obtained, we can speculate, hypothesize and determine the interactions between photon fields of minerals and living organisms. Since, at this moment, this is speculation the research first needs to focus on light properties of minerals. In this research we were led by our earlier photon studies of river clay with different composition obtained from 50 different locations in The Netherlands. These data showed that some ingredients in soil have higher light storage capacity than others. In the present research, a mixture of minerals derived from a U.S mine in the Rocky Mountains has been utilized to develop a research strategy to estimate efficiently the photonic properties of mixtures of crystalline minerals. A major advantage of the minerals was the size of the particles. With larger (mm-range) sized particles of the mountain minerals it is possible to perform a.) a better hand-made separation of the mixture into different mineral types, b.) an analysis of the photon properties of both mixtures and single individual minerals, and c.) a study on the interaction of single individual particles of photon emitting minerals.

1. B. PHOTON EMITTING MINERALS IN A MIXTURE OF ANCHI CRYSTALS

1. B. 1. Delayed luminescence technology

A mixture of crystalline stones, mined in the Rocky Mountains (Anchi Inc., Boulder, Colorado, USA), was used in this study. By hand, visually different types of crystals were separated and used for determination of delayed luminescence properties. Generally the crystals have a negligible DL, except for a small part (5.6%) of opaque, white crystals, which were later analyzed as being white feldspars.

For the DL measurements, the photomultiplier tube type 9558QB with an end-window of 52 mm diameter (Electron Tubes Enterprises Ltd, Ruislip, UK) was used. This photomultiplier (PMT) is sensitive in the spectral range 300-870 nm; it has a very low electronic background (noise level) when it is used in the cooling mode (minus 25^{o}C). The PMT is mounted vertically and objects to be measured are placed beneath the PMT. The excitation facility is

integrated within the photon counting device; it has a choice of different light sources with different wavelength bands (colors).
In the measurement procedure, the mineral sample in the measurement chamber was excited by switching on a light source (a halogen lamp or a LED). During the time of the excitation, the shutter in front of the photomultiplier remained closed. The illumination was ended at the time that a shutter between the excitation source and the sample is closed. Almost immediately (approximately 100 milliseconds) thereafter, the second shutter in front of the photomultiplier is opened. The shutters are regulated by computer programs. Since counting of photons starts 100 ms after ending the excitation, the measurement data do not include fluorescence from minerals since this takes place in less than microseconds. Only delayed photon emission, i.e., light energy that was stored for longer (>100 ms) periods in the mineral was recorded by the photomultiplier. The output of the photomultiplier tube (PMT) is electronically regulated by computer; photon counting was in consecutive pre-defined time intervals (gate times) for a pre-defined period. In most presented experiments, the gate time was 200 ms and the total duration of measurement was 120s.

1. B. 2. Characterization of delayed luminescence of white crystals: towards two types.

Delayed luminescence was estimated from large number of individual white (feldspars) crystals. The data show large differences in DL intensity and kinetics. The differences between individual crystals were reproducible indicating that the measurement itself did not damage the photon storage capacity. The distribution of initial values of DL, i.e., detected in the first gate time of 200 ms, showed two populations of feldspars. It was estimated that 7.8% of the white crystals were "high-emitters" (3000 or more counts in the initial 200 ms gate time) and 92.2% were "low-emitters" (1000 or less counts in the initial gate time of 200 ms). In the total crystal mixture only 1.4 % were high-emitters. Between the initial values of 1000 and 3000 counts hardly any crystals were found. Figure 1.1 presents the mean DL curves of each population, both after white light and UV (365nm) excitation.

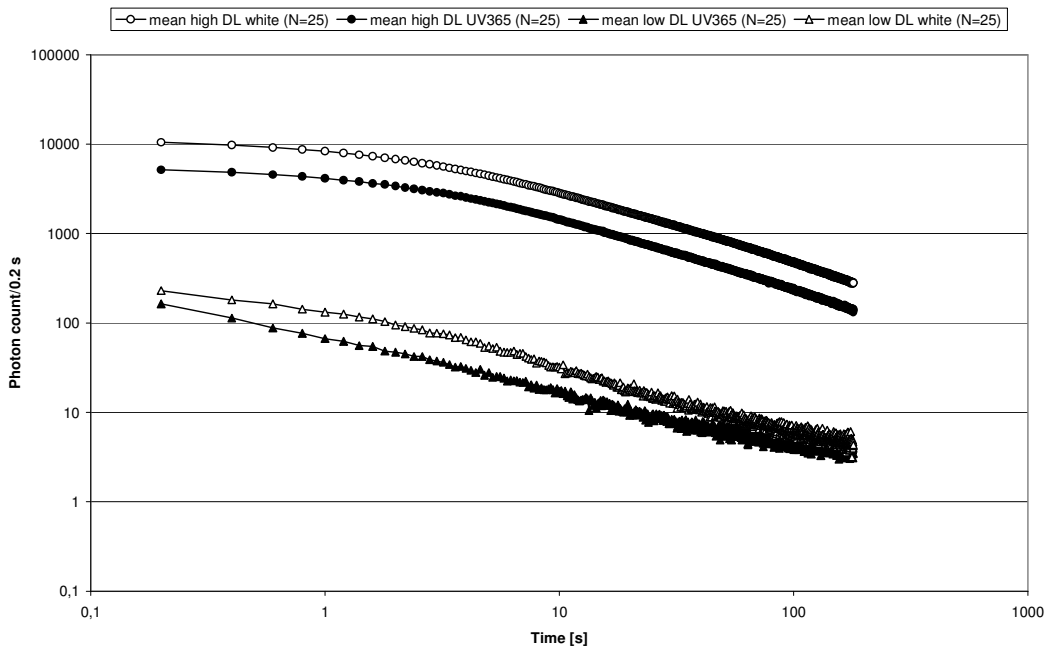

Figure 1. 1. Mean DL curves for 25 high-emitters and 25 low-emitters after 10 seconds excitation with white light (halogen lamp) and UV light of wavelength 365 nm (LED).

The selected excitations (white light and UV 365nm) for the presentation of DL data in Figure 1.1 were selected after estimation of the excitation spectrum of the low-emitters and high-emitters. The effect of different excitations colors on delayed luminescence were estimated with white halogen light and light-emitting diodes (LED) in the UV (365 nm) and the visible spectrum (blue, green and red). The data presented in Figure 1.2 are a representative illustration of the excitation spectrum: the white light induced DL is predominantly due to the high efficiency of excitation in the blue – UV range. There is some minor no difference in excitation spectrum between the high-emitter and the low-emitter, mostly in the ratio of UV / red sensitivities.

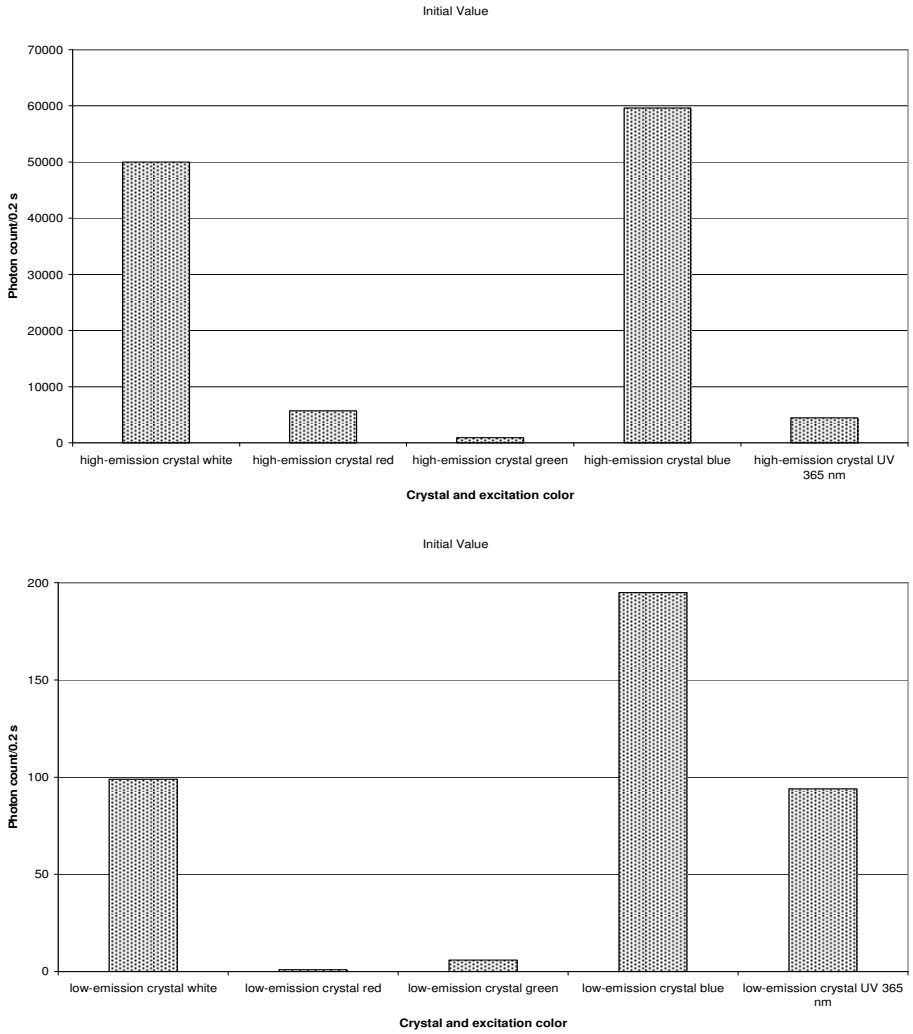

Figure 1. 2: Excitation spectra of a "high-emitter" and a "low-emitter".

A more detailed analysis of the shape of the mean DL decay curves in Figure 1.1 shows differences between the 'low-emitters' and the 'high-emitters'. This is of interest because it may cause a shift in the relative contribution of the emissions from these crystals in the overall mixture during the time after the light exposure. The 'high-emitters' typically had a

slightly convex DL curve on a double-logarithmic scale. In contrast, the DL curve of the 'low-emitters' was convex for the first 10 s and then became concave.

Systematic and quantitative analysis of delayed luminescence from a randomly selected population of 25 high emitters and 25 low emitters resulted in data on absolute values and shapes of the delayed luminescence of the 'low emitter' and 'high emitter' populations (Table 1.1). For the characterization of the shapes of the DL curves, the ratio of the slope in the early period (0.2-3.0 s) and late period (5.0-180 s) of DL was estimated.

Table 1.1. Quantitative analysis on absolute values and shapes of the of delayed luminescence from a randomly selected population of 25 'high emitters' and 25 'low emitters'.

A. Mean and standard deviation (SD) of the Initial Value (IV) and the Sum DL(i.e., sum of the whole measuring period; 0.2-180 s).

Crystal type (N=25)	Initial Value (± SD) [photon counts 0 - 0.2 s]		Sum DL (± SD) [photon counts 0.2-180 s]		Weight (± SD) [gram]
	white	UV 365 nm	white	UV 365 nm	
mean high-emitters	10409±9126	5093±4674	831199±991372	413012±492059	0,16±0,11
mean low-emitters	194±491	91±150	7352±22107	3404±7733	0,12±0,06

B. Early and late slopes of the linear fits through the DL curves.

	Early slope (mean)	Late slope (mean)	Ratio Early / Late slopes
High-emission crystal after white excitation	-0,2308	-0,8037	0,2872
high-emission crystal after UV365 excitation	-0,2266	-0,8052	0,2814
low-emission crystal after white excitation	-0,4115	-0,6630	0,6207
low-emission crystal after UV365 excitation	-0,5386	-0,4803	1,1214

The data suggest that in a mixture the contribution of emissions from the two types of emitters in the 'overall' emission changes during the time that delayed luminescence takes place. This is of interest since it will be demonstrated that these two populations of emitters have distinct emission properties.

1. B.3. High- and low emitters: physical and chemical analysis

Careful visual inspection could not reveal morphological systematic differences between high-emitters and low-emitters. An illustration of 6 high-emitters and 6 low-emitters is presented in Figure 1.3.

File Figure 1. 3 is separate

The minerals were used for physical analysis by Dr. J.C. Zwaan (mineralogist at the Naturalis Museum in Leiden, The Netherlands). The density of L-emitters ranged between 2.60-2.63 g/cm^3, that of H-emitters between 2.56-2.58 g/cm^3. Both ranges were too low for calcite

(density of 2.71 g/cm^3). Subsequently, the chemical composition of the low- and high-emitters has been estimated by X-ray diffraction and X-ray fluorescence. The data suggested that both types of white samples are feldspars, but with a different composition. Low-emitter data correspond with albite, with a chemical composition of $NaAlSi_3O_8$. High-emitter data correspond with a K-feldspar, with the chemical composition of $KAlSi_3O_8$). In addition, the K-feldspar has slightly over 1 % (weight) of Rubidium (Rb).

1. B. 4. 'High-emitters' and 'low-emitters' differ in emission spectrum

The emission spectra of delayed luminescence of low-emitters and high-emitters were estimated after inducing the delayed luminescence by a 10 s excitation with white light. Since the delayed luminescence of an individual sample can be reproducibly estimated following subsequent excitations, the emission spectrum can be estimated by inducing consecutive delayed luminescence and measuring each delayed luminescence with a different color filter between the sample and the photomultiplier tube. Technically, it must be noted that these filters are not influenced by the excitation because the filters were hidden between the opening of the photomultiplier tube and the shutter in front of the tube.

The filters are cut off filters cutting the spectrum below a critical wavelength. Filters with transmission cut off at 395, 455nm, 495nm, 550nm, 610nm, 665nm, and 715nm were used. This means that the 395nm filter cuts the light below 395nm. Only light emitted by the crystals in the range 300-395nm will be detectable with this filter after subtraction from the value without filter. The limit of 300nm is the characteristic of the photomultiplier tube. With the 455nm filter only light emitted by the crystals in the range 300-455nm will be detected after subtraction from the value without filter. By subtracting DL values corresponding with consecutive filters, the emission spectrum is estimated. For the correct quantitative calculation, data were corrected for spectrum-dependent counting efficiency of the photomultiplier tube and for the broadness of the wavelength band between two consecutive filters.

Figure 1.4 shows the emission spectra based on the early sum DL (photon counts in the period 0.2-5.0 s). Data demonstrate that the low-emitter has an emission peak at 495-550 nm (blue-green). The emission of high-emitters was at 715-800 nm (far-red). These data, in combination with the previously observed differences in decay kinetics of the two populations, led to the conclusion that one might expect that during delayed luminescence following white light or UV excitation, the emission (color) pattern will shift. Based on the relative percentages of 'low-emitters' (92.8%) and 'high emitters'(7.2%) in the original mixture of white feldspars, such mixture is expected to emit in the beginning a comparable intensity of red and blue-green light, which then shifts to the red later in time of delayed luminescence.

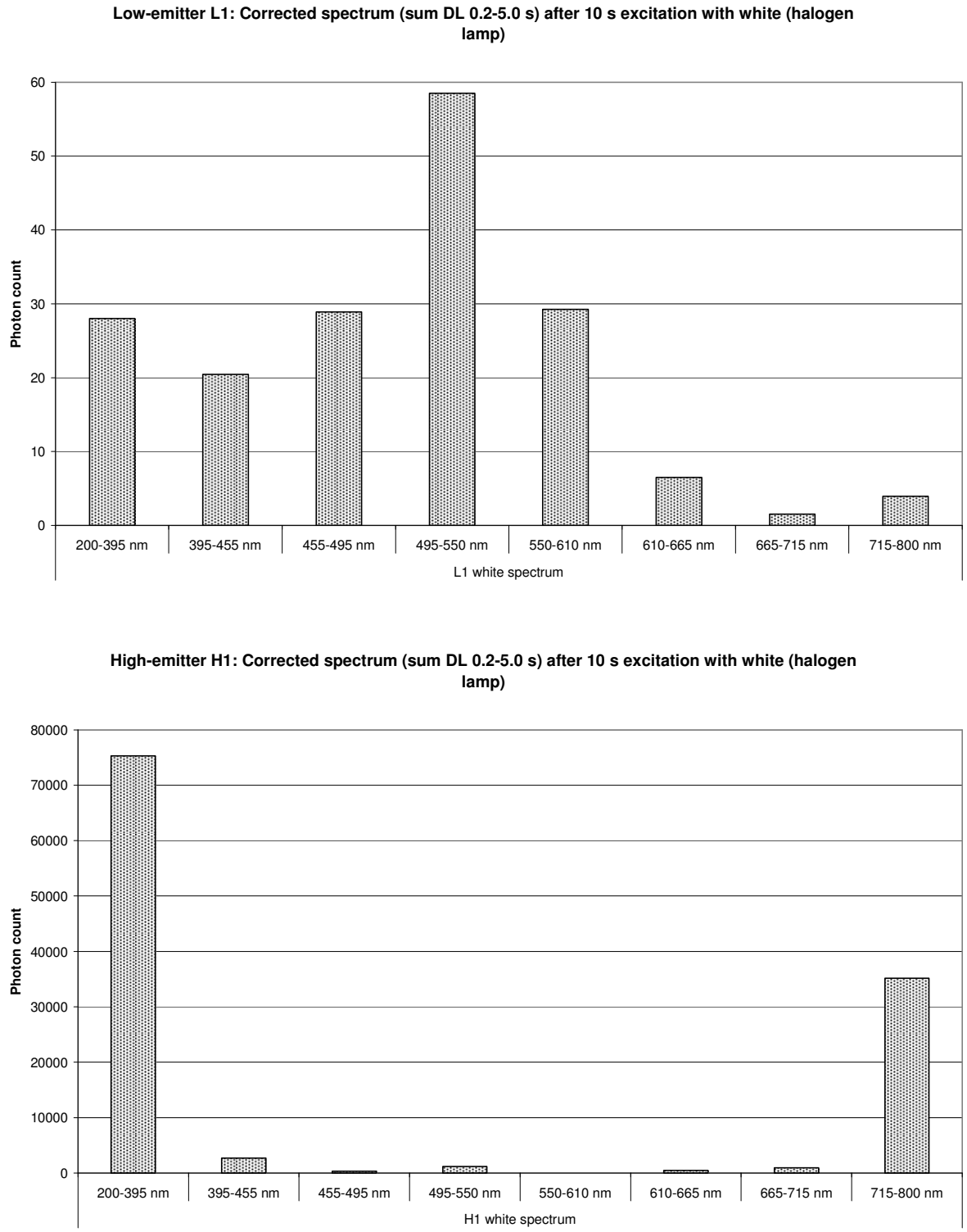

Figure 1. 4. Representative spectra of a low-emitter (upper part) and a high-emitter (lower part) after 10 s excitation for each emission filter with white light. The measurement duration for each emission filter was 180 s.Spectra are corrected for filter transmission, band width and quantum efficiency of the photomultiplier.

1. C. SPATIAL EMISSION ASPECTS WITHIN AND BETWEEN CRYSTALS.

1. C. 1. Protocol and technology utilizing Microchannel Image Intensifier

Twenty-five high-emitters and 25 low-emitters were tested for emission signals that would be sufficient to make spatial images. The first series of experiments was performed with a 2-dimensional imaging system, equipped with an AEG XX1400 Microchannel Image Intensifier Tube by Y. Yan (International Institute of Biophysics, Neuss, Germany). For excitation, a 360 nm LED, another UV lamp and a white LED were used. Every 18 sec a photograph of the photon emission image was made. It was evident that only high-emitters could be imaged, as the low-emitters already fell under the detection threshold of the imaging device within 18 sec.

White or UV light excitation did not reveal localized emission spots in high-emitters, but a diffuse, whole-stone emission. This suggest the high-emission stone's whole lattice is involved in the high emission.

1. C. 2. Crystals in grid patterns

The high-emitters, either as small (5x4 mm) crystals or (10x5 mm) crystals were situated in a 3x3 square grid pattern (9 crystals). The selection and placement of the crystals in the grid was performed without knowledge about the delayed luminescence properties of the individual crystals. The size of the grid pattern was varied, i.e., crystals were placed with various distances between the centres of the crystals (small stones 5, 7, 10, 12 and 15 mm, big stones 7, 10, 12, 15 and 17 mm). The location of each crystal vis-à-vis the other remained constant; only differences between crystals varied. The grid was excited for 10 s with white light (LED) or 360 nm LED and 5 s with a UV lamp. After each excitation images of the grid were made (Olympus µ730 camera, exposure time 1 s) immediately after (for the UV lamp 30 s after) excitation and then at 18 sec time intervals.

Figure 1.4 and 1.5 show composite picture of the relative intensities of the stones. The series depicted represent pictures taken at 1 min time intervals. This crystal stayed visible for the longest time of all stones (at least 9 min).

Files Figures 1. 4 and 1. 5 are separate

The figures of the imaging experiment make it also possible to compare the images when the distance between the crystals has increased. In all cases, the excitation of the grid results in the highest intensity of light emission from the central crystal. The surrounding crystals are less and different in intensity.
A remarkable observation was that at some distances the delayed luminescence remained detectable for a longer period of time than for other distances. This phenomenon was observed both for the small stones and the big stones. The distance that a maximum intensity of delayed luminescence could be observed differed between the small and big stones. For the small stones this maximum is at 10 mm after white light excitation, 7 mm after 360 nm

excitation and 5 mm after UV lamp excitation. For the big crystals this is 10 mm after white light excitation, 10 mm after 360 nm excitation and 7 mm after UV lamp excitation.

The individual high emitter stones were separately measured using the photomultiplier equipment. The intensities are presented in figure 1.6. Each series of 9 bars represent the intensities of the upper row (from left to right), middle row (from left to right) and the lower row (from left to right). Again, the highest light emission was detected from the central crystal, which is the 5th bar of each series. Roughly, the relative intensities of the crystals in the grid correspond with the estimations made of the individual crystals.

The data presented in Figure 1.6 also allow a comparison of delayed luminescence after white light and UV excitation. It is evident that both the small and big stones demonstrate that excitation by UV (365 nm LED) could be (slightly) different from the excitation by white light.(halogen lamp),.

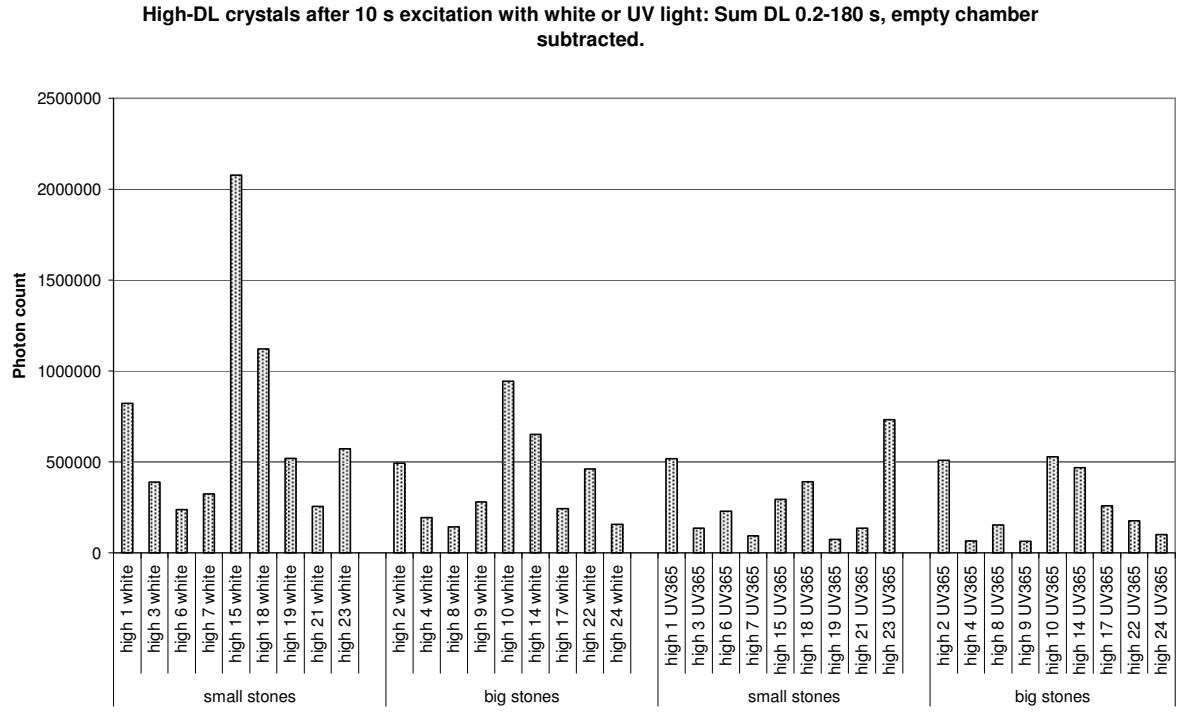

Figure 1. 6. The imaged high-DL crystals were measured individually with a PMT after 10 s excitation with white (halogen lamp) or UV (365 nm LED) light.

1. C.3. Crystals in grid patterns studied with CCD technology

The phenomenon of grid pattern delayed luminescence intensity was again studied with high-emission Anchi crystals (average diameter 4.3 mm) that were imaged by a highly sensitive charge-coupled device (CCD), type iXonEM+ 888 (Andor, Belfast, Ireland) equipped with a Xenon lens (Jos. Schneider Optische Werke GmbH, Bad Kreuznach, Germany), focal length 25 mm, maximum aperture f/0.95.
The back-illuminated CCD of the camera has a >90% peak quantum efficiency (at 575 nm) and had a spectral sensitivity in the range of 350-1000 nm. The CCD format contained 1024x1024 active pixels for each full frame with each pixel size being 13x13 µm, resulting in an image area of 13.3x13.3 mm.

The camera was cooled at -100°C, resulting in a dark current of the CCD was 0.000077 electrons/pixel/sec. A 2x2 binning has been used for an increased signal to noise ratio.

The crystals in a square 3x3 grid on black paper was excited and then imaged. The excitation was performed for 10 s with a hand-held torch of 9 bright white LEDs, at 5 cm (small grids) - 10 cm (wider grids) distance above the crystals. Imaging was then performed with an imaging exposure time of 1 s; a series of 1023 images was made with a kinetic cycle time of 2.11 s. This resulted in a series of images 2158 s (36 min) long.
In consecutive series of images, the distance between crystals in the grid was systematically varied while each crystal kept its position relative to the other 8 crystals.

Figure 1.7 presents an illustrative image of the grid. In this series the distance has been varied and images are compared at corresponding times after excitation.

File Figures 1. 7 is separate

The large advantage of the CCD equipment is that the image data can be directly used for quantification of the signal of the individual stones. The software of the CCD camera enables one to carefully match the stone, measure the intensity, correct for background and ultimately follow the light intensity of the individual crystals in a series of images. Figure 1.8 shows that for at least some crystals the absolute light intensity measured as early sum DL varies as a function of grid distance, with the maximum at 6.5 and 8.5 mm grid distance.

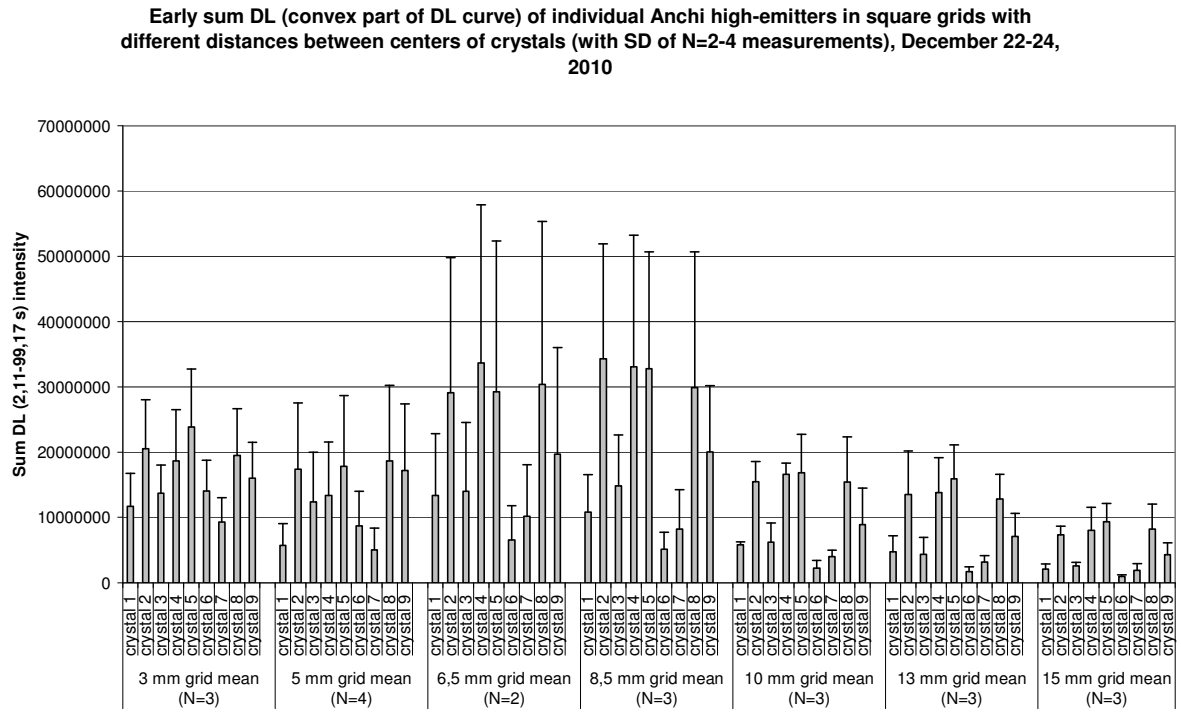

Figure 1. 8. Absolute values of the early sum DL of the same 9 high-emission crystals in square 3x3 grid with various distances. The average stone diameter was 4.3 mm.

As a next step in the analysis, the data were utilized to estimate normalized light intensity values, i.e., the relative contribution of each stone to the light intensity of the whole grid. The outcome is shown in figure 1.9. The data, interestingly, suggest that even the relative contribution by each stone to the emission of the whole grid changes as a function of distance. This may be indicative for the interaction between crystals, a phenomenon which requires further confirmation.

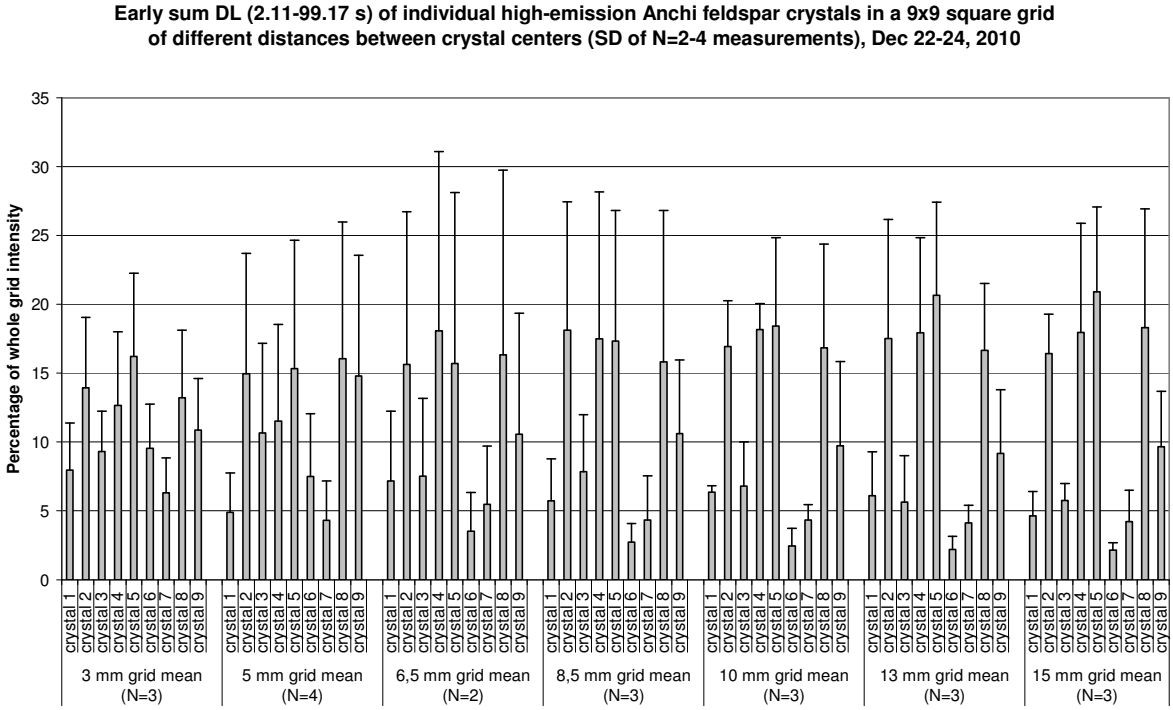

Figure 1. 9. Relative values of the early sum DL (as percentage of the whole grid intensity) of the same 9 high-emission crystals in square 3x3 grid with various distances. The average stone diameter was 4.3 mm.

1. D. THE INFLUENCE OF TEMPERATURE ON ENERGY STORAGE C.Q. LIGHT EMISSION OF HIGH-EMITTERS.

1. D.1. Protocol

The energy storage capacity of crystals in their lattices may be influenced by other external energetic conditions, such as temperature or vibrations. The temperature effects are of main interest because they may be expected from natural environmental temperature fluctuations. However, similarly, pressure or vibrations are considered as means to influence delayed luminescence. Specifically, to understand these temperature effects on high-emitters and low-emitters, an experimental model for research was developed. The principle of the model includes the study of the temperature on a quasi-stable level of long-term delayed luminescence. In fact, this latter can be considered as a form of thermoluminescence.
[It must be noted that a few experiments have been carried out related to pressure-induced luminescence. However, the lack of special equipment and consequently the reliability of the data is less than the temperature data. Therefore, we focus here on thermal effects.]

For the experimental approach, a temperature-controlled table was constructed which could be placed in the sample chamber of the photomultiplier equipment. On top of this heating table, small objects can be measured at a constant temperature. The temperature range used was between 20°C and 40°C. When the heating table was set at 20°C, the temperature of the crystals was very stable. When temperature of the sample table was increased to 40°C, the temperature increased, initially this rise is fast and then it flattens. This is related to the heat loss which corresponds to the difference in temperature between table and the surrounding sample chamber. When, on the other hand, the heating element is switched off, the temperature decrease is fast in the beginning and then flattens. The temperature as a function of time is illustrated in Figure 1.10.

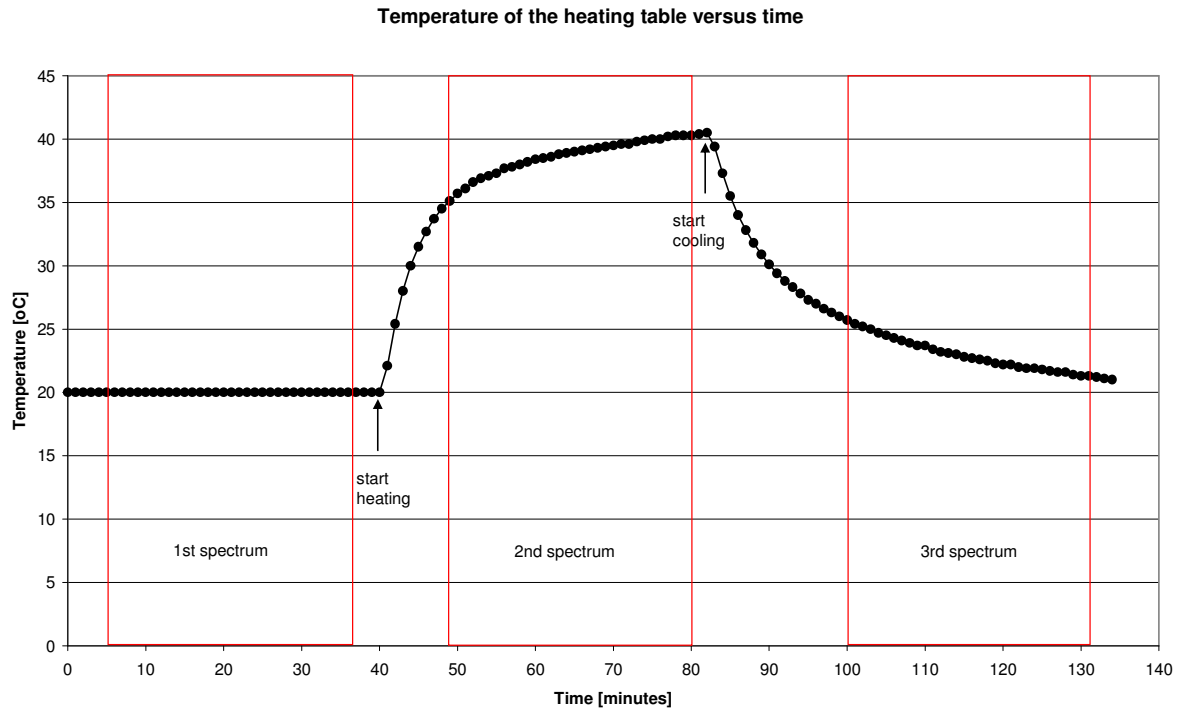

Figure 1. 10. Temperature as a function of time during heating and cooling the temperature controlled heating table inside the sample chamber of the photomultiplier. The temperature setting was changed at times indicated by arrows. The first arrow indicates the change from 20°C to 40°C. At the second arrow the temperature setting of 40°C was changed to 20°C. The rise as well as the temperature decrease is fast in the beginning and then flattens. In addition, the phases are marked in which emission spectra of crystals (see also figure 1.7)were estimated.

The experimental protocol to estimate the effect of temperature on light emission requires that the light-induced photon emission is quasi-stabile during the period of experimental changes in temperature. According to Figure 1.10, this experimental time should be at least 45 min for a unidirectional temperature shift, and for such period the rather (quasi) constant (delayed) photon emission is required. To reach this goal, the crystals were exposed to sun or daylight for 30 min and then stored in complete darkness for 5h. Since the decay of delayed luminescence follows a hyperbolic law, and the time to decrease the emission to 50% of its previous value (half life time or $t_{1/2}$) increases exponentially, at 3-5h after excitation the decay is very slow and can be considered a quasi-stable state of (long-term) delayed emission.

The final protocol, therefore, is to study the photon emission of the crystals in the time period of 3-5 h after the crystals were 30 min exposed to sun light.

During that period, low-emitters and high-emitters were exposed to a cycle of a continuous rise in temperature (20-40 ^{o}C), followed by a continuous cooling (40-20 ^{o}C). The duration of the experiment including a single cycle of heating and cooling could then be performed within 90 min. At regular time intervals during the heating-cooling cycle both the temperature and photon emission were estimated.

1. D.2. Temperature – photon emission intensity relationship.

The relationship between photon emission and temperature in case of a high-emitter and a low-emitter is presented in Figure 1.11. Data show that the photon emission of the high-emitter increased over the first 6^{o}C degrees (20-26^{o}C). Then, the emission decreased again, notwithstanding the further rise in temperature. In contrast, the photon emission of the low-emitter hardly showed any increase during the first increase of 8^{o}C (20 – 28^{o}C) and then substantially increased. The data led to the conclusion that high-emitters and low-emitters differ in their temperature sensitivity regarding emission of stored photons. Furthermore, in both low-emitters and high-emitters the phenomenon of hysteresis was observed, i.e., the cooling curve followed a lower path in the relationship temperature / photon emission than the preceding heating curve.

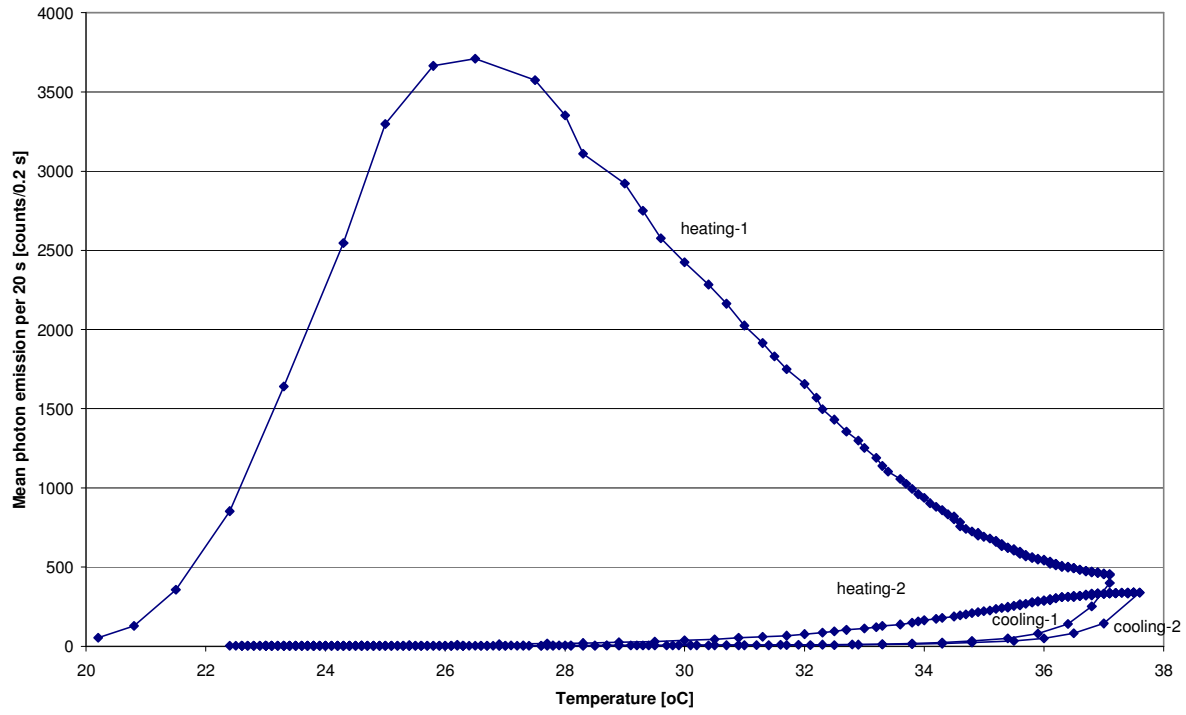

Figure 1. 11. Photon emission versus temperature of a high-emitter (No. 16) 3-5 hours after sun light exposure. Every data point represents a unique combination of temperature and mean photon emission of a 20 second period. Heating-1 and cooling-1 correspond to the cycle of a high emitter; heating-2 and cooling-2 correspond to the cycle of a low emitter.

The influence of temperature on the 'quasi-stable' long-term delayed luminescence is somewhat variable for individual crystals. This was estimated by measuring the temperature – photon emission relationship for six randomly selected crystals of the 'low-emitter' type and six of the 'high emitter' type.
For this comparison a 'high' temperature of 35 ^{o}C was selected corresponding with skin temperature (see later). Then, the photon emissions corresponding to 20^{o}C and 35^{o}C were estimated. The data presented in Table 1.2, illustrate the variability in temperature dependent emission. Thus the average photon emission of the low-emitter of 0.73 at 20^{o}C had increased to 31.04 at 35^{o}C, whereas the photon emission of the 'high-emitter' of 248.6 at 20^{o}C had increased to 3744.7 at 35^{o}C.

Table 1. 2 Photon emission of low-emitters and high-emitters (3-5 hours after the crystals' 30 min excitation by sun light) measured during 3 min, immediately after the crystals were temperature-equilibrated.

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Anchi B crystal:	Temperature [^{o}C]	mean - chamber		Temperature [^{o}C]	mean - chamber
low-emitter s	20	0,02	high-emitter 11	20	1393,57
	35	1,60		35	1616,52
low-emitter t	20	0,86	high-emitter 14	20	119,19
	35	88,01		35	2498,84
low-emitter u	20	3,23	high-emitter 15	20	121,98
	35	96,46		35	17176,39
low-emitter v	20	0,13	high-emitter 16	20	11,38
	35	4,85		35	798,55
low-emitter q	20	0,23	high-emitter 17	20	33,49
	35	6,44		35	1187,36
low-emitter r	20	0,13	high-emitter 12	20	33,32
	35	5,85		35	1507,88
low-emitter p	20	0,54	high-emitter 13	20	28,31
	35	14,12		35	1426,43

With the observed large variations in the increase of photon emission intensity per degree Celsius it becomes of interest to ask whether the spectrum has changed.

1. D. 3. Spectrum

In order to study the influence of temperature on the spectrum of the emitted light, the emission spectrum was determined at 20^{o}C and compared with the spectrum at increased temperature and the spectrum when temperature had decreased again. One crystal of each type was utilized for this purpose. The emission spectra are presented in Figure 1.12. It is evident that during spectral analysis, the change in the photon emission is relatively little.

It is concluded that spectra before, during and after the increase in temperature are very similar. Between the 'low-emitter' and the 'high-emitter' the differences are very marked, and, apparently, they are temperature independent. In adition to the UV band , the emission spectrum of the 'low-emitters' have a peak at 455-610 nm, whereas the 'high-emitter' has its peak in the far red (715-800 nm). In summary, temperature changes may change intensities of

photon emission, but the wavelength spectrum remains characteristic for the ‘low-emitter’ or ‘high-emitter’ type of crystal.

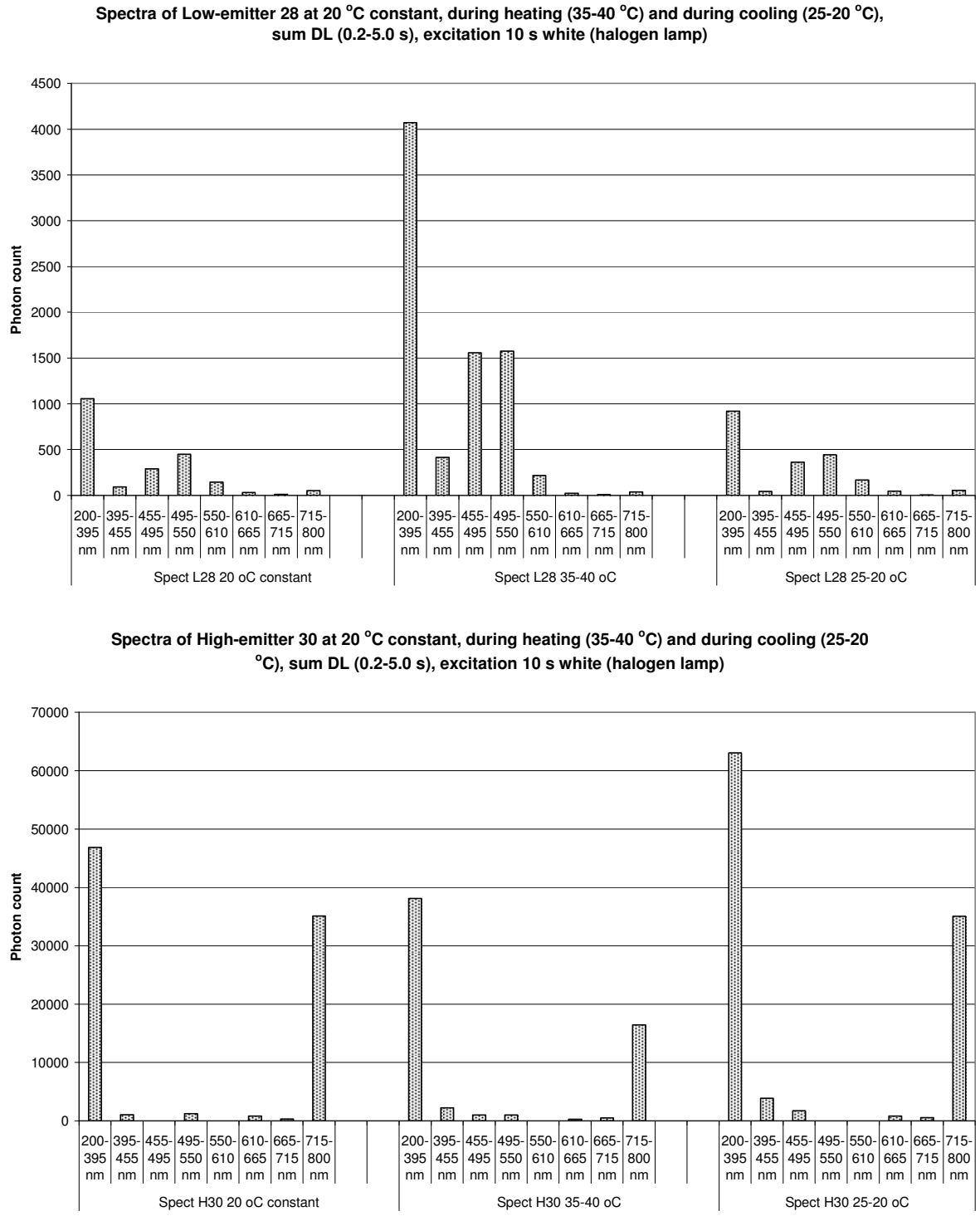

Figure 1. 12. Emission spectra of a low-emitter and a high-emitter Anchi B crystal during a constant 20 °C, during heating (37 °C) and after cooling (22 °C).

Chapter 2

Crystal photon emission and the human body.

2. A. INTRODUCTION

2. A. 1. Background of the human photon emission program

A living organism emits light. This has a very low intensity and is named ultra-weak photon emission. With highly sensitive photomultiplier equipment this photon emission from living organisms can be detected and even analyzed for its color. The very weak human photon emission has been carefully analyzed with a type of photomultiplier that is sensitive for the UV and visible light range (300-650nm). The human radiation corresponds with the blue-green region. With a photomultiplier with a broader sensitivity range up to the red region, another research team has observed that human emission spectrum also contained a red component.

It has been suggested that the emitted light reflects intrinsic human photon field. Within the human body, myriads of molecular processes are taking place and energy including photons are continuously released from cells and tissues. The emission of energy as single photons reflects only a little part of the energy transferred in adjacent molecular structures for restructuring and corresponding metabolic reaction. The research field of photon storage, photon emission and photo-stimulation in relation to the living system are highly specialized. Only a few research teams integrate these research field to study the regulatory and formative (field) properties of the intrinsic photon field. In a few cases this knowledge has been attributed to the understanding of the human photon field and its relationship with health and disease.

One of the expectations was that the emitted field could be reversed in order to use it for the purpose of influencing the organism. Such hypothesis , however, can be raised only when the human photon emission has specific properties that are different from sunlight or derived from the common artificial light sources. For interfering, either constructive or destructive, it has been suggested that the emitted light has coherent properties. However, the demonstration of coherency with the present photomultiplier systems is difficult and no definite evidence is presently obtained. Only indirect evidence suggests the special properties. This indirect evidence comes from different approaches: (a) the analysis of kinetics of emitted light (in full darkness) after light-activation of a living system, (b) the analysis of transparent properties of this same emitted light, and (c) the analysis of interaction of the emitted light with specific natural substances or artificial reflecting mirror substances. Data on the kinetics of so called delayed luminescence are available, less is available on transparency, whereas on (reflecting) substances only a few examples have been studied.

Natural (reflecting) substances (derived from living organism or nonliving nature) have been studied based on the experience in special fields of (alternative) medicine. Thus, in 2003, studies were performed in cooperation with Ackerman on colored collagen-based plates. When these plates were placed close to the body surface (skin) resulted in higher photon

emission. Similar observations came two years later (2005) from the use of natural silk that was placed on the skin.

Shortly thereafter, another promising idea developed in cooperation with the photon research team of Slawinski (Poland). In 2007, they presented good arguments for use of rhodium for the preparation of a (plate) mirror for body photon research. In fact, rhodium is an inert metal and member of the platinum group. It is used in catalytic converters; it is corrosive resistant. Its early application in the 1940s was electroplating for decorative uses since it is a hard, silvery, durable metal and does not form an oxide under normal conditions. When electroplated on white gold or platinum it gives a reflective white surface and broad spectrum reflectance. End of 2008 this research line was temporarily stopped because the research attention was then focused on crystals as substances that may interfere with the human light field.

2. A. 2. Aim of the human research with Anchi crystals

The state of the art regarding the crystal research is presented in the previous chapter. To summarize the most important observations, 6 statements can be made.

1. The crystal mixture is a composition of a limited number of types of crystals, a few types are characterized by special light storage properties.
2. The light storage type of crystal belongs to the feldspars, and two different types are distinguished. Albite is a low-emitter, emitting in the blue green range; K-feldspar is the high-emitter, containing slightly over 1 % (weight) of Rubidium (Rb) and emitting in the red range.
3. Under natural conditions of excitation (sunlight) these crystal types show long-term weak photon emission, the radiation cannot be seen with the naked eye and is more in the range of biological radiation.
4. The radiation from these crystals is sensitive for temperature (and pressure or vibration). Considering the temperature range from 20 to 40^{o}C, the temperature sensitivity differs for the two types of crystals.
5. The radiation from the high-emitter crystals is influenced by the distance between the individual crystals. In the distance effect , the size of the crystals may play a role but this particular field needs further evidence.
6. The established protocols and previously obtained data on relative quantities of the two types of emitters, their relative quantity in the mixture, the size and light properties should allow quantitative estimation of the optimal light properties of the crystal mixture.

In this chapter, a few photonic properties of crystals are described when the crystals situated in direct contact with the hand or close to but not touching the hand. Two question are asked: (a) Does body temperature influence crystal's photon emissions, and is crystal's photon emission sensitive for other types of (distant) radiation.

2. B. TECHNOLGY IN HUMAN PHOTON EMISSION

2. B. 1. Technology for recording photon emission of the hand

Photon emission of the human body is very weak and special equipment, in particularly with respect to its signal noise ratio, is required for its detection. To avoid any contribution of the

red part of the spectrum which may be related to heat, the emission was recorded with an Electron Tube 9235B photomultiplier tube having a spectral sensitivity of 300–650 nm (Electron Tubes Ltd., Ruislip, UK). This special device of Meluna Research B.V. has a selected tube with high sensitivity for reliably measuring the low photon signals from the hand. This tube has an end window of 52 mm diameter and by mounting it in vertical position, can easily be used to estimate photon emission of an object placed below. In fact, the photomultiplier tube was vertically placed on top of a box-like construction so it looked down on the object, for instance a hand or crystal, that was placed in the box's dark chamber through an opening in the front side of the box. This special dark chamber with the photomultiplier system on top was specially designed for recording of hands. Any opening around the wrist arm is closed in an absolute light-tight manner utilizing a long light tight sleeve attached around the arm. Between the open chamber and the photomultiplier opening is a shutter that is opened by computer when the photon counting starts.
The type of photomultiplier tube used makes it possible to record photon emission with optimal signal noise ratio up to a temperature (of the tube) of 20 ^{o}C. Therefore, the entire equipment was used in a darkened room that was maintained at a temperature of 18 ^{o}C. During the experiments, the human subject sits relaxed with the right hand under the photomultiplier with the hand dorsum facing the photomultiplier. To avoid fluctuations in the spontaneous photon emission of the hand dorsum, the subject followed a special protocol of dark adaptation and avoided stress situations. It was carefully checked that such situation was present during the experiments. Measurements were performed during 5 minutes each, with a gate time of 50 ms (0.05 s). The stability of the background was carefully checked throughout the experiment.

2. B. 2. Protocols for recording emission of crystals in combination with the hand.

Special care was given to the recording of the crystals in combination with the hand. As crystals, the 10-mm size type was used. Prior to their involvement in the experiment, these crystals were exposed to sunlight for 30 min and then stored in absolute darkness. From the previous chapter it is known that the light emission in the dark (delayed luminescence) becomes less in time with a decay kinetics that is described by a hyperbolic curve. It means that half time of the photon emission is not constant but increases in time in an exponential manner. In the case of the crystals this decay kinetics results in a quasi-stable long-term photon emission already after a few hours. Therefore, the crystals were used 3-5 h after their exposure.
The protocol for estimating photon emission of crystals in combination with the hand depended on the research question. Each research question had its protocol. Thus, three protocols can be distinguished. In the first (Protocol A), the crystal and / or hand were measured while the crystal was placed on the right hand dorsum and this hand dorsum remained open (visible) for the photomultiplier. In the second protocol (Protocol B), the hand remained hidden for the photomultiplier; it was placed under a black cardboard table that was directly placed over the hand. The cardboard paper had a 3 mm diameter hole which could fit the crystal and subsequently made contact with the skin. In this latter case a thermocouple was attached to the top side of the stone with a small piece of clear tape, for monitoring its temperature. This protocol was aimed at studying the influence of a direct body (skin) contact on the crystal's photon emission. The third protocol (Protocol C) was almost similar to the second one, but the cardboard construction was such that a distance of 1 cm remained between the hand dorsum under the cardboard and the crystal stone that was placed in the hole of the cardboard table. In some experiments, the protocols B and C are combined.

2. C. INFLUENCE OF CRYSTALS ON HAND PHOTON EMISSION

2. C. 1. Initial data on crystal emission when placed on the hand.

The first question deals with the properties of low-emitters and high emitters in relation to the spectral sensitivity of the detection device. It must be noted that in the present experiments ONLY the emission of high-emitters and low-emitters in the spectral range limited to 650nm was estimated. This implies that these results cannot be compared with previous data from high emitters since they predominantly emit in the red range. Therefore, the major question raised is whether the present photomultiplier system is capable of detecting photon emission from both types of crystals on top of the photon emission of the hand.

According to protocol A, the photon emission of the hand dorsum was measured when the hand was placed in the box. After dark adaptation this emission is stable, i.e., it does not show an upward or downward trend in time. In such condition, an individual crystal was placed on top of the hand. The crystal had been excited by sunlight 3-5 h before it was used in the experiment and it had a low quasi stable photon emission. The long-term emission of individual crystals could differ which resulted in increased emission values of the hand in combination with such crystal. For this reason one crystal of each type may not be representative and we randomly selected 7 crystals of each type.

The procedure of placing carefully the crystal on the skin under the photomultiplier took several minutes. This was sufficient to raise the temperature of the crystal to values corresponding with the skin temperature. This had been tested separately. The increase in photon emission after placing the crystal is presented in Table 2.1. Data are presented for both 'high-emitters' and 'low-emitters'.

Table 2. 1. Mean UPE (background subtracted) and mean UPE minus the hand UPE (in counts/0.05 s) for the measurements of individual high and low-emission Anchi B crystals plus right hand dorsum. The hand was not hidden. The measurements are listed in chronological sequence. [15-17 sept 09]

	mean-background	mean UPE minus hand		mean-background	UPE minus hand
Hand alone	0,19		Hand alone	0,21	
Hand plus high emitter 14	1,06	0,85	Hand plus low emitter p	0,86	0,64
Hand alone	0,25		Hand alone	0,23	
Hand plus high emitter 15	14,35	14,11	Hand plus high emitter 11	101,30	101,07
Hand alone	0,24		Hand alone	0,23	
Hand plus high emitter 16	0,28	0,05			
Hand alone	0,23				
Hand plus low emitter s	0,21	0,00			
Hand alone	0,21				
Hand plus low emitter t	0,36	0,16			
Hand alone	0,19				
Hand plus low emitter u	0,83	0,65			
Hand alone	0,18				

Hand plus low emitter v	0,17	0,00
Hand alone	0,17	
Hand plus low emitter q	0,19	0,03
Hand alone	0,15	
Hand plus low emitter r	0,15	0,00
Hand alone	0,14	
Hand plus high emitter 17	0,14	0,00
Hand alone	0,15	
Hand plus high emitter 12	0,17	0,02
Hand alone	0,15	
Hand plus high emitter 13	0,16	0,02
Hand alone	0,13	

The emission of individual crystals tested, 7 ‘low-emitters’ and 7 ‘high-emitters’ varies between low, not detectable, to values that could be 4-5 times (for some ‘low emitters’) or even 70-400 times (for a ‘high emitter’) more than the hand emission. In summary, it is concluded from these data that the emission of high-emitter and low-emitter crystals is distinguishable from the emission of hand with the 300-650nm sensitive-photomultiplier. However, conditions to discriminate must be established for individual crystals.

Immediately after measurement in combination with the hand, the crystal was placed at room temperature in complete darkness with the purpose to estimate photon emission of the crystals at room temperature with the same technology. This measurement of crystals alone was within the time range of the experiment that the long-term emission was quasi-stable. Therefore, theoretical we expected no change to occur during the short period of dark storage. When placed in the device and measured, the emission data demonstrated that emission values of most ‘high emitters’ and one ‘low emitter’ are significantly lower than when measured on top of the hand. The interpretation of these data is that the hand contact with the crystals had stimulated the photon emission of ‘high emitters’ and some ‘low emitters’. However, it was evident that the reliability of this procedure and corresponding data is rather limited and can be easily criticized. For continuation of this research, new protocols were developed.

2. C. 2. Crystal photon emission and temperature when in direct contact with the hand

In the following experiments high and low-emission white feldspar crystals were tested on the right hand dorsum, 3-5 hours after exposure to day light: However, in this case, the protocol B was used, implying that measurement of the stone with the hand was carried out while the hand was hidden under the black cardboard table. The crystal’s temperature was monitored.

Summarizing, the right hand was hidden under the black cardboard table with a small (diameter 3 mm) hole, covered by the 10 mm stone, which made contact with the skin of the hand dorsum. The temperature of the stone was monitored by a thermocouple attached to its top with a piece of clear tape. The estimation of the photon emission of the crystal was first measured and then, the hand was placed in the correct position, touching the crystal. The

temperature of the stone on the hand rose from room temperature (20 °C) to 24-28 °C. The rise in temperature corresponded with an increase in photon emission of the crystal.

In preliminary experiments, this temperature – photon emission relationship was first studied with 3 crystals with relatively high emission values. During the hand-induced temperature increase, every 25 s, the photon emission and the temperature were registered. The data from each individual crystal was used to calculate the relation between temperature and photon emission. A highly significant linear relationship is suggested by the correlation data in Table 2.2.

Table 2.2: Correlation between mean photon count per 25 s (background subtracted) and temperature during and after hand exposure, correlation coefficient r and error chance p. The correlation is considered significant if $p < 0.05$ and is then printed bold.
[27 aug 2009]

High-emitter No.	r and p
8	**,8927**
	p=,000
1	**,9847**
	p=0,00
7	**,8532**
	p=,000

With these data, a larger group of crystals was explored for their relationship between photon emission and temperature induced increase. Utilizing protocol B, i.e., the crystal touched the hand using the cardboard, the photon emission and temperature increase were estimated over a period of 5 min. The data on photon emission increase and temperature increase are presented in Table 2.3 (part A).

As demonstrated in Table 2.3A, the increase in temperature of the crystal depends on the temperature of the hand and may vary in the different trials. Temperature increase ranged between 4.1 and 6.8 °C. Thus, a fixed final temperature cannot be expected. To compare data of different sessions and different crystals, the increase in photon emission per °C was introduced based on the findings of linear relationships (Table 2.2).

It is evident that crystals show a highly individual temperature coefficient vis-à-vis photon emission. Values ranged between 0.00 and 0.45 for low-emitters, and between 0.06 and 23.13 for high-emitters. Careful study of these data demonstrates a major characteristic: the relationship between temperature coefficient for photon emission and the initial absolute emission value. The latter data are (also) presented in column 5 of Table 2.3B. This relationship highly significant and similar for low-emitters and high-emitters. This relationship will be further utilized in studying additional influences of the hand on photon emission of the crystal. More exactly, this question can be asked as follows: Does the hand (as model-part for human body) induce, distantly, emission of crystals, on top of the temperature effect.
For this reason, the data of Table 2.3 will be compared with data obtained when crystals are actually close to but not touching the hand.

Table 2.3. Crystals with temperature monitoring, hand hidden for the PMT. The ratio (UPE difference)/(Temperature difference) was calculated based on data on UPE and temperature

of the crystals at the beginning and end of the contact with the hand. Data are expressed in counts/0.05 s. [15-16 sept 2009]

Part A: UPE of the crystal on the hidden hand and temperature at beginning and end of hand exposure [15-16 sept 2009]:

	mean UPE of 25 s [counts/0.05 s]			
Crystal on hand	UPE at count 6000	UPE at count 12000	Temperature [°C] at cnt 6000	Temperature [°C] at cnt 12000
Low emitter p	0,104	0,306	21,2	26,1
Low emitter q	0,012	0,024	21,1	25,6
Low emitter r	0,034	0,016	21,4	26,3
Low emitter s	0,013	0,091	19,1	25,9
Low emitter t	0,671	3,065	20,6	26,4
Low emitter u	0,873	3,097	21,3	26,2
Low emitter v	0,035	0,043	21,6	26,2
High emitter 11	32,252	92,268	20,6	25,5
High emitter 12	0,314	1,128	20,5	25,2
High emitter 13	0,148	0,774	21,3	26,4
High emitter 14	8,485	33,557	21,3	27
High emitter 15	36,671	168,527	21,5	27,2
High emitter 16	0,103	0,525	21,6	28,1
High emitter 17	0,409	1,071	21,6	25,7

Part B. Data from part A were used for correlation analysis: left 2 data columns of UPE difference and temperature difference end-beginning of hand exposure (hand hidden) [15-16 sept 2009]:

	Hand not measured (hidden hand)			Initial UPE of crystals (part A)
Crystal on hand	UPE difference end-beginning hand exposure	Temp difference end-beginning hand exposure [oC]	UPE difference/Temp difference	UPE minus hand
Low emitter p	0,202	4,9	0,04	0,104
Low emitter q	0,012	4,5	0,00	0,012
Low emitter r	-0,018	4,9	0,00	0,034
Low emitter s	0,078	6,8	0,01	0,013
Low emitter t	2,394	5,8	0,41	0,671
Low emitter u	2,224	4,9	0,45	0,873
Low emitter v	0,008	4,6	0,00	0,035
High emitter 11	60,016	4,9	12,25	32,252
High emitter 12	0,814	4,7	0,17	0,314
High emitter 13	0,626	5,1	0,12	0,148

High emitter 14	25,072	5,7	4,40	8,485
High emitter 15	131,856	5,7	23,13	36,671
High emitter 16	0,422	6,5	0,06	0,103
High emitter 17	0,662	4,1	0,16	0,409

2. C. 3. Crystal photon emission and temperature when crystals are close to but not touching the hand

For this type of experiment, the protocol was extended to a combination of protocol B and protocol C. The photon emission and temperature of some 'high-emitters' and 'low-emitters' was measured when placed on the cardboard table in direct contact with the (right) hand dorsum as well as close to but not touching the hand, i.e., with the hand 1 cm below the crystal. In this experiment, a thermocouple was attached to the top of the stone to monitor the crystal's temperature. It was established before that such construction has no influence on the photon emission recording.

In these experiments, like in the previous ones, crystals were used 3.5-6.5 hours after a 30-minute exposure to full sun light. The protocol in detail included 5 consecutive measurements of 300 s (5 min). The initial measurement was the photon emission of the crystal alone during the period 0-300 s. Then the hand was placed under the card board such that the crystal was 1 cm above the hand dorsum, and the second photon emission recording was started. This registration was in the period of 300-600 s. Then, the hand was removed and the 'first post' measurement (of the stone alone) was recorded in the period of 600-900 s. Then, the hand again was placed in the box such that the hand dorsum touched the crystal and recording was carried out during the period of 900-1200 s. finally, after removing the hand, the 'second post' measurement (of the crystal alone) was during the period of 1200-1500 s.

Such protocol makes it possible to compare the temperature effects (by conduction and by irradiation) with some other unknown effects from the hand on the crystal's photon emission. The table below (Table 2.4) shows the photon emissions of the crystals measured in the different stages of the experiment. Table 2.4 is divided in two sub-tables; the first (sub-table Table 2.4A) includes the primary data on photon emission of the crystals alone and at 1 cm distance from the hand plus the corresponding temperature data. Sub-table 2.4B presents the temperature coefficient data vis-à-vis photon emission in direct contact and at 1 cm distance from the hand.

Table 2.4. Photon emission and temperature of crystals alone and crystals that were close to or actually were touched by the hand dorsum. Photon emission was expressed in counts/0.05 s, mean value from the last 25 sec of measurement, and temperature was expressed in ^{o}C. The crystals in the experiment were used under quasi stable emission conditions, 3.5-6.5 hours after a 30-minute exposure sun light. The sequence of measurement: at 300 s is the stone only, at 600 s is the stone 1 cm above the hand dorsum, at 900 s is of the stone only, at 1200 s of the stone touching the hand dorsum. [9 & 13 okt 2009]

Part A.

TABLE 2.4A	mean UPE of 25 s:		Temperature of the crystal:	

Crystal 1 cm above hand	Crystal only UPE at 300 s	Crystal 1 cm above hand UPE at 600 s	Crystal only Temperature [°C] at 300 s	Crystal 1 cm above hand Temperature [°C] at 600 s
High-emitter 12	16,24	30,14	21,1	25,2
High-emitter 13	0,45	0,56	21,4	27,1
High-emitter 14	0,26	0,14	22,2	24,8
Low-emitter o	0,00	0,08	20,9	28,3
High-emitter 14	24,47	40,84	20,0	25,6
High-emitter 15	65,89	105,23	20,3	24,5
Low-emitter q	0,06	0,10	22,1	25,4

Crystal on hand	Crystal only UPE at 900 s	Crystal touching hand UPE at 1200 s	Crystal only Temperature [°C] at 900 s	Crystal touching hand Temperature [°C] at 1200 s
High-emitter 12	18,19	35,34	23,1	26,3
High-emitter 13	0,38	1,01	22,9	29,0
High-emitter 14	0,19	0,16	22,7	24,6
Low-emitter o	0,03	0,19	22,1	27,8
High-emitter 14	29,23	34,02	22,1	25,2
High-emitter 15	82,19	180,88	22,0	27,7
Low-emitter q	0,09	0,07	23,1	25,3

Part B: [9 & 13 okt 2009]

TABLE 2.4B	Temp difference	UPE difference	UPE / degree Celsius	Initial UPE
Crystal 1 cm above hand	after-before 1 cm above hand	after-before 1 cm above hand		
High-emitter 12	4,10	13,90	3.39	16,24
High-emitter 13	5,70	0,11	0.019	0,45
High-emitter 14	2,60	0,00	0.00	0,26
Low-emitter o	7,40	0,08	0.011	0,00
High-emitter 14	5,60	16,37	2.92	24,47
High-emitter 15	4,20	39,34	9.37	65,89
High-emitter 12	3,30	0,04	0.012	0,06
	Temp difference	UPE difference		
Crystal on hand	after-before contact with hand	after-before contact with hand		
High-emitter 12	3,20	17,15	5.36	18,19
High-emitter 13	6,10	0,63	0.103	0,38
High-emitter 14	1,90	0,00	0.00	0,19
Low-emitter o	5,70	0,16	0.028	0,03
High-emitter 14	3,10	4,80	1.55	29,23
High-emitter 15	5,70	98,70	17.32	82,19
Low-emitter q	2,20	0,00	0.00	0,09

The data of sub-table 2.4A suggest, as expected, that the photon emission has increased when the hand is close by or is touching the crystal. The data also show the temperature increase. One crystal of the high-emitter type ('high-emitter'14) and one crystal of the low-emitter type (low-emitter q) are the exceptions. Both exceptions correspond with the lowest temperature increase. Table 2.4B shows the temperature coefficients of photon emission. As previously (Table 2.3), these coefficients can be compared with the initial photon emission (Table 2.4B).

It is concluded from Table 2.4, part B (column 4 and 5) that temperature coefficient is highly correlated with the initial photon emission intensity for both the contact and the distant situation.
The data indicate that temperature plays a dominant role in both conditions.

2. D. TRANSPARENCY MEASUREMENT: IS THE HAND TRANSPARENT FOR LIGHT EMISSION FROM CRYSTALS

2. D. 1. Crystal under the hand while measuring the hand with the photomultiplier

The last paragraph of this chapter focuses on photon emission measurements of the hand dorsum under the condition that a crystal was placed under the hand, touching the hand palm. Using the hand as a 'model-part' of the human body, this special protocol was meant to study the property of transparency vis-à-vis crystals with different light properties. Similarly, the right hand dorsum was measured while the same hand's palm was not touching, but 1 cm above the crystal.

In the first experiments, the crystals were tested when they had a quasi-stabile emission (after exposing crystals to sunlight as before followed by storage in the dark for 3-5 h). Data are presented in Table 2.5, upper half.
Another set was exposed to sun light and utilized more rapidly in the experimental setting. In the latter situation, this did not result in large differences in the low-emitter, but a significant rise in emission of the high emitter crystal (Table 2.5, lower half).

Table 2. 5: Mean UPE (in counts/0.05 s) of the right hand dorsum with the palm 1 cm above and touching the low- and high-emission white feldspar crystal. Crystals were stored dark for the first set of measurements and exposed to sun light 3-5 hours before the next set of measurements. Experiments are listed in chronological sequence. [18-19nov09]

Crystals stored dark:	Mean minus background
Low-emission crystal q	0,06
High- emission crystal 14	0,21
right hand dorsum	0,24
hand palm 1 cm above crystal q	0,27
hand palm touching crystal q	0,28
right hand dorsum	0,28
hand palm 1 cm above crystal 14	0,27
hand palm touching crystal 14	0,26
right hand dorsum	0,26
Crystals after sun:	
Low- emission crystal q	0,04
High- emission crystal 14	5,08
right hand dorsum	0,23
hand palm 1 cm above crystal q	0,18

hand palm touching crystal q	0,20
right hand dorsum	0,20
hand palm 1 cm above crystal 14	0,20
hand palm touching crystal 14	0,20
right hand dorsum	0,21

It is concluded that the crystal under the hand did in no case lead to a higher hand emission. In contrary, the hand masked the emission of the 'high-emitter' crystal. However, this conclusion must be considered within certain limits. The hand marked namely the emission within the band width (300-650 nm) of the sensitivity of the photomultiplier tube. The specific deep red emission of the 'high-emitter' crystals has been extensively described in the previous chapter of this report. Therefore, another protocol and equipment was utilized. This is discussed in the next paragraph.

2. D. 2. Application of CCD imaging.

The availability of the CCD camera (technical details in Chapter 1) led to an extension of the research questions with respect to the photon transparency of the hand for red photons emitted by the 'high-emitter' crystals. The CCD has a broad sensitivity reaching in the red part of the spectrum that corresponds with the red photon emission of high-emitters.

The transparency measurements were performed with high-emitter crystals shortly after excitation by sunlight. Such crystal was placed under the palm side of the hand, whereas the recording of the hand dorsum was performed. Figure 2.1 is an image suggesting that the hand is transparent for the high-emitter radiation. The image suggest that this emission is not due to leakage along the sides of the hand.

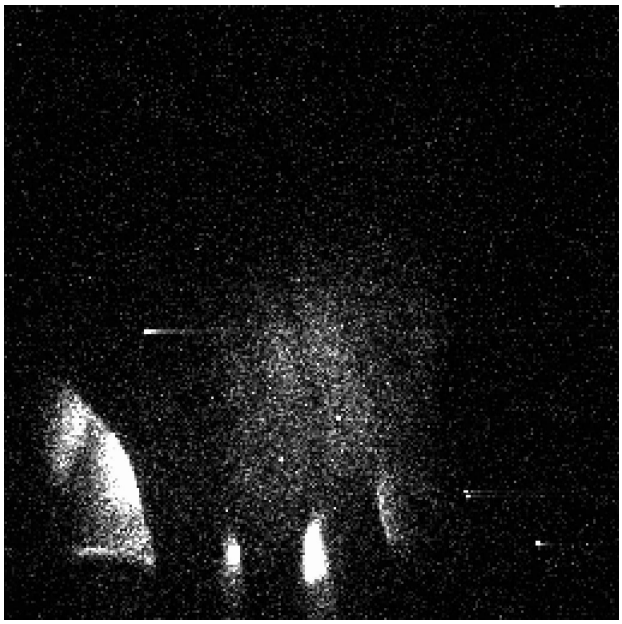

Figure 2. 1: Image of a human hand with a sun-excited crystal beneath it: at the bottom of the image 4 fingers (dark) are visible. The thumb is on the left and outside the image. The light from the crystal shines through the hand and out between the fingers.

To evaluate the specific red emission part of the spectrum in the CCD image, this CCD data were compared with the two 'high-emitter crystal' (H1 and H2) recorded by the 300-650 nm photomultiplier as in the previous paragraph. The crystals were measured, also, immediately after a 30 minutes excitation by sunlight. Again, the crystals were tested alone or placed under the palm whereas the hand dorsum was measured. The data are presented in Table 2.6. It is shown that the emission from the hand dorsum does not change when the crystal is placed on the other side indicating that with the 300-650nm sensitive photomultiplier equipment it is not possible to register any transmission of the crystal's radiation.

Table 2.6: Photon measurements of the left hand dorsum (Hand 1 and 2) without crystal, of the left hand dorsum with the high emitter H1 or H2 under the palm (Hand H1 and H2) and of the high emitters (H1 and H2) alone, just after a 45 minutes exposure of the crystals to the sun light. Measurements are shown in sequence. [6aug10]

6-aug-10	Photon counts/0.05 s		
	mean	SD	mean-BG
BGsc	0,30	0,73	0,00
Hand 1	0,46	0,81	0,17
Hand H1	0,46	0,80	0,16
H1	37,73	13,83	37,43
Hand 2	0,47	0,87	0,18
Hand H2	0,46	0,83	0,16
H2	22,87	8,67	22,57

This combined set of data suggests that the red emission of the crystal, while hidden from detection by the hand, can be measured by this type of CCD system.

It must be noted that red light generally penetrates more far in the human body than the blue green component. Only red light can be seen by eye through the thickness of a hand when one hold a white torch (white contains all visible wavelengths) on the hand palm. The data are of interest for further studies on the role of light from very weak light sources with intensities which are in the same range as the internal photon field.

Chapter 3

Highlights of the study

(In Italics: Suggested urgent additional research)

Sub typing the Anchi mixture vis-à-vis photonic properties

It was estimated that 18% of Anchi crystal mixture can be excited by sunlight and have the capacity of photon storing and delayed luminescence. This fraction can be further sub typed in 1.4% "high-emitters" (3000 or more counts in the initial 200 ms gate time) and 16.8% "low-emitters" (1000 or less counts in the initial gate time of 200 ms). Between the initial values of 1000 and 3000 counts hardly any crystals were found.

Excitation of low- and high emitters by sun light needs the same wavelength.

The low-emitters and high-emitters have the same spectral wavelength band, i.e., blue and UV part (400nm and lower)..

Chemical analysis

X-ray diffraction and X-ray fluorescence suggested that both emitter types are white feldspars, but with a different composition. Low-emitter data correspond with albite, with a chemical composition of $NaAlSi_3O_8$. High-emitter data correspond with a K-feldspar, with the chemical composition of $KAlSi_3O_8$). In addition, the K-feldspar has slightly over 1 % (weight) of Rubidium (Rb).

Data from more crystals of each type are required to confirm the statement and determine any variability vis-à-vis photonic properties.

Light emissions differ in time

The 'low-emitters' and the 'high-emitters' differ in light storage characteristics, i.e., shape of DL decay curve. This may cause a shift in the relative contribution of any emission characteristic differing between these two types of crystals in the overall Anchi mixture. Such a characteristic is the emission spectrum

Emission spectrum, intensity and kinetics

Data demonstrate that the low-emitter has an emission peak at 495-550 nm (blue-green). The emission of high-emitters was at 715-800 nm (far-red). These data suggest that during delayed luminescence following sun light exposure, the emission (color) shifts. Based on the relative percentages of 'low-emitters' (92.8%) and 'high emitters'(7.2%) in the original mixture of white feldspars, such mixture is expected to emit in the beginning a comparable intensity of red and blue-green light, which then shifts to the red later in time of delayed luminescence.

The extrapolation to radiation properties of the mixture needs more conditions to be explored: interaction and interference between photonic crystals of the same type, between photonic crystals of different types and between photonic and non photonic crystals.

Two dimensional interference studies

Interference studies on crystals of the same type (low- or high-emitters) were initiated in two dimensions. The recording of emission in time was performed with a 2-dimensional imaging system, equipped with an AEG XX1400 Microchannel Image Intensifier Tube. At certain distances the delayed luminescence remained detectable for a longer period of time than for other distances. The distance that a maximum intensity of luminescence occurred was dependent on the size of the crystals (small stones approximately 7 mm; big crystals approximately 10 mm).

The phenomenon of (grid) pattern dependent delayed luminescence intensity was confirmed by imaging high-emission Anchi crystals (4.3 mm) utilizing a CCD device, type iXonEM+ 888 (Andor, Belfast, Ireland). The increase in absolute light intensity was measured at 6.5 and 8.5 mm grid distance. The data, interestingly, suggest that even the relative contribution by each stone to the emission of the whole grid changes as a function of distance.

The phenomenon that individual crystals may react differently in the interaction between crystals requires further confirmation.

Necessity for 3-dimensional measurements

The line of data, so far, is sufficient and make urgent to continue the interaction studies with high-emitters in 3-dimensional structures. With different 3D-lattices it will be possible to get insight in the role of crystal size, the total quantity and space measures in the emission. These estimations should first be carried out at a fixed, preferably, room temperature and under vibration-free conditions. The reason is that the energy storage capacity of crystals in their lattices may be influenced by external energetic conditions, such as temperature or vibrations. The temperature effects are of main interest because they may be expected from natural environmental fluctuations. However, similarly, pressure or vibrations are considered as means to influence delayed luminescence.

Relationship between photon emission and temperature

Data on the relationship between photon emission and temperature for a limited number of high-emitters and low-emitters showed that the relationship differed for individual crystals. In a high-emitter it increased over the first 6^{o}C degrees (20-26^{o}C). Then, the emission decreased again, notwithstanding the further rise in temperature. Te photon emission of a low-emitter hardly showed any increase during the increase of 20 to 28^{o}C, and then substantially increased. Furthermore, in both low-emitters and high-emitters the phenomenon of hysteresis was observed, i.e., the cooling curve followed a lower path in the relationship temperature / photon emission than the preceding heating curve. It indicates that temperature increase is really emptying stored photons.

The generality of the different relationship temperature – photon emission for both emitter types must be further confirmed.

Spectra at different temperatures

Spectra before, during and after the increase in temperature are very similar. Between the ‘low-emitter’ and the ‘high-emitter’, the differences are very marked. In addition to the UV band , the emission spectrum of the ‘low-emitters’ have a peak at 455-610 nm, whereas the ‘high-emitter’ has its peak in the far red (715-800 nm). Apparently, the differences between high- and low-emitters are temperature independent.

It must be kept in mind and tested that in the Anchi mixture both types are present and that, due to different temperature sensitivities, the emission colour may shift depending on the temperature. Moreover, for the data extrapolation towards Anchi mixtures, other, non-photonic components and the 3-dimensional construction must be taken into account.

Necessity for reflection studies

To improve the significance of the data for understanding the effect of Anchi mixtures we must take into account that emissions not only interact between crystals, but that photons escaping the sample could also interact when reflected under appropriate conditions. Natural (reflecting) substances have been experimentally tested (colored collagen-based plates, natural silk) or proposed based on theoretical physical arguments (rhodium mirrors in body photon research).
Such reflection studies are urgent, in particular, when 3-dimensional structures are planned.

Crystal properties in human use are temperature dependent.

For human us, the temperature dependence of the crystal is important. Photon emission of crystals in contact with the hand (as model of the body) shows that body temperature enomously stimulates photon emission of crystals. However, it was also evident that different crystals showed (a) highly individual temperature coefficient vis-à-vis photon emission, and (b) a stable direct relationship between temperature coefficient for photon emission and the initial absolute emission value. This makes it possible to compare these data with data obtained from crystals that were placed close to but without touching the hand. In the latter case, one can imagine that influential conditions other than temperature can be detected. However, no significant contributions of other types of radiation was observed.

Transparency of human body for crystal emission

Crystals placed under the palm of the hand did not lead to any detectable increase in emission of the dorsum of the hand. At least when the recording was performed with the 300-650nm photomultiplier system. The hand masked completely the emission, even from 'high-emitter' crystals. However, this conclusion is limited because it does not rule out the transparency for the specific deep red emission of the 'high-emitter' crystals With another protocol and CCD equipment, transparency measurements were performed with high-emitter crystals shortly after excitation by sunlight. The first images suggest that the hand is transparent and that the recorded emission is not due to leakage along the sides of the hand.
Further repetitions on the transparency are urgent

Role of vibrations

The effect of vibration on photon emission of crystals has been experimentally established. However, careful quantitative studies need special equipment and additional constructions, both could not be done in time.
These experiments are of special importance for understanding the possibility that in a 3-dimensional construction, with the appropriate crystal size in an internal housing with reflecting inside walls, a vibrational continuum can be created based on outside vibrations.