



**The Foreign Hand** Computer-generated drawings by Wolfgang Zach

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# **The Foreign Hand**

Computer-generated drawings by Wolfgang Zach

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## Preface and Acknowledgement

With its exhibition of Wolfgang Zach's current works, the Kunsthalle Bremen again presents an outstanding example of the city's art to which the Kunstverein has been committed since its very beginnings. This commitment has already found its expression in numerous exhibits. Due to the special character of Zach's works, the exhibit *The Foreign Hand* fits into two recent focal points of our collection. This presentation forms part of a comprehensive examination of the history and potential of digital imagery which we have been conducting since 2004. To create his drawings, Zach turns to the Internet, computers, his own computer programs and plotters.

The complex technical process in Zach's work is employed as a way of reflecting on the drawing process and on the act of drawing. In his approach the drawing action of the plotter itself assumes a greater meaning than all of the preliminary tasks carried out in the computer.

Due to this central aspect of Zach's current works, the exhibition *The Foreign Hand* fits well into the successive exhibits of current drawing styles presented in Bremen's Kunsthalle featuring various artistic approaches by Nanne Meyer, Paco Knöller, Malte Spohr and Monika Bartholomé. Since the late 1960s, a wide variety of art trends have emerged which have opened up new paths for the traditional medium of drawing.

The actual possibilities that can be further developed in this context are demonstrated by Zach's intricate technical process, which rethinks the attendant conditions of hand drawing and optimizes them by machine.

The starting images of his current works comprise two different series: on one hand, high-altitude photographic views of the Earth's surface, on the other hand telescopic views of the stars. In its exhibition *The Foreign Hand* the Kunsthalle Bremen has on display a selection of Zach's two series which represents all of the important motifs to be found in his work as well as the two types of plotters he uses.

Many people contributed to the success of the exhibition and this catalogue and we would like to thank them for their excellent and motivating cooperation. Special thanks also to the Senator for Culture for his generous promotion of this catalogue. Many thanks to Jutta Drabek-Hasselmann, whose design of the catalogue clearly shows that her many years of familiarity with the works of Wolfgang Zach were a decisive factor in achieving such a satisfactory presentation of his current drawings. We would like to extend special thanks to Herwig Gillerke for his unconventional interview with his fellow artist, whose conversation provides an extraordinary look at the oeuvre and artistic thought of Wolfgang Zach. Our thanks to Kai Fischer for his careful and thorough editorial work and to the Breyer printing shop in Diepholz for producing the catalogue.

A special thanks to Wolfgang Zach for his excellent cooperation and intensive preparations for the exhibit. Thanks are given here on behalf of the Kunstverein in Bremen and the Kunsthalle Bremen, also to our reliable partner in the Bremen artists' scene. Wolfgang Zach was invaluable in providing such a wide range of cooperative efforts, thereby providing a link which the Kunstverein in Bremen and the Kunsthalle Bremen can rely on in their commitment to contemporary art and their interest in current local trends.

We would also like to thank all of those who contributed to the realization of the exhibit and catalogue.

Georg Abegg  
Chairman of the Kunstverein in Bremen

Wulf Herzogenrath  
Director of the Kunsthalle Bremen

Ingmar Lähnemann  
Intern at the Kunsthalle Bremen

## Ingmar Lähnemann: The Foreign Hand – Drawings about drawings by Wolfgang Zach

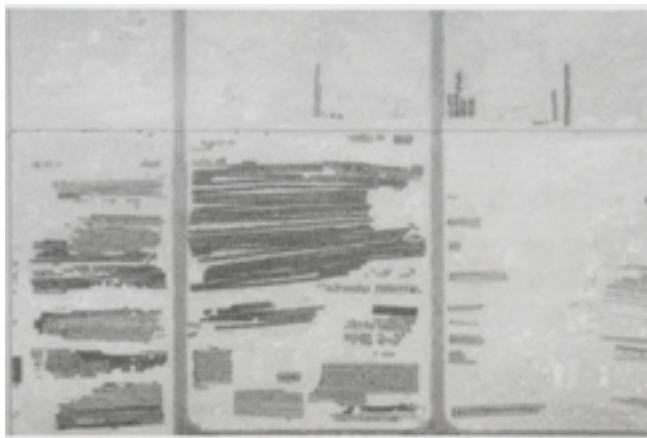


fig. 1, 24°21'17,45''N,54°30'22,35''E, h 781m, 45x63 cm, 2007

### Current drawings

The drawings of Wolfgang Zach, which form the main series of his artistic work since 2006 and which are presented here in this catalogue and in the exhibition *The Foreign Hand* in the Kunsthalle Bremen, exhibit a wide range of variation.

Their common denominator is the manner in which they are drawn and their embodiment in various shades of white and black, in other words in diverse gray tones. Most of the drawings also exhibit a high degree of abstraction, frequently making it impossible for observers to relate the generally amorphous images to real situations. (Fig. 1)

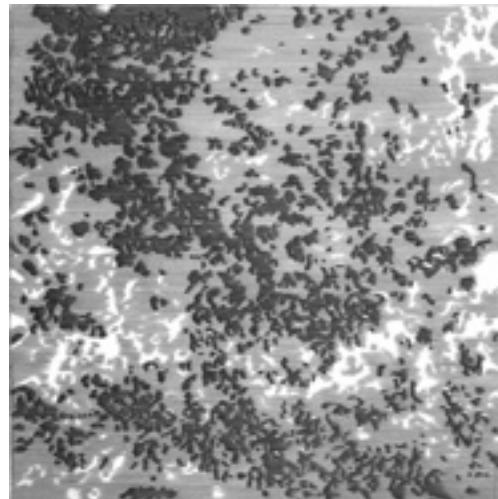
Some works, however, show quite clearly that their point of departure is based on photography, with visual objects whose actual appearance and real function can be recognized. Upon surveying the variations in Zach's current themes, it is clear that these are anything but abstract images. The abstract tendencies of the works are already established in the photographic templates and are merely elaborated in the process of Zach's drawing. And even if the artist does play with the difficult recognizability of certain forms in his works, and thus with viewers' perception, it is not the primary facet of his drawings to pretend to be something that they do not represent. The drawing 22° 53'06,69'' N, 31° 21'09,74'' O, h 3,02 km (Cat. No. 15,

p. 40), whose mundane title indicates that the foreground of the picture is not occupied by an illusion, is at first sight nevertheless reminiscent of the free-form, pictorial, black & white depiction of a canal lined by trees. Within the context of the exhibition in the Kunsthalle Bremen, whose paintings from the Worpswede artists' colony provides a good comparison of such motifs in the museum, one is all the more willing to see the work in such a context. If one recognizes the pictorial elements which undercut a realistic rendering of such a subject – such as the supposed trees below the moor canal – one is left with the association of an informal painting whose suggestive manner generates a variety of clear reminiscences. References that may come to mind at first sight are, in addition to the Worpswede painters, such artists as Jean Dubuffet or Antoní Tàpies. Yet 22°53'06,69'' N, 31°21'09,74'' O, h 3,02 km is neither a moor canal nor a painting, although its dimensions of 157 x 240 cm may point in this direction. This work of art is not even an informal one.

What one is looking at instead is a drawing which is based on a complex and complicated drawing process and is a rendering of a photograph which Zach retrieved from the infinite world of images to be found on the Internet. The association with a moor canal is not completely removed from reality, as the picture does indeed contain landscapes. Judging by his selection of original objects,

the results presented in the current drawings lead one to conclude that the artist has a definite interest in the original images, which already posses a high degree of abstract elements. First of all, this relates to the perspective from which the landscapes and all of the real objects in them were recorded. Zach takes his originals from a collection of pictures of the Earth's surface photographed from a bird's eye view, some at great distances. This distance is provided at the end of the title of each drawing – thus in the case of the supposed moor canal we are actually looking at a section of the Earth's surface as seen from a height of 3020 meters. 1) One can look this up in order to check the rendered scene as viewed from our normal perspective, since

fig. 2, Malte Spohr, g. L.X., Farbstift auf Bütten,  
42x42 cm, 2005(Courtesy Galerie Werner Klein Köln)



Zach provides in his titles the exact geographical coordinates of the original picture. In this specific case, a desert landscape can be observed in which a canal has been built, with sand and earth pushed against its banks.

2) Zach likes to use landscapes that already exhibit abstract qualities and all the more so when seen from a bird's eye view. In addition to many source photos taken of the desert, there are also many original images of the polar sea and the tundra. 3)

As much as the overhead view of ice floes (Cat. No. 14, p. 39), for example, exhibits non-representational graphic qualities, with the ice floes taking the shape of polygons on a uniform background, the artist actually devotes very little effort in achieving an abstract effect in the sense of masking the real conditions of his source images. Instead, there are the many instances in which he captures the curiously abstract qualities of the Earth's surface and their rearrangement by humans. In the work *lat 32,434647°, lon 13,607670°, h 1,59 km* (Cat. No. 23, p. 47), for example, one can see that this is an overhead view of a barren landscape which is highlighted by what seems to be vegetation planted by humans in regular rows. Although we know their real shape, the uniform spots appear in the picture as small punched holes and as a contrast to the amorphous surfaces in the drawing. Zach is interested in the peculiarities presented by an unusual perspective and this is the departure point for his pictures. These peculiarities are in many cases represented as abstractions of

1) Depending on the subject of a picture, the specified altitude can prove to be more than just technical information. For example, the drawing *lat 30,522481°, lon 19,761797°, h 1,14 km* (Cat. No. 20, S. 44) shows a section of a water surface and the edge of the beach. Due to a lack of details, it might be assumed that the ocean here was photographed at close range. But as the title indicates, the camera was located at an altitude of 1.14 km.

2) This scene illustrates another aspect of the source pictures of the drawing. In most case Zach presents snapshots, or views which no longer existed by the time of their conversion into the artistic drawing, or at least no longer in this form.

3) Even though there is a clear tendency to use landscapes showing extensive abstract forms when seen at a great altitude, it should be emphasized that Zach employs the same approach to subjects that are hardly foreign to us, where we experience more familiar pictures of the world in the view as seen, for example, in *53°08'21,90" N, 8°40'41,87" O, h 80 m* (Cat. No. 11, p. 36). Although the Bremen cityscape may not be recognizable, the view of metal reels on factory premises in such an orderly arrangement is a familiar sight in Western industrial society, since the overhead view and Zach's processing have been abstracted only slightly.

landscapes, on one hand, and of human activity, on the other.

But by no means does the artist intend to keep the sources of his drawings a secret from his audience. In comparison to the small format and intricately detailed hand drawings of Malte Spohr (Abb. 2), whose works were on display at the Kunsthalle Bremen in 2007, it is plain that Zach's works also derive a visual attraction in that, in many cases, it is hard to tell whether they are presenting a microscopic or macroscopic view of the world, although at least the association with one or the other is evident, and that neither of the artists can be attributed with presenting an inventive abstractive image. However, it is quite possible to see that Zach's works proceed from a macroscopic view. This possibility offered to viewers is intended by the artist.

Furthermore, his drawings also make a clear reference to the complex machine-based process on which they are based. This is shown in particular by their large-format scale, since in addition to their uniform length or width of 157 cm, it can be seen that the images shown result from exact parallel lines that follow the 157 cm long side. But even the uniform shadings of the smaller formats indicate the machine-based drawing process.

### Computer-generated drawings

The basis of the gray-shaded pictures is a complicated process comprising a number

of technical steps in which Zach converts his source images into drawings. They are drawn by a graphite lead, in other words a tool traditionally used in draftsmanship. But in this case, this lead is not guided by the hand of the artist but instead by drawing devices, or plotters. Zach employs two types of plotters. The small-format drawings where the surfaces are generated by shading, are executed by conventional industrial plotters, such as those used by architects, since these devices are capable of producing particularly exact lines. In order to achieve in these drawings the differentiated contrasts and transitions from one shade of grey to the other, and thus accurately convert the original forms of the source image, Zach uses various graphite leads having hardness grades which range from 2H to 4B. This type of plotter, in which the paper is drawn over a roller, was acquired by the artist in 2001 and he has been using it for his drawings ever since. The technique of creating hatched surfaces and the fine shading thus imparted to the picture makes this plotter ideal for processing certain source images. Thus, portrait photos, which Zach has recently converted to drawings (Fig. 3, Diana) can only be executed with a small plotter in order to achieve a high degree of resemblance to the actual photo.

The older, larger plotter is not suited for such subjects. Zach started executing large-format drawings with this type of plotter as early as 1987. He built the plotter himself: on one hand, because at the time a plotter was hardly affordable, and on the other hand

because it enabled Zach to become familiar with every technical detail in the process of machine-assisted drawing, to optimize it for his particular needs and finally to control the results. [4\)](#) This plotter functions in the manner of a drawing table across which a track-guided carriage passes over the flat paper parallel to two edges of the table. This allows the processing of paper having a width of up to 157 cm and theoretically of infinite length, for Zach has designed this plotter in such a way that it can write slowly on long reels of paper across the drawing table. One example of a very large, and thus very tedious, complicated and error-prone drawing is provided by the work *Galaxie 510 - G13, ESA* (Cat. No. 40, p. 62) from 2008.

[5\)](#)

The actual drawing, which in the case of the large plotter is executed by a 4B graphite lead, and the differentiation of the shades of gray in the picture as generated by the degree of pressure applied, are preceded by a complex technical process in which the selected source image is modified and prepared for the drawing. This includes the use of mechanical and electronic elements on which the operation of the drafting device is based. Zach has optimized this operation for his own intended results.

The plotter as designed by the artist for his own purposes is controlled by a computer program which was written by Zach himself. In the beginning a program was written for each specific source image and its reproduction as a drawing; later a universal program emerged that Zach nevertheless adjusting the program

to the specific characteristics of the drawing in preparing the source images. The basic core of the program comprises data by means of which it is possible to match the scan lines of the original photo with the line width in the drawing, since it is only on this basis of this correct ratio in the individual lines of the gra-

phite drawing that it is possible to achieve similarity with the picture. The programming of the computer is preceded by image processing which Zach also executes with the help of the computer, in this case, however, with conventional graphics software. Here he alters the source images to make it possible

fig.3, Diana, drawing, 63x85 cm, 2008



4) The role of technology and its intensive use in Zach's complete works would provide enough material for a complete article. But it should be noted here that in his early artistic successes in the 1970s he had already mastered the art of welding in order to create bicycle-like objects that he had abstracted from conventional bicycles. With these art objects he addressed the function of locomotive devices by breaking down their inherent context, thus creating new possibilities for their use that could also be realized in public transit happenings. It has become increasingly clear that Zach utilizes his affinity for technology and also his gift for being able to master complex technical processes – including even laser technology – to create abstract manifestations of technical processes.

This applies to his bicycle objects as well as to his mobile wire sculptures and art projects in public spaces, such as the Bremen Tide Fountain of 1991, which used moving elements to display the current level of the Weser river, or the laser object for the Bremen Congress Center of 1992. And it applies in particular to the technical implementation and reproduction methods of his current drawings.

5) This work shows the second important topic that has preoccupied Zach in his current drawings since 2006, which began shortly before the bird's eye views of the Earth and whose source images were also taken from the Internet. This topic is the view of outer space and the conversion of photographic images of stars, black holes, galaxies, etc. This drawing was specifically made by the artist for this exhibition and the specific exhibition space in the Kunsthalle Bremen. This poses the question concerning the significance of the site for presenting these pictures, which Zach pursued in 2005 in a double exhibition of such star pictures in KUBO, Bremen, and in public on an advertising column.

The artist thereby illustrated how variable the same pictures and the same technology used to produce them can be employed to produce a drawing that can have the same convincing effect of an apparently autonomous museum picture as well as a poster in public space.

The special technical process used in Zach's drawing challenges conventional definitions of art.

6) In terms of the ever increasing technical aspect of the drawing process in Zach's current works, another important criterion is that he sources the Internet as an ever-changing provider of new images. This is shown in his two current series. The satellite view of the Earth as well as the view from Earth of outer space and the stars, hitherto available only to scientific experts, can now be readily accessed by computer and the Internet. Although Zach accepts personal photography as a equally valid source image (see the interview with Herwig Gillerke, p. 23), the Internet represents an important technical intermediate step in his production of a work of art. Finding one's own images will become even more obsolete for the artist than it was in the preceding media-oriented world of daily life. In this respect, Zach also mirrors our day-to-day process of acquiring images, where entirely possible, visible images are increasingly mixed with impossible images made visible only by modern technology.

7) Although Zach was able to procure prefabricated components, these were not as compatible as is commonly the case nowadays for building your own computer. For that reason he required the help of his brother, a computer scientist, who could write the BIOS for his first computer.

to produce a drawing. An important aspect in this process is the conversion of the color source photos into gray scales and a specific processing step with respect to their contrasts, depending on which image and which series is concerned.

For example, the level of contrast in a black & white image of a desert landscape is not as strong as that in a picture taken of the polar sea or a view of the stars. In the forefront of all these technical intermediate steps is the artist's selection of the source image from the infinite pool of images to be found on the Internet. 6) As already described, this selection represents an important decision with respect to the overall reception of the final drawing.

## Computer drawings?

Zach has been using computers for creating his works since 1983, employing skills acquired in his IT studies at Karlsruhe from 1969 to 1972 before attending the city's academy of arts. Starting in the 1980s, personal computers became widespread, making computer technology available and affordable for private use. But the fact that there was no personal computer available with which he could implement his artistic ambitions resulted in the artist not only programming his own software but also designing the hardware himself and building his own computer. 7) Although Zach studied this technology at a

time when it was dominated by mainframe computers, he should still be regarded as belonging to the second generation of artists using computers in their works, since the personal computer represented a significant caesura in computer-assisted art.

In the 1960s, pioneers of computer art began opening up the new medium with respect to its formal possibilities and theoretical significance. One tends to find images which vary or invent abstract forms and which reflect the use of the computer and plotter as reproducing media.

In particular, starting in the late 1960s when trained artists were assessing the new medium, there also emerged the aspect that computers and plotters could push the characteristic signature of the artist into the background and generate a space between the artist's idea of the image and the executed drawing. In these applications the computer was regarded as technical intermediate step that the artist consciously made in which the random moment – including such theoretical positions taken by Max Bense, for example – was an essential element that contributed to the special artistic form.

These key aspects of early computer art have been present in Zach's computer-generated works since 1983 and can be seen in his current drawings as well. The specific possibilities provided by a computer appear in the conversion of the source photography to a plotter drawing which enables the artist to achieve congruities otherwise unobtainable without the precision of these technical devices. In particular, the question concerning

the original picture, the original idea of the picture and the role of the artist, as well as the challenge brought to bear on this role, is clearly suggested when one realizes how many decisions are not subject to Zach's specific artistic gift but are determined by technical workflows. This holds true with respect to the selection of a reference picture taken from daily life, a common procedure ever since the pop art period of the 1960s in which the artist's genuine invention of an image was reduced to absurdity. But it also relates to committing the execution of the drawings to the plotter.

On the other hand, computers and plotters (and, prior to the advent of the plotter, the dot matrix printer Zach used for printing his computer-generated graphics) no longer represent that different sort of medium which enables unknown possibilities in the production of art, thereby differing from traditional art media in that it proceeds from a mere device. For Zach, this is indeed a technology which makes certain processes available to him, but which has not provided any decisive breakthrough in the theory of art. In this sense, the artist does not utilize computers and plotters in order to reflect on art and the artist as a whole, but rather on the specific process of drawing.

Yet here it is also clear that Zach is still aware of the changes that computers have provided and reflects this in his works. Compared to current computer art, a medium so widespread in even the smallest daily processes that it can hardly be defined anymore, Zach's drawings reflect an almost

anachronistic interaction with the computer. He is familiar with the inner workings of all intermediate technical steps in the generation of the drawings. This applies equally to hardware as well as his own programming. In contrast to today's conventional method of working with computers, he does not resort to ready-made elements and software packages which facilitate or assume the specific tasks of the artist or refine his technique to such a degree that certain interventions are no longer visible. In Zach's approach, the computer is anything but an element for accelerating the process of generating images.

### Drawings of a foreign hand

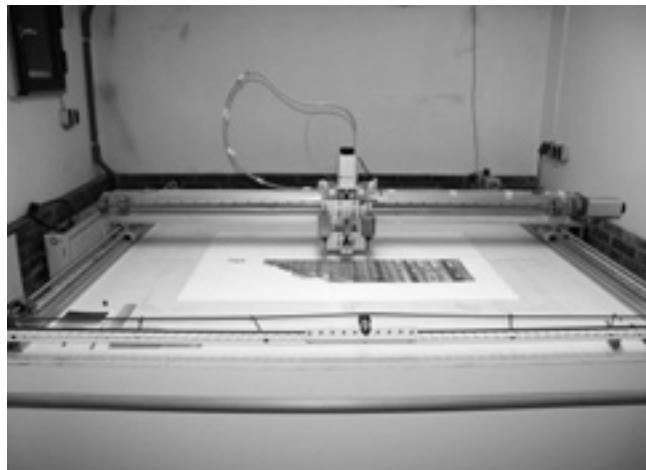
Instead, the technical process in the machine production of the drawings proves to be an involved and complex one which requires the repeated intervention of the artist in order to achieve the necessary precision on which the similarity of the works with the selected source image is based.

Depending on their size, some drawings may take as long as several days or even weeks to complete. The drawing apparatus used to create *Galaxie 510* for the exhibition in the Kunsthalle Bremen took three weeks. The two drawing methods available to Zach are subject to errors precisely due to their being executed by graphite leads. For example, the artist must anticipate broken leads and changes in paper and must account for the tapering of the leads as they draw. He must therefore calculate in advance the possible

technical and mechanical problems that might occur in the drawing process and factor them into the computer program.

The production process of Zach's current drawings, even those of small format, is so elaborate, particularly with respect to the actual drawing of the graphics, that one very essential criterion concerning the original use of computers and plotters in art has been almost annulled. For these mechanical media were once chosen because they ensured a new form of reproduction processes which raised the issue concerning the originality of a work of art more clearly than conventional printing methods. In the case of Zach, it is also worth considering whether his specific artistic achievement might not possibly be found in his programming work, seen basically as his specific artistic signature. The finished drawing, subject to the mechanisms of art distribution, i.e. shown in exhibitions and traded on the art market, would in this sense be little more than an imperfect visualization of what the artist has achieved elsewhere.

fig. 4, plotter constructed in 1987 by Wolfgang Zach



But Zach remains involved in the entire process of drawing, any conscious commitment of artistic achievement to the plotter itself is only marginal; instead the artist controls every step in the drawing process and, in particular, the actual drawing by the graphic leads. Due to this ongoing monitoring of machine activity and the often very long intervals before a drawing is finished, it makes no difference to Zach whether he repeats a motif as a series or extracts a different motif from the almost infinite pool of source images in the Internet and processes it into a drawing. His works thus approach once again the traditional concept of an original work of art and its value, although his technical media contradict this idea.

The artist Zach attends to the entire drawing process in detail. He deconstructs this process into its individual components, which can be readily compared to the classical artistic method in making a hand drawing in that an idea of an image is conveyed from the brain to the hand, which in turn converts it into the drawing. He must take into account those processes which play a role in every execution of a drawing, such as arm movement, hand posture, etc. and certain unpredictable aspects such as fatigue in the artist's hand, which retroacts on the line being drawn. This description highlights the susceptibility of traditional hand drawing to error, by which an element of randomness is integrated into every drawing but which also marks a certain artistic consciousness.

A consciousness characterized by Picasso's dictum that hand fatigue while drawing is a perception of time. <sup>8)</sup>

Compared to the usual process of creating a hand drawing, Zach's precise artistic reflection on the individual aspects of this process, which he mirrors by machine or simulates in the sense of a test arrangement for the drawing, proves to be an optimization of the drawing process achieved by committing it to technical components. It is possible for him to draw a line with such precision that he can define it as an "absolute line". <sup>9)</sup> Zach is able to reduce to a minimum all elements of traditional drawing by hand that contribute to the randomness of the line, the minimum elements being that of the materials' susceptibility to errors, i.e. the graphite leads and the paper itself, but which also enhance the liveliness of the drawn line. With his formal approach the artist contributes a new definition to the medium of drawing.

But in contrast to the generation of conceptual artists and computer art of the 1960s and 1970s, Zach is no longer occupied with emphasizing the medium of drawing as a means for reflecting and reversing its traditional dialectical role. For centuries, drawing has been merely regarded as a preliminary work in the preparation of true works of art in other media such as painting, on one hand, and as proof of the individual's artistic genius and state of mind in the single drawn line, on the other hand. For Zach, it is

quite natural that drawing is an independent medium and he also relates to its equally valid position vis-à-vis other art media with some works which assume very large formats.

As seen in the art of photography from the 1980s onwards, we again witness an emancipation from painting. The intimacy of drawings, which for centuries was their essential characteristic and which made them all the more attractive for connoisseurs of art, was likewise suspended in the 1960s and especially in the 1970s, but essentially in that this medium was transferred to areas in which its specific characteristics were all but unrecognizable because other, non-traditional materials were used for drawing and because this involved mural drawings or even room drawings. It is quite an achievement to transfer the traditional graphic drawing on paper into such a format that the images are perceived by the viewer as being comparable to painting. But Zach does not primarily employ these formats because drawing might have played a hitherto subordinate role. He does not wish to caricature any traditional function of drawing.

Zach's drawings also negate the expression of an artist's individual, subjective state of mind as well as refusing any testimony of specific artistic genius, since they are not executed by hand anyway. And Zach also refuses to use the medium of drawing for making any explicit statements concerning art theory or the politics of art. His works reflect the

process of drawing itself, which also becomes clear in terms of the parallels to hand drawing inasmuch as his drawings achieve the same effect by being executed by a foreign hand. Unmistakable drawing elements can be found in the motifs he represents (gestural lines, for example, see Cat. No. 12, p. 37) as well as in the individual lines which ultimately comprise the overall image. On the other hand, it is precisely these exact, parallel lines which attest to their technical execution and which counter the impression of a drawing made by hand.

### Signs as a drawing

Within the context of the effect achieved in the execution of a drawing by a foreign hand, Zach's reflection of the drawing process, in addition to the complex technical connections involved along the way from the source image to the final drawing, relates primarily to the graphic act of drawing and the perception of the image by viewers. We have already discussed the importance of matching scan lines in the source photo with the line width of the plotter for transferring the source image to the drawing. But this is more than just a technological necessity in the process of generating images, for even in the finished drawing Zach also emphasizes the fact that the pictures are created from individual lines and that the shades of gray in each line vary in their differentiated transitions from one to another. The viewer realizes that the surfaces in the picture are composed of lines whose

8) Rosand, David: *Drawing acts: studies in graphic expression and representation*, Cambridge 2002, p. 12.

9) Wolfgang Zach in a note to the author in 2008. It must be kept in mind that the absolute nature of this line relates only to it being created under approximately perfect technical control conditions, not to the claim of drawing an ultimate line.

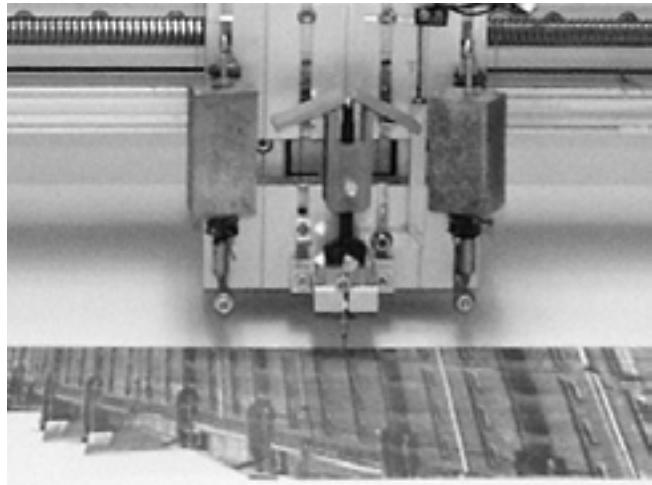


fig. 5, plotter detail, during process of drawing

various shades of gray merge and interact with one another. Regardless of how abstract or representational the finished picture is, the viewer can always construe the drawing process, thereby deconstructing the drawn image into its components. Viewers of Zach's works are thus referred back to the graphic act of drawing and in this respect it is also significant that the impact of an original work of art is repeatedly created in his drawings.

Drawing is frequently described as "setting a sign" and characterized as the interplay between the seemingly neutral surface (of the paper) and the active tracing that energizes this surface. By relinquishing the form and meaning of each sign – the contiguous surfaces in the picture as well as the individual line and its specific composition – to a technologically dominated process of selection and programming, Zach takes a decisive step backwards in terms of artistic reflection. He does not conceptualize in any way the sign he puts to paper but instead analyzes it with respect to its material reality. It remains obvious how each individual line is the result of the frictional wear of the graphite lead, how the strength of its pressure defines its path traced on the paper. Here Zach combines the macroscopic view of the source images with a microscopic view of the structure of the drawing. He describes this aspect of his works as "placing dust on paper" (Fig. 5). In this characterization it becomes clear that Zach's drawings contain their own disappearance – or at least the possibility of

it – in a kind of vanity symbol, but one which relates to the picture instead of to the viewer. The perplexing element of these drawings continually vacillating between their material plane and the represented image merely highlights the central role played by reflection in the process of drawing these works.

### The drawing and the image

With their emphasis on generating pictorial similarity, Zach's drawings are linked quite closely to an appreciation whose great significance for the function of the medium can be seen in the traditional theoretical examination of drawing that has been subsumed under the term "disengo" since the early Renaissance period in Italy. Leonardo da Vinci, who should be seen as one of the first artists who explicitly contemplated the special significance of the medium of drawing for art history, asserted that in drawing a demonstrative illusion is executed which, in contrast to painting, remains visible. He was referring to the contour line, which constitutes the figure in the picture but which does not exist in nature. Drawings may indeed use shading to take on an almost "picturesque" composition, thus concealing the element of the individual line to a large extent, yet it always remains contained in the drawing. This is also apparent in Zach's small format drawings that are made by the plotter using shadings and in the variation of different grades of hardness of the graphite lead. Even in those areas of the image which depict

practically black surfaces it can still be seen that these surfaces are produced by the accumulation of lines.

Herein lies a crucial difference to painting. And as soon as reference is made in the drawing to lines that are still visible, as Zach does in his large-format works that are clearly composed of parallel lines, Leonardo's characterization comes into focus, namely that in the medium of drawing two aspects of the image are inevitably distinguishable: the artistic creation of the image, on one hand, and the replication of the image in its presentation, on the other. **10)** Zach no longer concludes from this insight of Leonardo's that it is the drawing in particular which proves the artist as being a genuine creator, who by virtue of his individually manipulated lines has the power of creating images, figures, worlds. This artistic-political dimension of traditional disengo theories is negated by Zach's image generating process, in other words by the selection of source images and the machine-based production of the drawings which reproduce these images.

But it is through his works that the artist shows his viewers the neuralgic point of all reproductive art: to generate images from his own settings that are constituted in such a manner that their material elements compose the intended image in the perception of the viewer. Particularly in the digital age it is nothing new to us that the images we see in various artistic media represent an illusion but

it remains a special achievement to generate such images and at the same time draw our attention to their material nature and make us aware that this generation of images takes place in our perception. **11)** Zach himself describes this process as "looking at average values" and he refers to average values in every technical step in the conversion of an image to a drawing or as drawing itself. **12)** In this sense, the viewer is always a participant in the drawing process.

**10)** Here Leonardo's approach can be applied only to this specific effect concerning the ambiguity in a drawing as to the creation and presentation of its image. An important distinction with respect to the drawing process as practiced by most artists since the Renaissance and on which Leonardo's dictum is also based, it can be ascertained in the fact that Zach constructs his drawn images from surface areas but never resorts to contour lines. In this sense, Zach dispenses with the function of the line as executing on the paper surface a spatial divide for the purpose of assigning a meaning. He does not use signs that divide the sheet of paper into areas that are defined and undefined, representational and non-representational. Once again, he thereby actively negates the indicative function of the individually drawn sign. Hierarchies do not exist in his drawings, whose margins make a radical cut in the picture and which do not serve as reference points for the forms in the drawing. The images are always recognizable as being an obvious detail of a larger context.

**11)** Rosand 2002, p. 2, defines the sign committed to paper in every drawing as fundamentally being a special opportunity for expressing this ambiguity. This aspect is considerably more pronounced in Zach's drawings than is the case with other graphic artists because the image emerges only when the individual lines are viewed in their totality. In this respect the respective line generates the pictorial illusion but on the other hand it fails to constitute a uniformly complete or intelligible image which can thereby also be unmasked as an illusion.

**12)** This characterization is first of all a purely technical one, since Zach refers to the average brightness in the mapped fields of the individual shades of gray which he draws in advance. He assumes that the individual stroke will exhibit the same brightness when applying these average values of mapped gray scales.

13) Zach has dealt with the special characteristics of drawing in relationship to other artistic media well

before his present series. This is probably seen most clearly in his cooperative efforts where he reflected on the process of drawing on the basis of objects created by other artists.

## Drawings without end

Wolfgang Zach's current works thus do not apply the medium of drawing in just a formal sense but also analyze the underlying conditions of this artistic medium and reflect its specific characteristics in the image formation process. 13) This image formation process is represented in his works with respect to the artistic act of setting signs as well as to the viewer's perception. This latter aspect of the drawing is reflected in the selected source images which Zach converts into his average values of drawing and perception. These images, while not actually visible to the viewer, reproduce the material reality of our world.

It has become clear that Zach's drawings, although actually being computer graphics and the artist an expert in computer graphics by virtue of his great technical expertise, are less concerned with issues surrounding technical media and more directed to traditional drawing by hand. Its qualities have been transported into the age of technical reproduction and at the same time its potential has been extended by Zach's technique.

Despite the great differences of form in Zach's subject matter, the many demonstrations of the process of drawing the original images allow themselves to be fitted together as an overview. The overall view of the images presented to the viewer provides, in a spatial

sense, a general unified image, but one which presents a stratified view in a temporal sense. For as much as Zach's current drawings reconstruct the Earth's surface and outer space like pieces of a puzzle, they are still just a snapshot – in terms of the specific image he has converted but also with respect to the act of drawing, which as an image composed of individual lines and various shades of gray on paper is a portent of its own dissolution. Zach's machines can and must keep on drawing. They process and interpret a flood of images in a precise, continuous yet curiously human manner, a flood of images which would otherwise rush by without our noticing. That is comforting to know.

## The different view

Herwig Gillerke interviews Wolfgang Zach

Herwig Gillerke: The exhibition is called *The Foreign Hand*. This title ultimately describes the work process you employ. You work with machines and with computer programs that you write yourself. Your approach is more than that of a data processor, or at least it does not seem very artistic at first glance.

Wolfgang Zach: It sounds as if you are only taking the operating process into account. Naturally part of the work I do also involves the formulation of ideas which are then executed by machines. In other words, I have to make a pretty detailed plan for my artistic work process because I have machines execute what other artists do with their hand. Whatever is missing from the plan in advance is not executed later.

H. G.: You like to do a lot of advance planning in creating your works, but ultimately the actual drawing is done by your machines – isn't there a great distance between you and the image carrier? You could also hire an assistant to work according to your instructions.

W. Z.: When I'm working I have a quite specific graphic idea of what I want to make. In the 1980s I built objects made of wire. These objects have a spatial geometric construction which can be described in mathematical terms. When I started making machine-plotted drawings of them, I had in my mind's eye a graphic concept of the idea of such an object and what such a work could look like

and move in space. I tried to describe this structure using mathematics. Then came the process of directing the machine by means of control commands so that it would make the drawing. You can't have assistants do that, it would involve an infinite amount of effort to convey that. I could also draw by hand. But I always try to develop this machine process to such an extent that the result cannot have been drawn by hand anyway.

H. G.: Your artistic work consists of finding a motif, writing a program and balancing the fine points. In addition, you have to keep up the supply of leads and examine their performance and to run tests on different kinds of paper. Isn't that a very cool and distanced attitude?

W. Z.: I calibrate the drawing process to a particular paper and always use the same lead. Since my programs are already developed, I can now concentrate on the draft and later judge the results in order to consider how I can improve my drawing process. But during the drawing process and with its result I try to access and alter the manual aspect of the machine. By that I mean what happens with the image and how the quality of the drawing changes when I vary the line intensity.

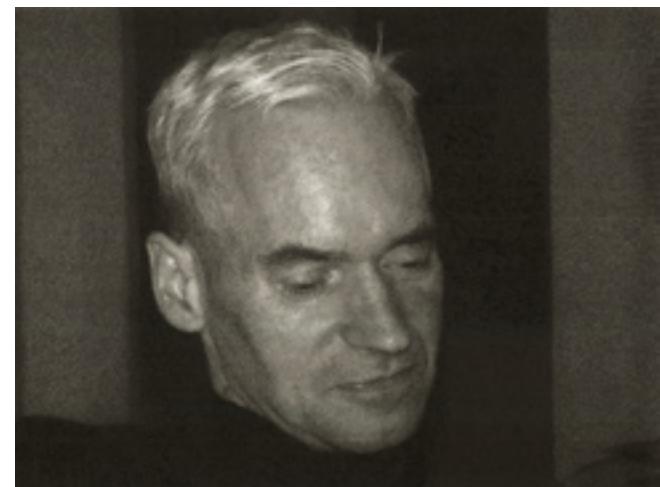
H. G.: Would it be possible to make your drawings in color?

W. Z.: First of all I would say that gray is also a color. I've basically been interested in wor-

king with color but it is simply not possible because the quality of colored pencils is too poor and their range is too narrow. I also wrote my program to work in color as well but I have not found the right materials.

In terms of chromaticity, I think that the differentiation in gray can also serve as a substitute for color. When you work on a drawing, the question is how can you reproduce shades of lightness and darkness. In principle, of course, you are working with light, by producing a structure of dust on the paper which absorbs light and which then becomes the image.

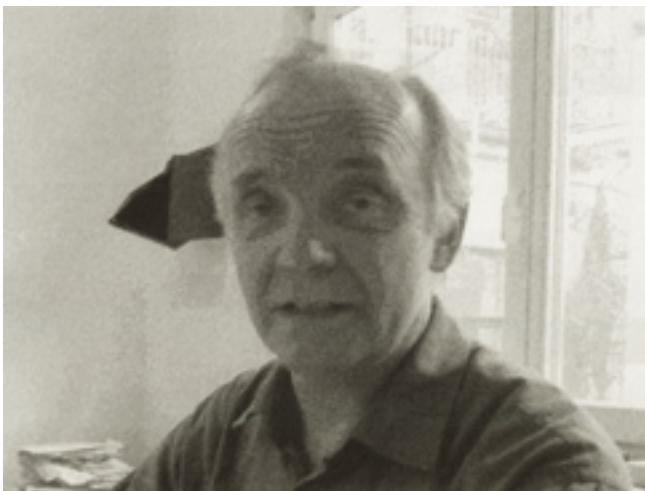
fig. 6, Herwig, drawing, 30x40 cm, 2008



H. G.: Another subject I would like to ask about: You have worked together with other artists many times, including Anna Solecka, who created photographic templates, and later with Karl Heinrich Greune, who made drafts. Do you sometimes feel that you are only an operator for fellow artists?

W. Z.: It might look like that from the outside. I don't feel that way. When cooperating with the two artists I myself had certain interests too. In the case of Anna Solecka, I didn't want to start at the testing stage with respect to the images' content after making such an effort in developing the program itself. I wanted the works to have an artistic level from the very start. She concentrated on the drafts and I concentrated on the program. You have to

fig. 7, Zach, drawing, 30x40 cm, 2008



realize that the pencil drawing on paper is actually quite complicated.

And it is just as complicated to have a machine do it. I wanted to concentrate completely on the technique of drawing, technique in the sense of how one guides the pencil across the paper.

My interest in working with Karl Heinrich Greune was that I wanted to make drawings of other types of surfaces other than photographic ones. Greune was very open from the start and soon became so excited that he made drafts especially for this drawing technology. The result from the machine did not look like a photo of his draft but were instead originals.

H. G.: In the last two years you have generally worked by yourself, searching the Internet for subjects, such as constellations in space and high-altitude photographs of the Earth's surface. Some views remind one of landscapes around Worpsswede with their water reflections, but it is actually a high-altitude view of the Earth's surface. How is such a motif selected, is it planned or are you sometimes surprised by the result?

W. Z.: Early on I discovered the images of "Google Earth". The landscapes have a special perspective because they are satellite images. I've always looked for landscapes that have something geometrical about them, inherent structures which cannot be clearly interpreted. Afterwards I select a detail and process it with a photo software program in order to get a template that is

particularly suited for pencils.

I also discovered the subject of stars in the Internet and tried to find areas that would lend themselves to drawing, although the repertoire of shapes offered by constellations is more limited than landscapes. Pictures from outer space reveal to us a world that is otherwise invisible. I was doubly interested by the fact that signals are employed to generate these images for the Internet. Each pixel corresponds to a digital signal from the satellite's photo sensor. I too use these signals to control the movement of my pencil. In principle, it's the same thing, only that instead of projecting an electron beam onto a screen to generate the image, I use a pencil. This gives me results where a structure similar to these constellations is created on paper by graphic dust penetrating the surface of the paper.

H. G.: You have recently started work on a new thematic series where you take photos, for example at exhibition openings. Your photos of people, in particular fellow artists, are then processed into drawings. Will these works ever be on public display or is this just a private project?

W. Z.: It's just a private project because it was only half a year ago that I reached a drawing quality that is sufficiently suitable for portraits. If I believe I have good results, then I do not rule out the possibility of showing them (Fig. 6 and 7). I have created a unique opportunity for myself with the development of combining photography and drawing.

H. G.: I remember that you started a series about three or four years ago involving well-known photography. You approached photographers and rendered, for example, a work by Robert Lebeck – the famous photo with the snatched saber. That was turned into a drawing of yours. Will there be more such works in this series?

W. Z.: Again, this involves cooperative efforts. In the beginning I thought that instead of becoming a photographer myself I would contact photographers doing something interesting that I would like to convert. This did not work out in actual practice. That's why I decided to tackle photography on my own. I'm interested in finding themes where the result of pencil on paper provides more than what is possible with other methods.

H. G.: If I remember correctly, that applies primarily to photos which have a lot of contrast. Relative monochromatic photos, on the other hand, are less suitable.

W. Z.: By using leads of eight different grades of hardness I can achieve a very broad range of gray scale values. Of the possible 256 gray values, I can print 200 and will certainly reach 256 gray scales in time. This effect is only possible in photography, which also takes in this range. But the subject matter must also confront you. Which is in contrast to my previous work, where I came up with concepts, made a draft, engineered it and then executed it. When I see an image, it is

no big difference to me whether it is found in nature and I press the shutter button or whether I find the picture in the Internet. Or I'll see a detail in a photo from someone else that has not been noticed.

H. G.: I remember that you made a drawing last year of one of my color photos, which for your tastes are very flashy, and I was surprised that this photo could be rendered in gray scales (Fig. 8). Have you ever thought about using color pictures or something similar as templates?

W. Z.: There is no boundary between color and black & white in digital photography. After working with Karl Heinrich Greune, I have the feeling that I can already judge what the result would be if I were to draw a painting. But since photography provides me with so many possibilities that I have not yet explored, I don't think that I would use other artistic media for my templates.

H. G.: Still, I would like to get back to the fascinating issue of painting and its conversion into drawing. Wouldn't you be attracted by the prospect of converting photorealistic painting into a drawing so that one would not be able to tell whether it was a photo or a painted picture?

W. Z.: I can't get too excited about that. Basically, the effort does not reinforce the result. Works of art must also endure in the eyes of the viewer who knows nothing about



fig. 7, drawing from „life“ from Herwig Gillerke, 120x80 cm, 2008

their background. For me, the technique that I use is only a means for generating art – in other words, the artistic content must be at the forefront of a work.

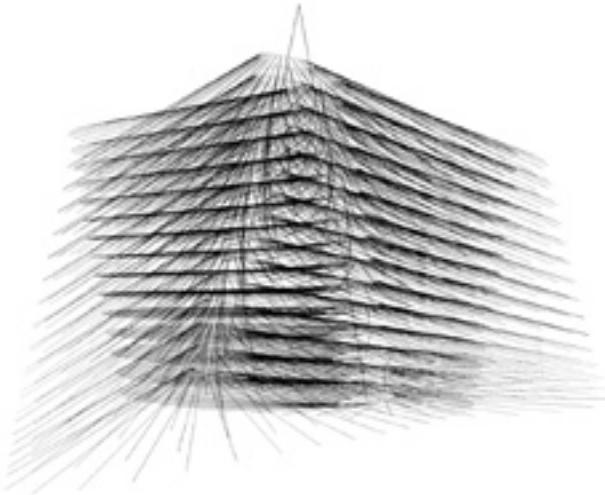


fig. 9, printer on Paper, 70x100 cm, 1987

H. G.: Sometimes you end up with drawings that are not quite perfect because a pencil lead failed to draw correctly or because you felt that the drawing was in some way unsuccessful. Could you imagine making these exponents into unique copies by reworking the machine drawing as an artist, or does that go against your working method too much?

W. Z.: That doesn't interest me because there are so many possibilities available to me in the working process itself that I don't use the failure as a supplement to the process. That would be a completely different artistic approach. The central theme running through my art is this strong bond between art and technology, ever

since I started making mobile sculptures.

H. G.: So you couldn't imagine making the program so irregular on purpose so that no one would be able to tell whether the result was from a concept artist working by hand and trying to draw as perfectly as possible, or whether the machine failed to produce a perfect drawing? To play with the various possibilities, so to speak – to be both yet to leave open what it really is.

W. Z.: Actually, I think that is the case with my drawings. If it were not announced that they were machine drawings, they would not necessarily be seen as such. Artists can also achieve a high level of drawing quality by hand, but not with this neutrality with which I do it. I would see the difference because I always observe my drawings very exactly and recognize their difference from manual techniques. An outsider would not necessarily see that and would think that this person can draw relatively well.

H. G.: You have been involved for quite some time with machines and refining their development. Could you imagine doing something different in terms of drawing? For example, putting it straight onto the wall, that would be much very close to drawing in the classical sense but still different..

W. Z.: Perhaps I should remind you that I made my drawings by hand in the late 70s and early 80s. Even when I started programming I always thought to myself: "I've been sitting

here a week writing my program before I even see something small on the monitor and then later on the printer – why don't I just pick up a pencil?"

So I can imagine that quite easily. On the other hand, there is the question of how far I go when I work with machines. I do have to exceed the limit to get the results that can only be made in this way.

H. G.: You have many different possibilities available to you, including your subjects. You have not restricted yourself to pictures of stars or of the Earth's surface. You could also take on commissioned work. Would that be a possibility, without giving up your artistic concept?

W. Z.: The question of commissioned work is basically a question of one's situation in life. The moment that I have no money and someone would like to commission such a work, why shouldn't I do it? I couldn't do just anything. For example, if it were a portrait, I would like to take the photo myself.

Work on commission is a topic in itself. As you know, art in public space is a main focus of my work, and that is usually commissioned. But I have always tried to put across my artistic standpoint. The tide fountain in Bremen is a good example. It consists of four height-adjustable columns with water flowing down them.

The height of the columns represent the tidal water level at three locations: in Bremerhaven, Brake and Bremen. The task here was to convey the tide level of the ground water near the Weser river. The moment I accept such a commission it is clear to me that the result can't have anything to do with my series of works in the studio. At the time, my objects were made of wire. But I completed the job, although I went beyond the original task. In the competition for the Zeven commission I simply ignored the topic, which was about the city's history, but won anyway. This was because I presented a work of art which took into account the town's spatial situation and which spoke to the judges as well as to the public. By having the movement of abstract objects controlled by rain and sun I provided the user with a link to nature. They see that nature changes the object and it connects to what is happening locally.

**H. G.:** In the near future you will continue to concentrate on drawings that you have further developed in recent years. Programming and technical apparatus will continue to be a component of your future works.

**W. Z.:** The machine that I built myself dates from 1987, so it's already 21 years old. The architects plotters date from around 1992, when their production stopped. Since I work with very old machines for which spare parts or technical support are no longer available, I have to be very careful with them. So although my work is somewhat "progressive", I am

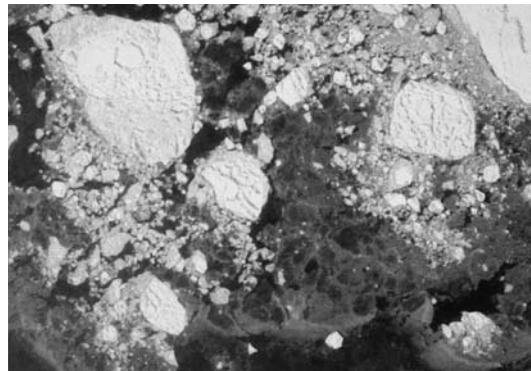
working with technology that are museum pieces. But my technology is now available to me just as much as a camera is available to someone who uses it to take pictures. And I will continue to use the means that I have placed at my own disposal, even in the future.

fig 10, Vitus fountain in Zeven, 2002

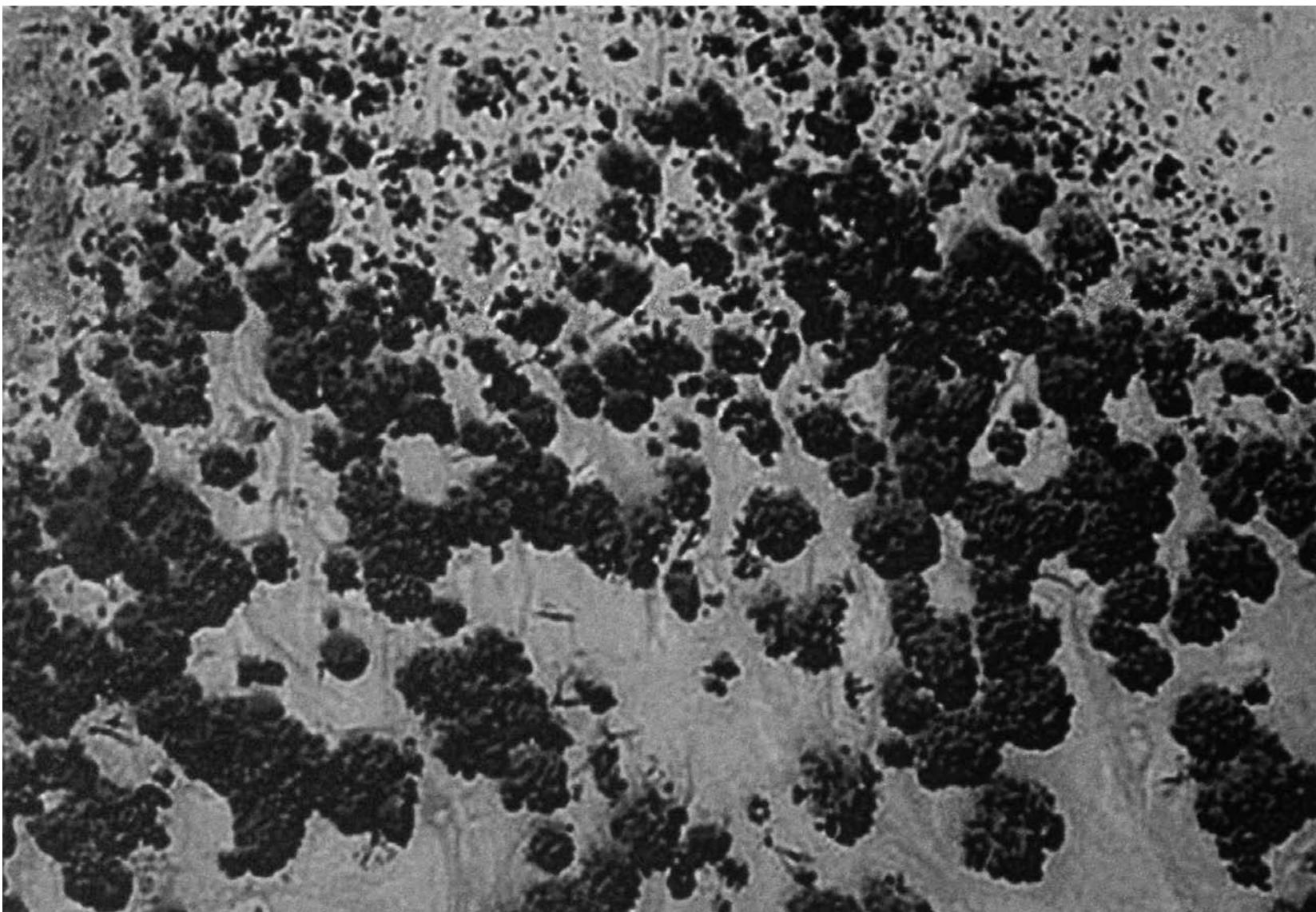




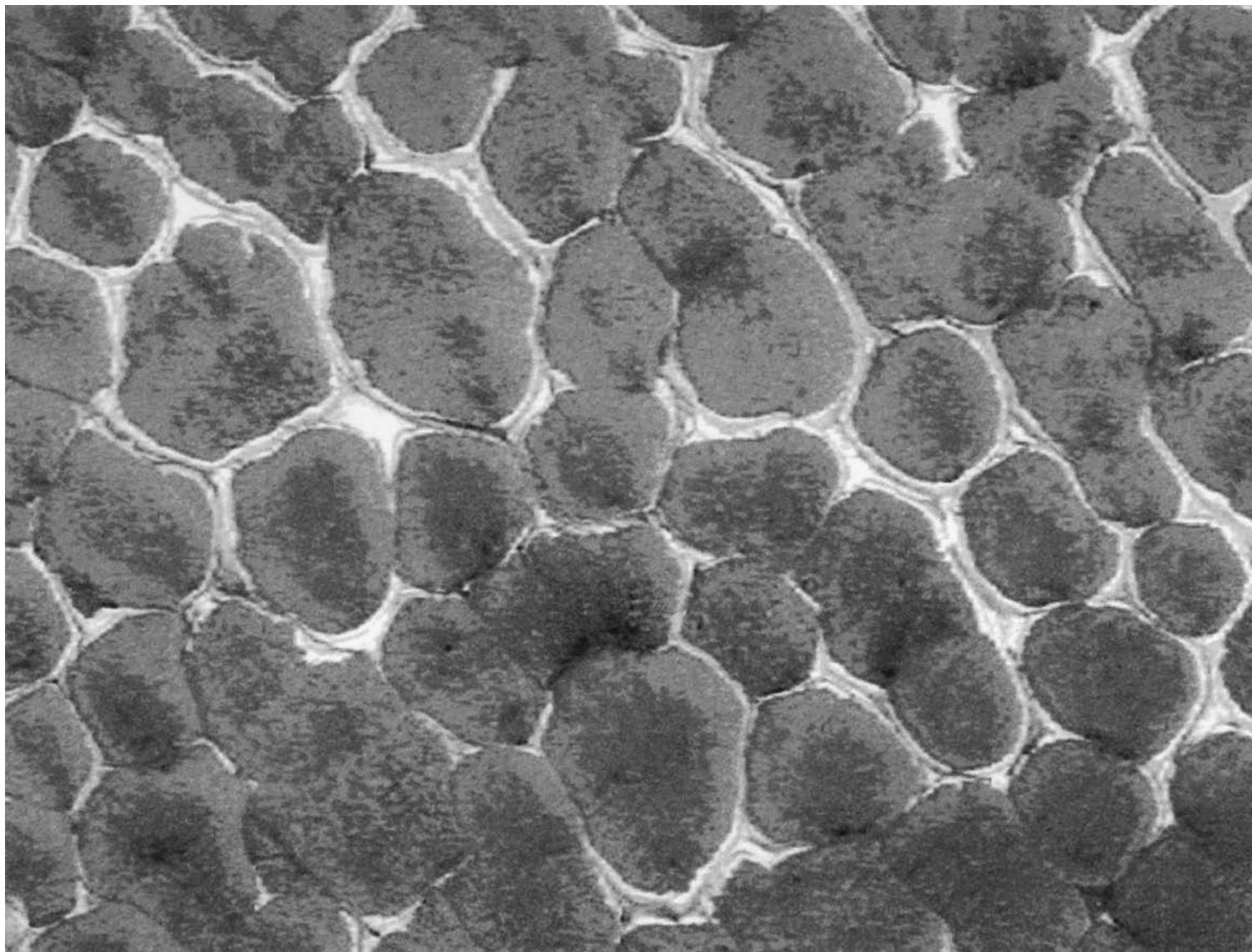
1  $60^{\circ}16'33,79'' N, 165^{\circ}36'38,79'' W$ , h 4,27 km, 45 x 58 cm, 2007



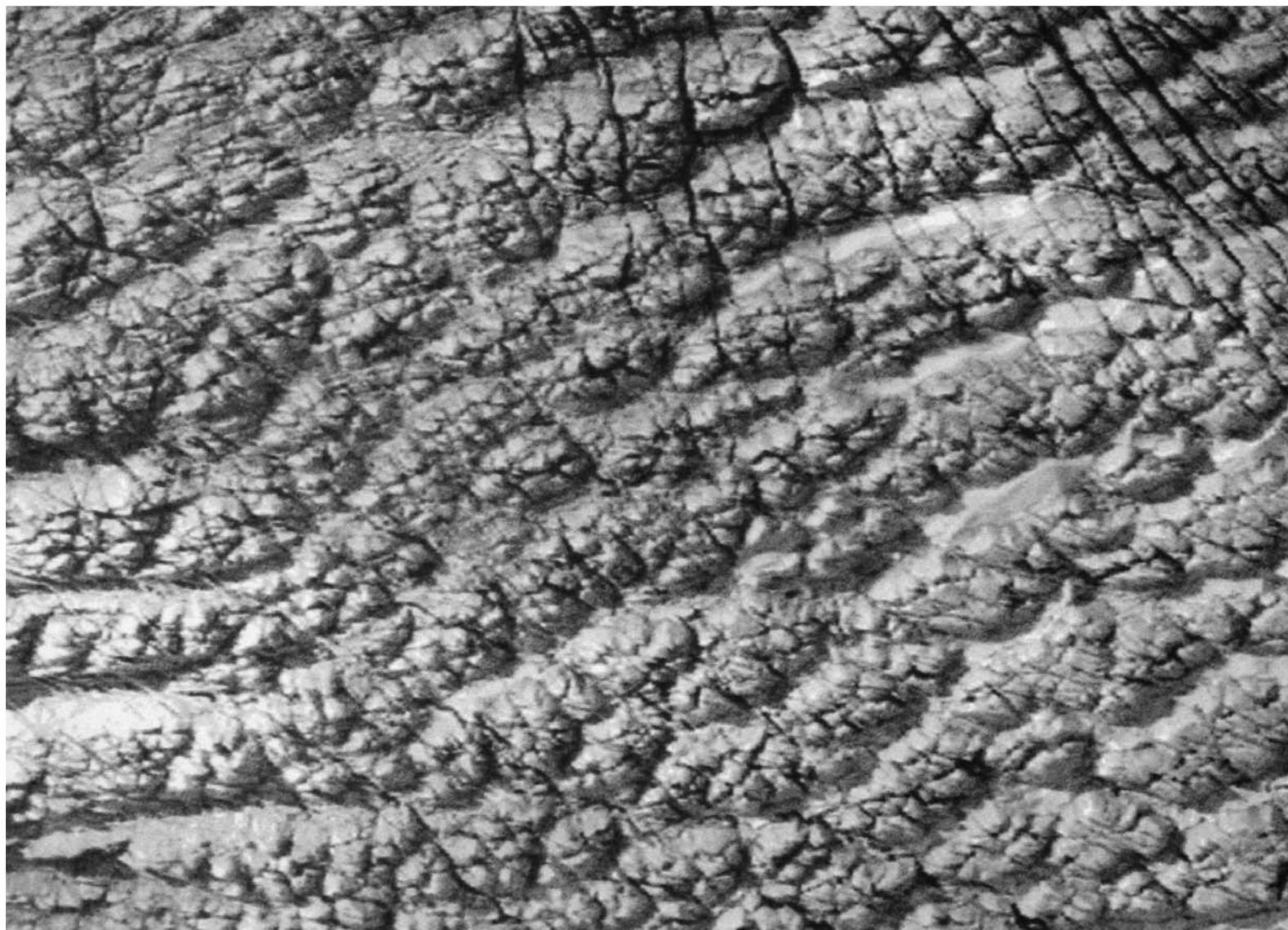
2 lat  $63,644779^{\circ}$ , lon  $-80,278920^{\circ}$ , h 905 m, 45 x 58 cm, 2007



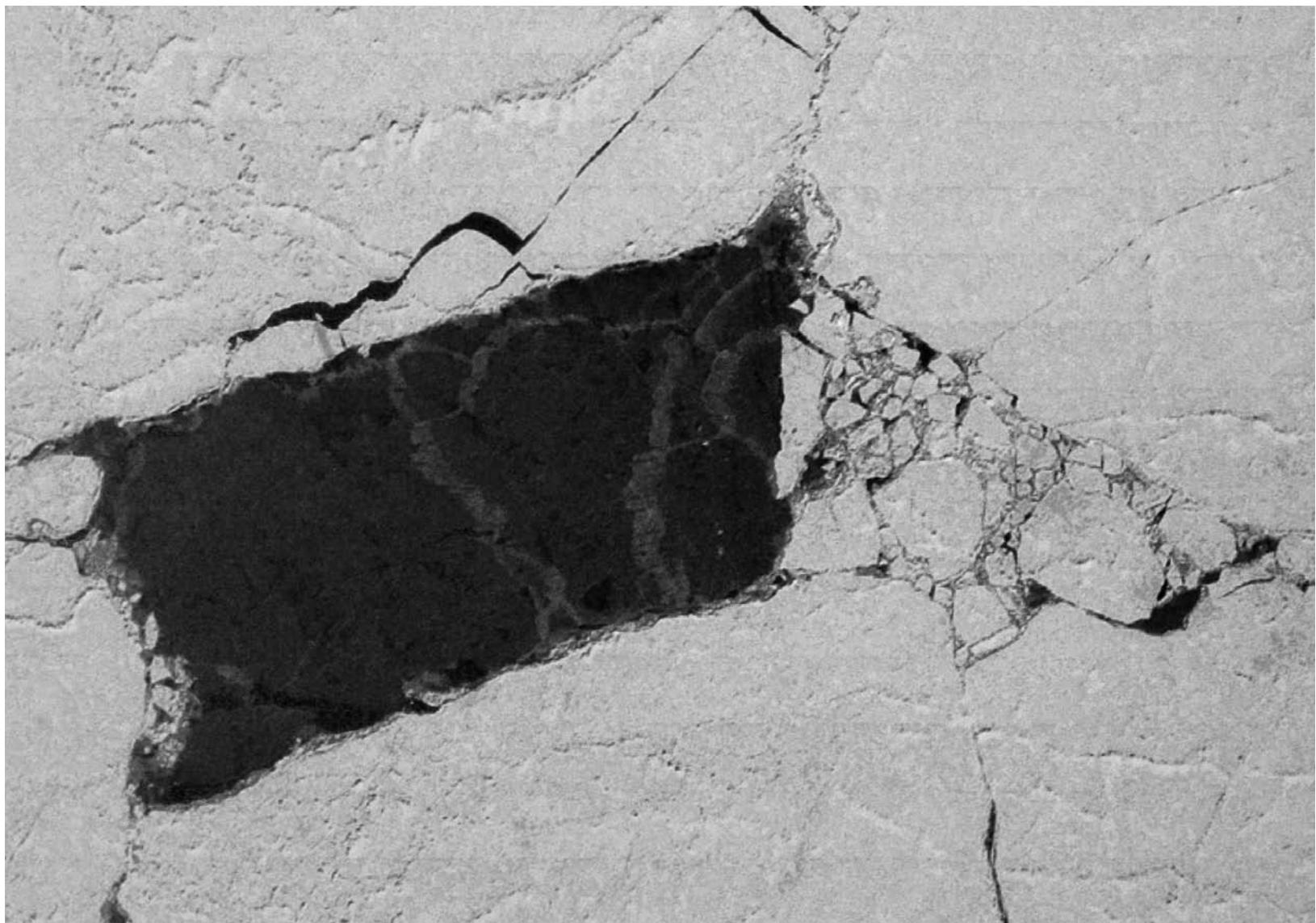
3 lat 14,965344°, lon 27,305706°, 45 x 58 cm, 2008



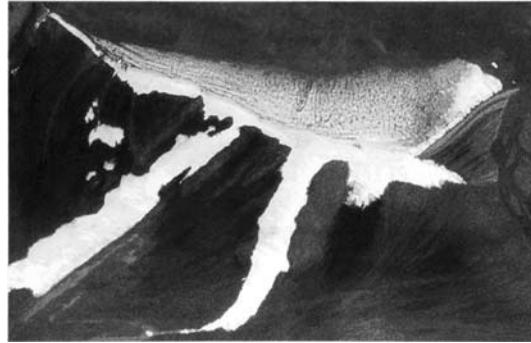
4 lat 71,434281°, lon -78,817887°, h 1,51 km, 40 x 55 cm, 2007



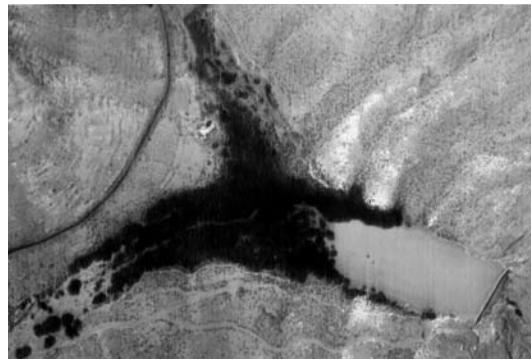
5 77°10'01,89" N, 15°07'53,72" O, h 817 m, 45 x 58 cm, 2007



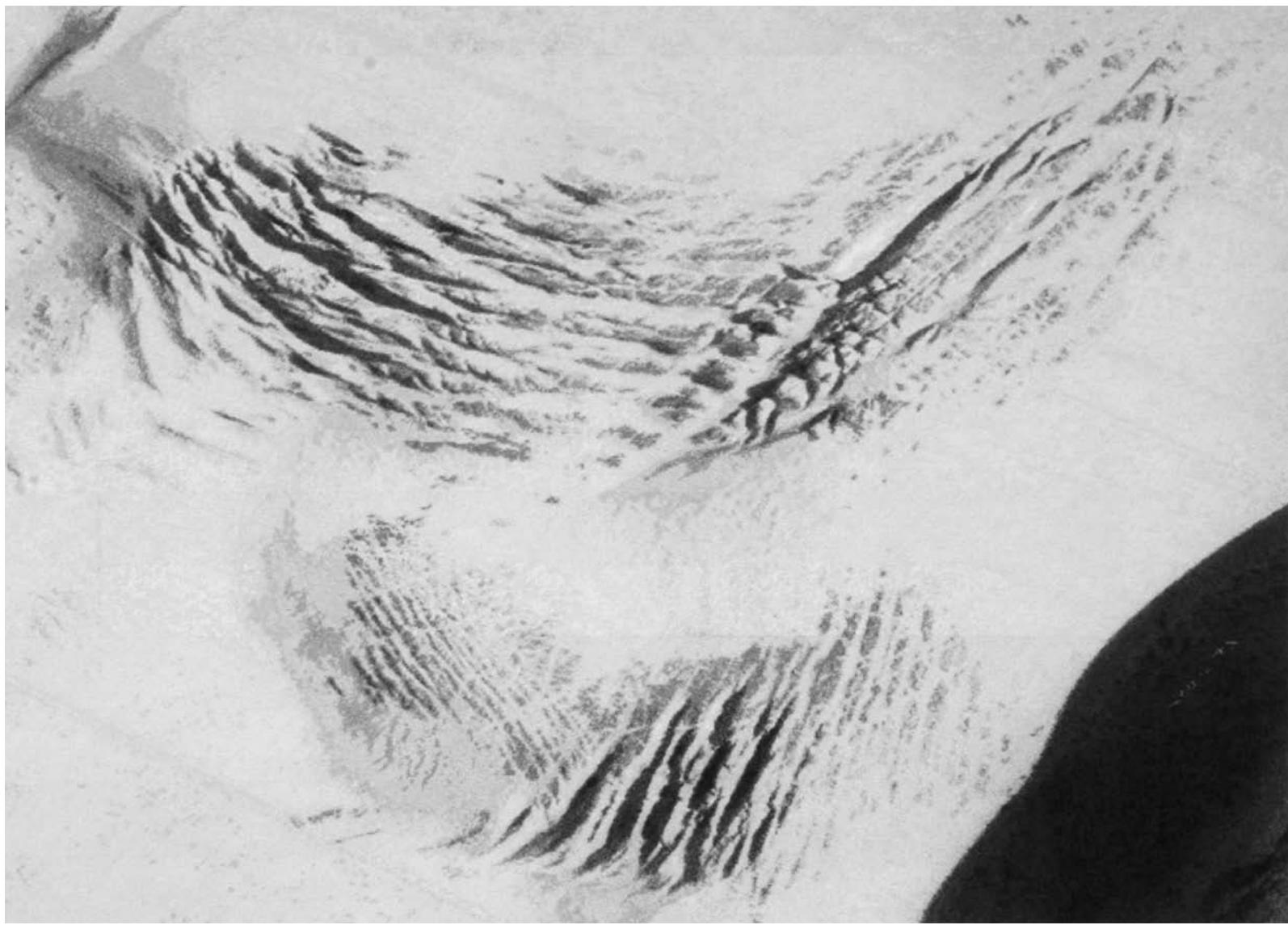
6 lat 64,169782°, lon -80,303866°, h 959 m, 45 x 58 cm, 2007



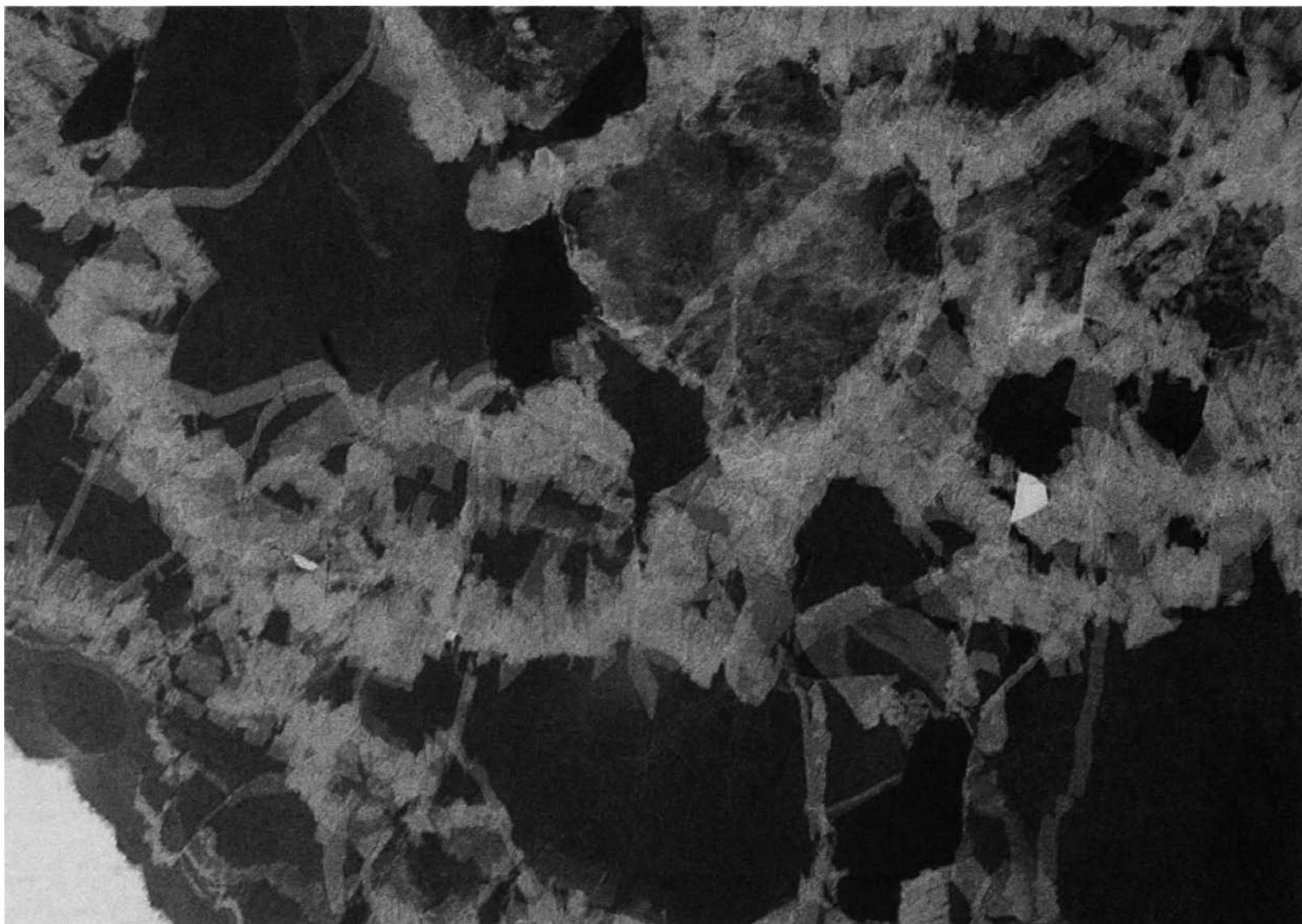
7  $73^{\circ}22'11.61''N, 54^{\circ}36'45.55''E$ , h 1,47 km, 40 x 55 cm, 2006



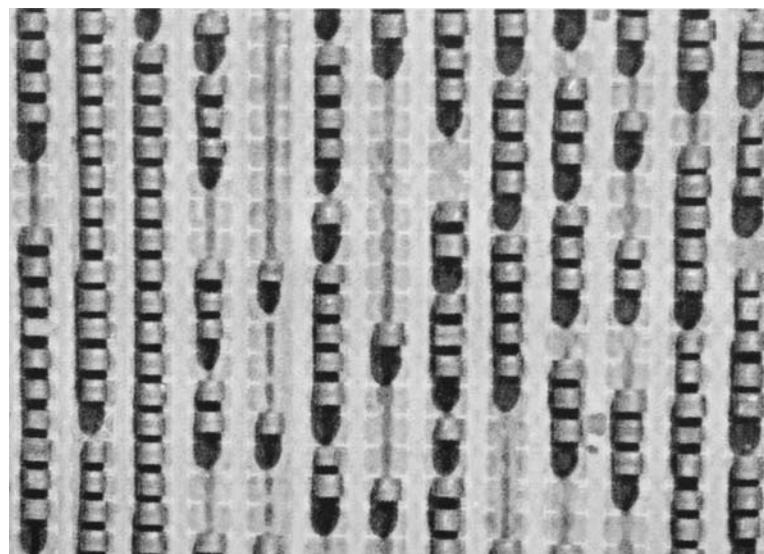
8 lat 28,389371°, lon -14,096889°, h 1,00 km, 157 x 232 cm, 2006



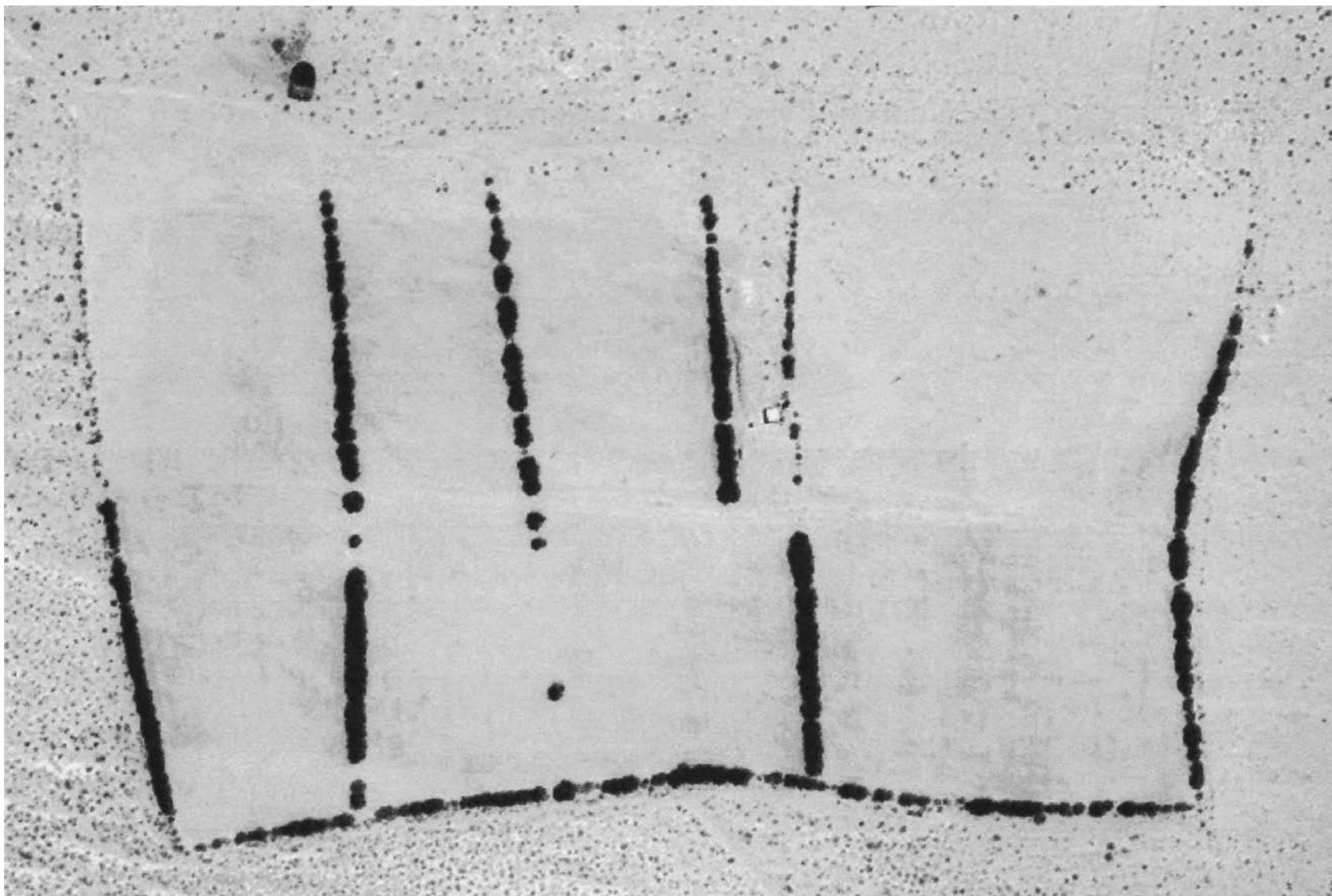
9 lat 70,518741°, lon -71,453101°, h 1,68 km, 40 x 55 cm, 2007



10 lat 65,245148°, lon -84,021420°, h 853 m, 45 x 58 cm, 2007



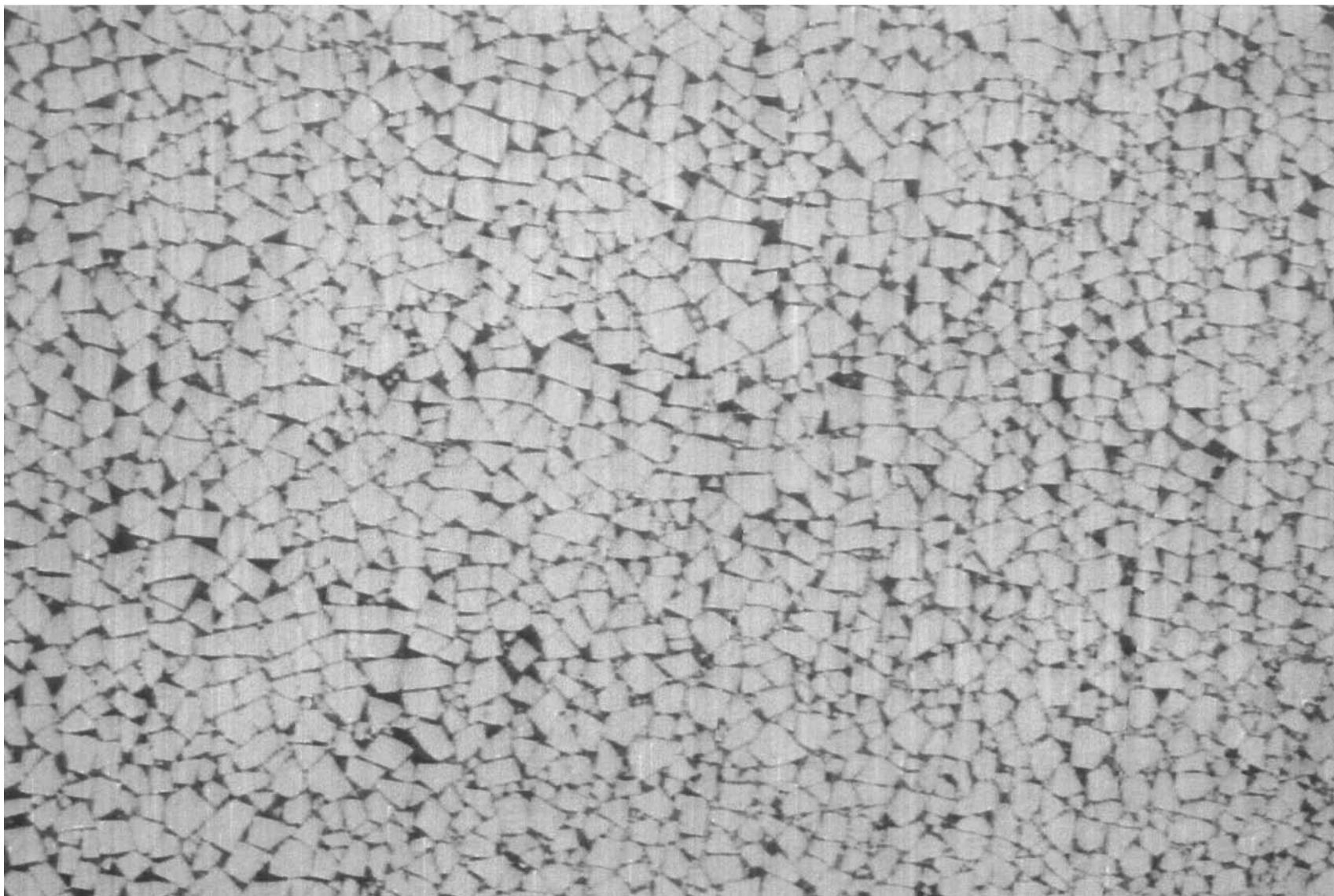
11 53°08'21,90" N, 8°40'41,87" O, h 80 m, 45 x 58 cm, 2007



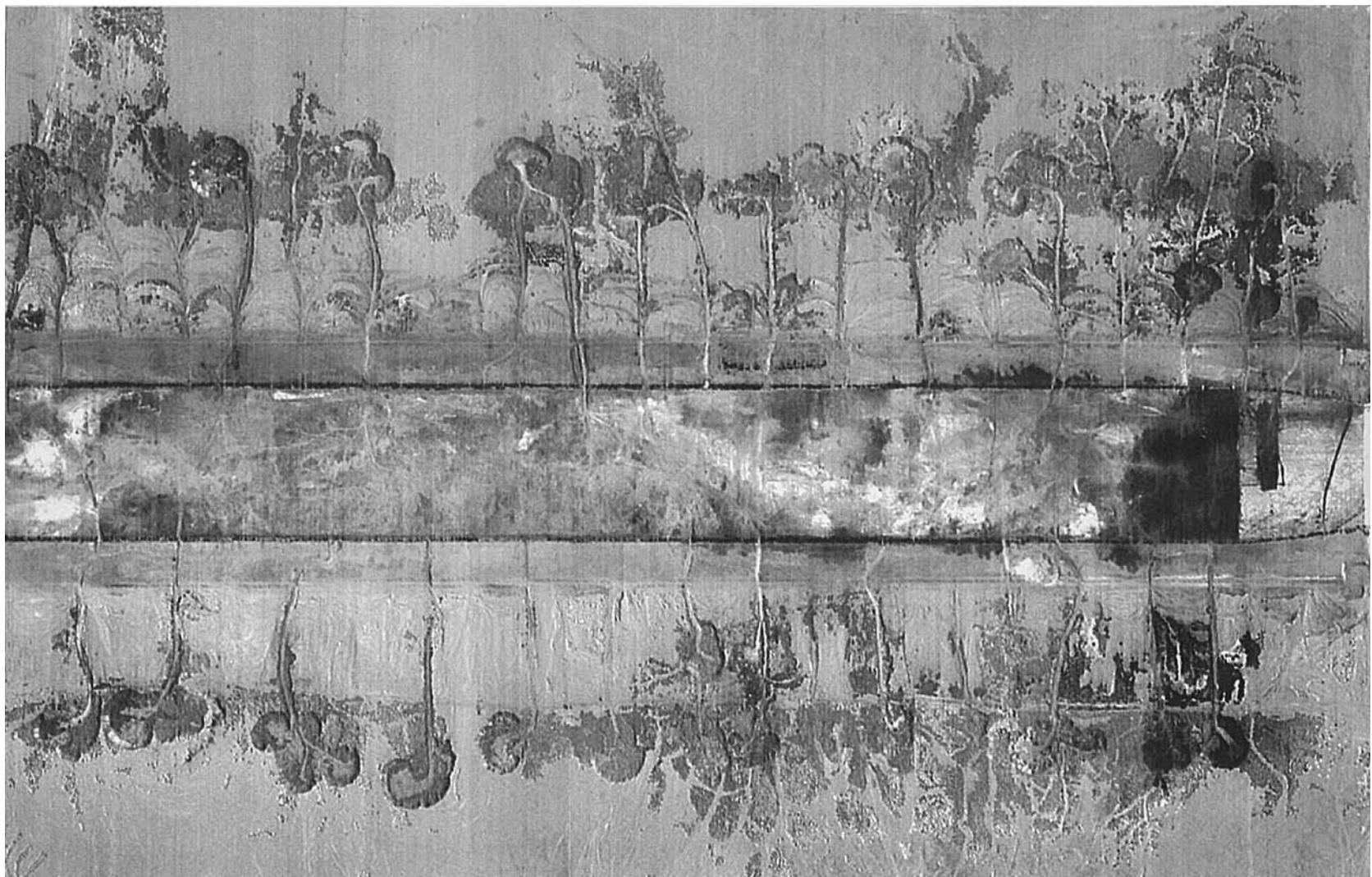
12 32°04'18,71"N, 11°28'11,85"E, h 1,00 km, 40 x 55 cm, 2006



13 lat 24,630690°, lon 54,853728°, h 5,97 km, 157 x 200 cm, 2006



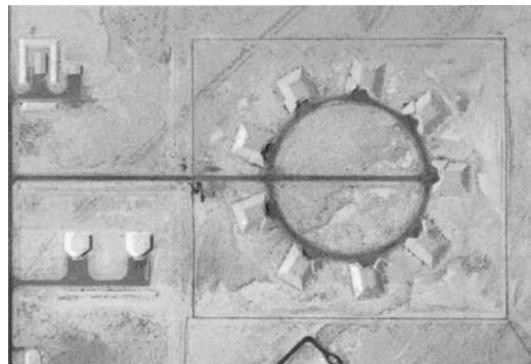
14 80°01'23,63" N, 47°39'55,97" O, h 875 m, 157 x 230 cm, 2007



15 22° 53' 06,69" N, 31° 21' 09,74" O, h 3,02 km, 157 x 240 cm, 2007



16  $24^{\circ}15'11,44'' N, 54^{\circ}34'31,11'' E$ , h 1,50 km, 45 x 58 cm, 2007



17  $24^{\circ}15'24,99'' N, 54^{\circ}31'34,46'' E$ , h 1,08 km, 45 x 58 cm, 2007



18 lat 30,499462°, long 19,722904°, h 3,09 km, 157 x 220 cm, 2006



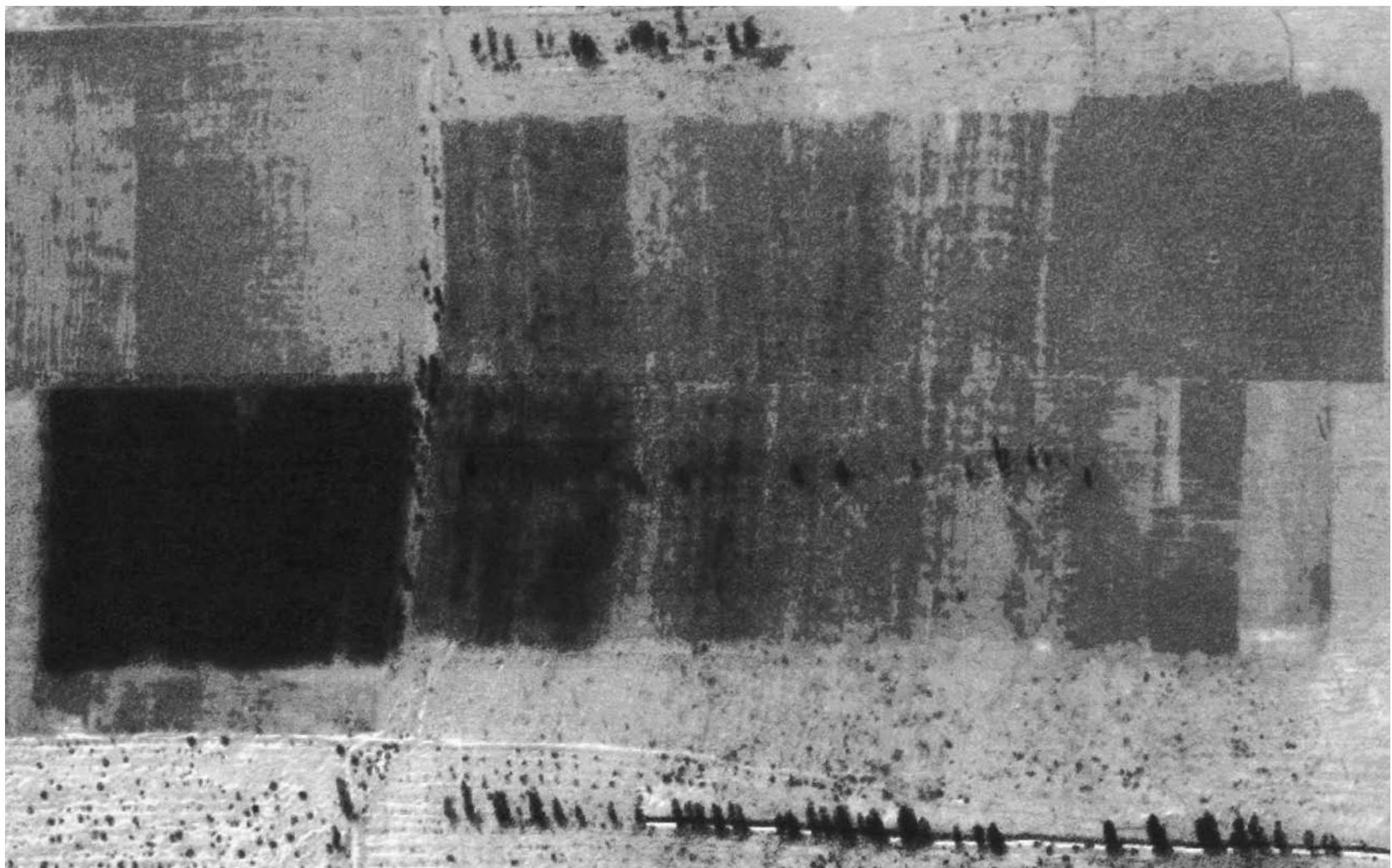
19 lat 32,546970°, lon 13,519829°, H 2,04 km, 40 x 60 cm, 2006



20 lat 30,522481°, lon 19,761797°, h 1,14 km, 220 x 157 cm, 2006



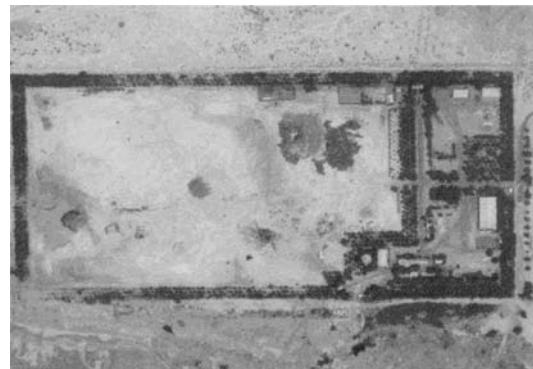
21 lat 25,930915°, lon 51,608161°, h 1,24 km, 157 x 210 cm, 2006



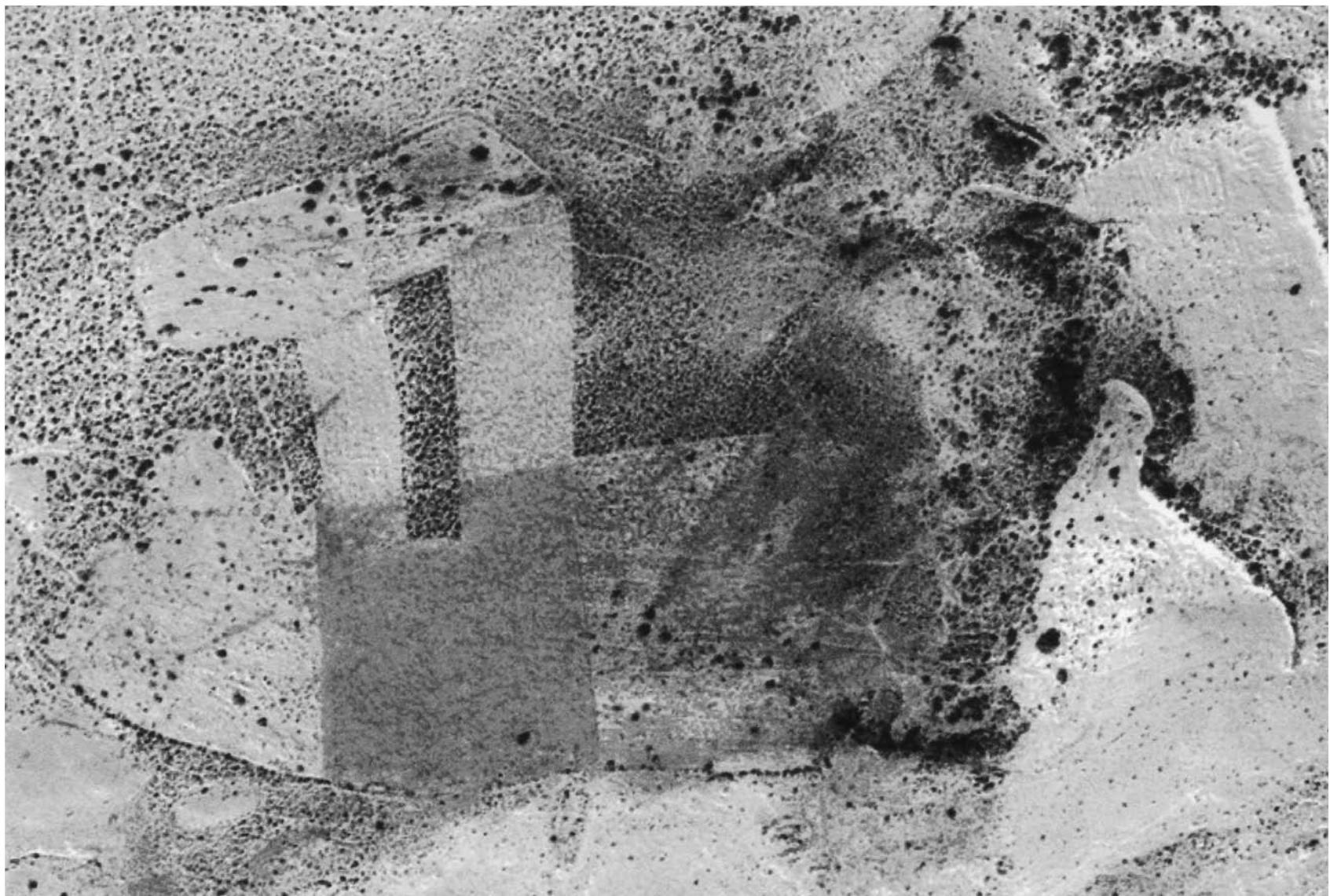
22 32°04'48,19"N,11°35'26,99", h 152 m, 40 x 55 cm, 2006



23 lat 32°43'46.47" N, lon 13°60'7.670" E, h 1,59 km, 157 x 210 cm, 2006



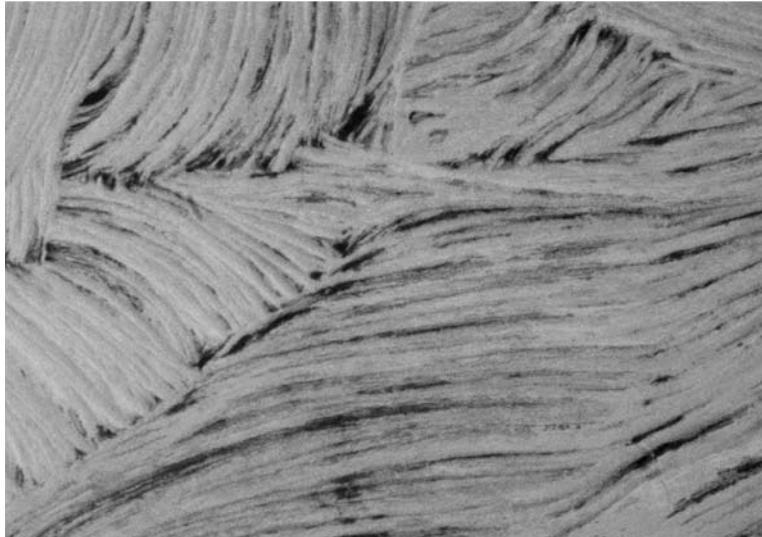
24 24°14'23.34" N, 54°37'42.41" E, h 1,06 km, 45 x 58 cm, 2007



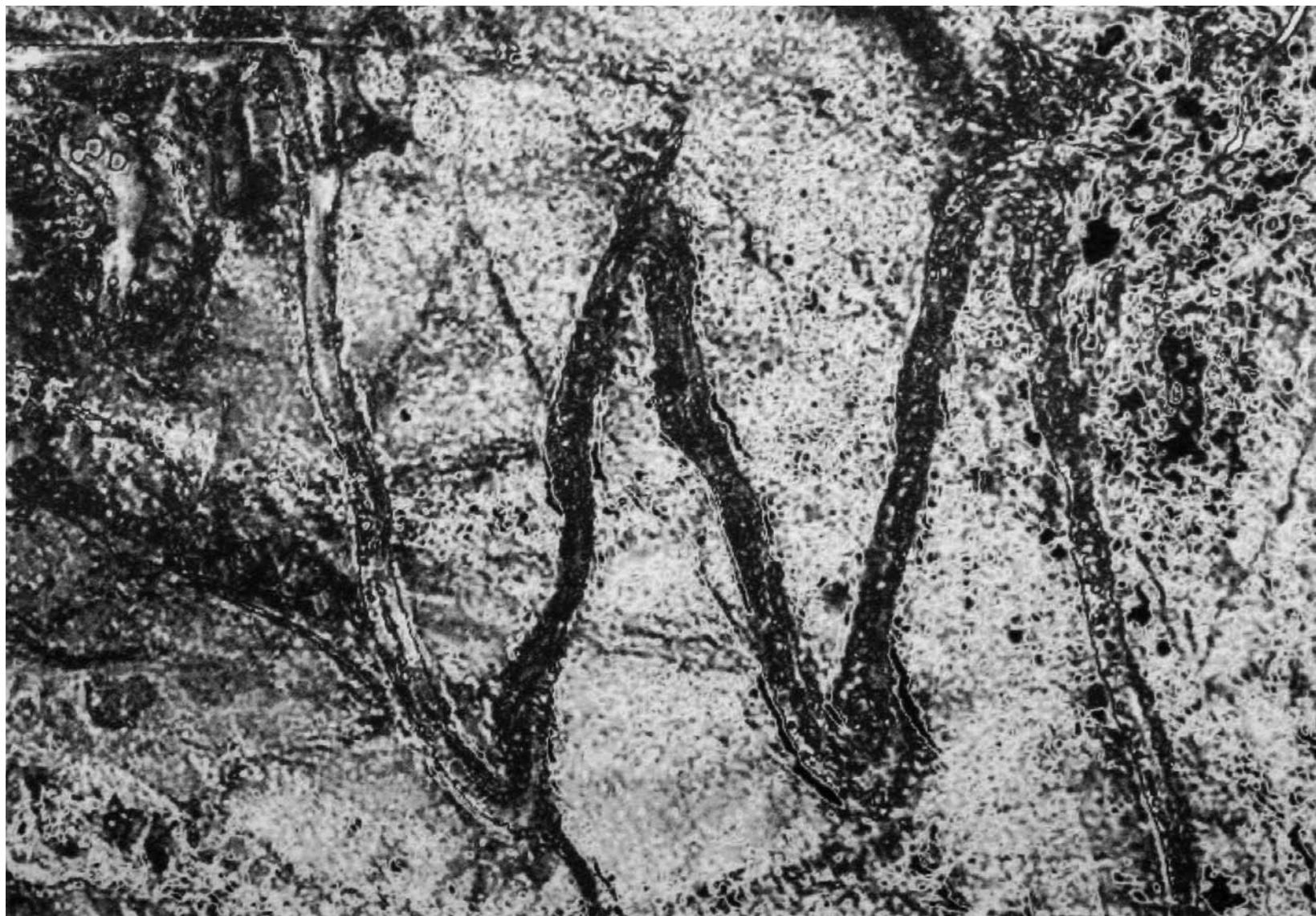
25  $32^{\circ}00'32,65''N, 11^{\circ}35'00,06''E$ , h 188 m, 40 x 55 cm, 2006



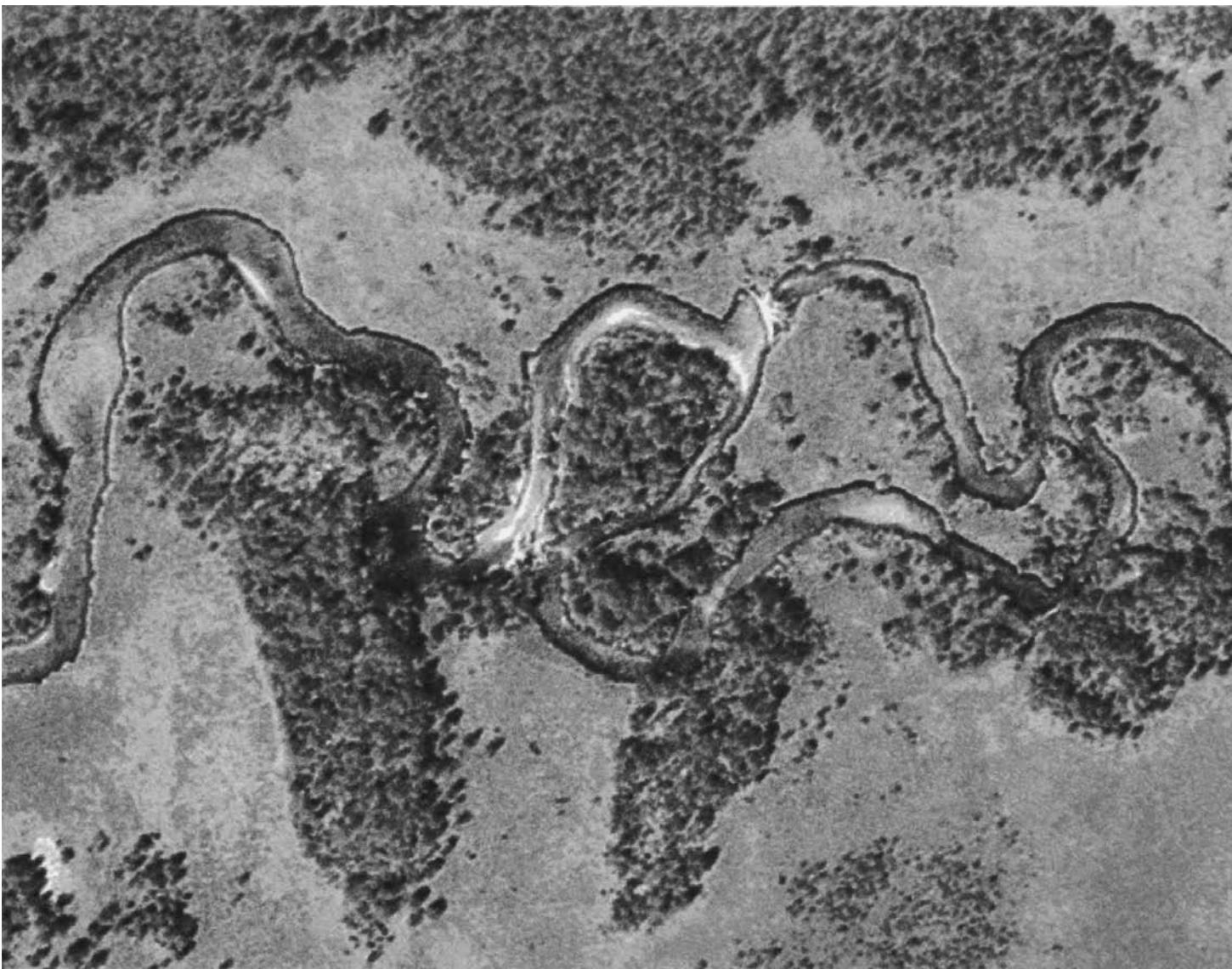
26 73°18'30,25"N, 111°54'20,53"E, h 1,12 km, 40 x 55 cm, 2007



27 lat 61,929519°, lon -79,715410°, h 1,37 km, 45 x 58 cm, 2007



28 31°52'48.92" N, 11°28'39.21" E, h 1.05 km, 45 x 58 cm, 2007



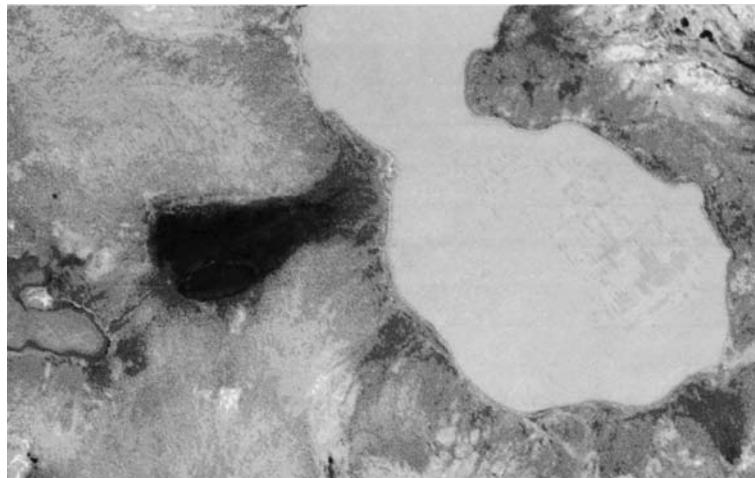
29 52°35'20,19"N, 108°04'51,46"E, h 1,31 km, 40 x 55 cm, 2007



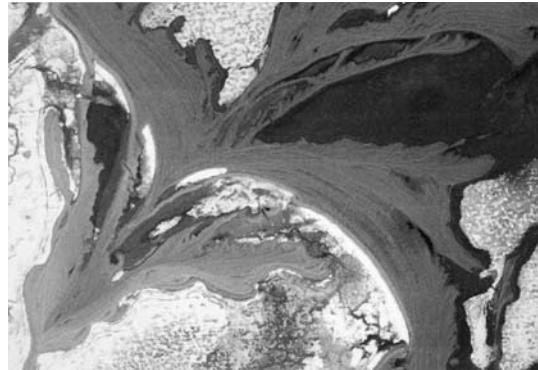
30 lat 64,297916°, lon -80,523300°, h 819 m, 45 x 58 cm, 2007



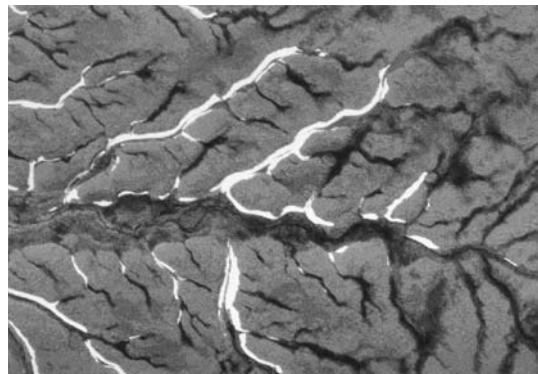
31 31°57'46,69"N, 11°29'09,54"E, h 253 m, 40 x 55 cm, 2006



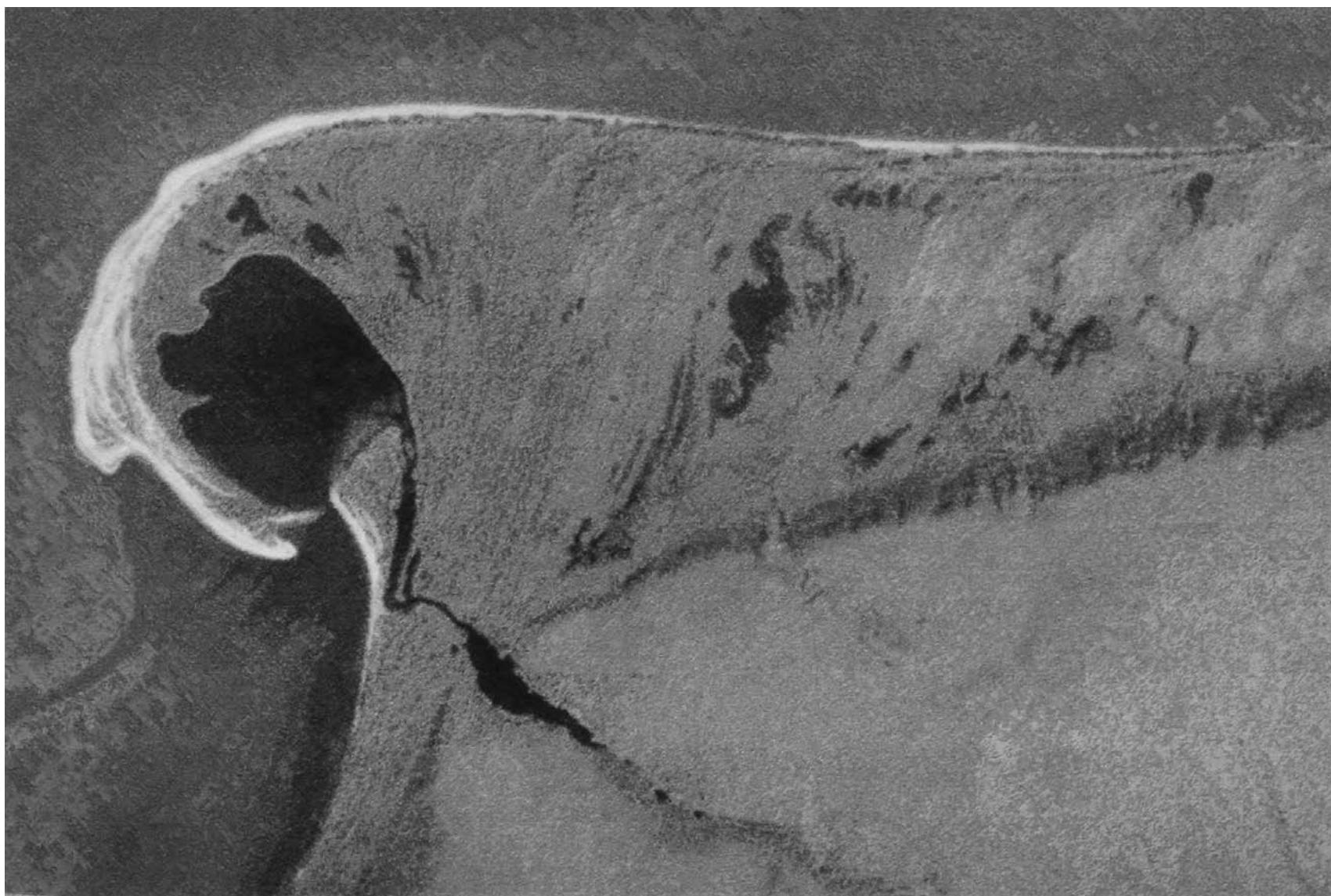
32 71°17'57,66"N, 52°20'00,38"E, h 1,08 km, 40 x 55 cm, 2006



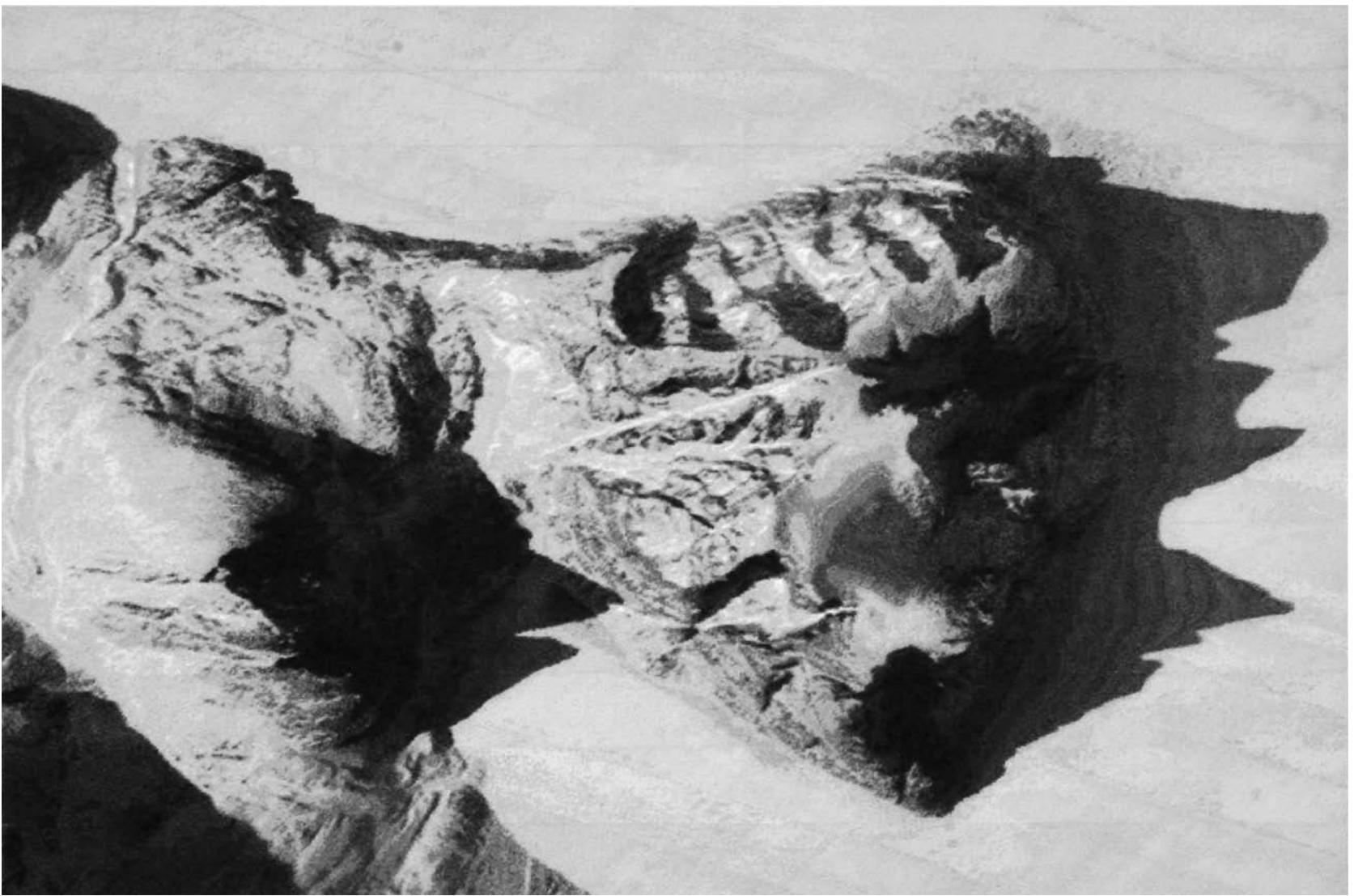
33 lat 61,585560°, lon -79,841726°, h 1,19 km, 45 x 58 cm, 2007



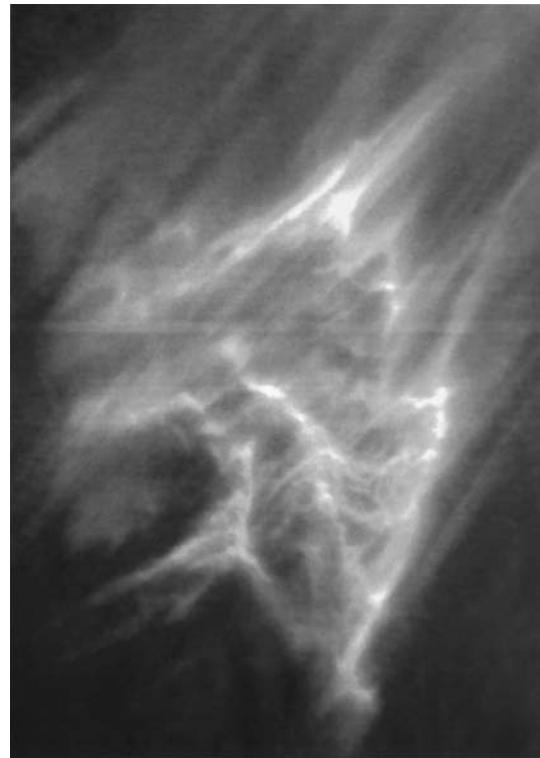
34 76°53'16,02" N, 118°12'31,24" W, h 2,03 km, 45 x 58 cm, 2007



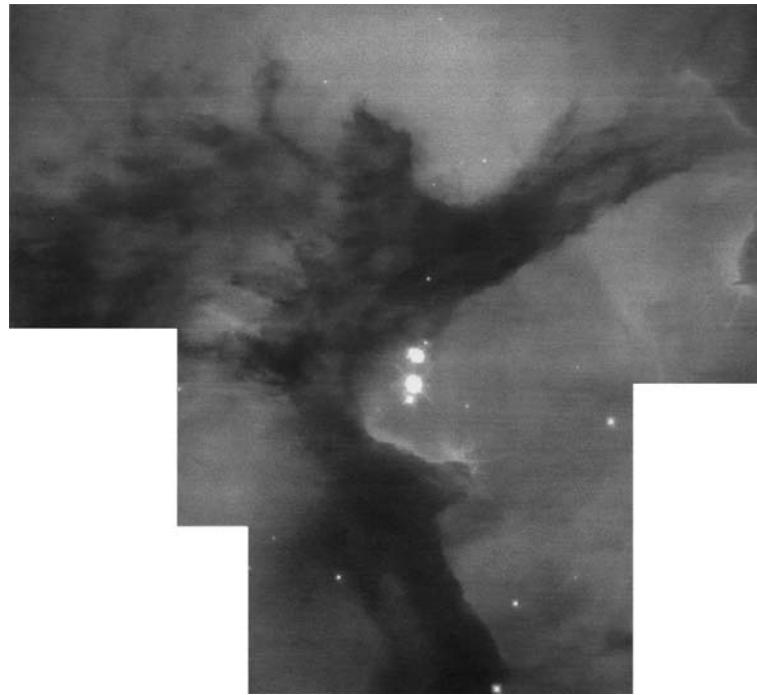
35 lat 66,485371°, lon -166,076981°, h 1,47 km, 45 x 58 cm, 2007



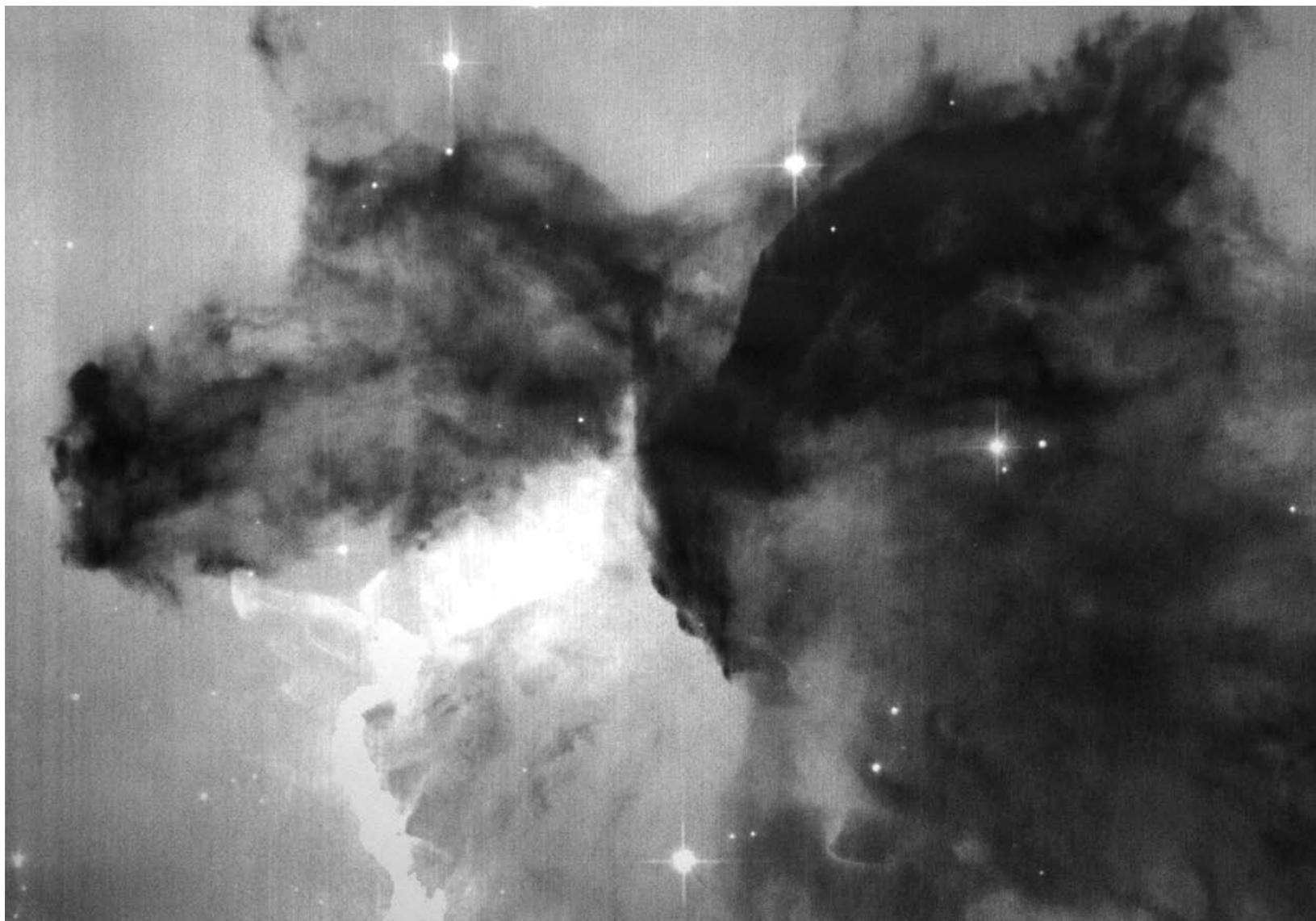
36 lat 70,556801°, lon -71,448697°, h 7,05 km, 40 x 55 cm, 2007



37 *Barnard's Meope Nebula, Pleijaden, WPC2, ESA, 220 x 157 cm, 2007*



38 *Trifid Nebula, NGC6514,ESA, 150 x 157 cm, 2007*



39 NGC6611, Adlernebel, ESA, 2004, 157 x 225 cm, 2005

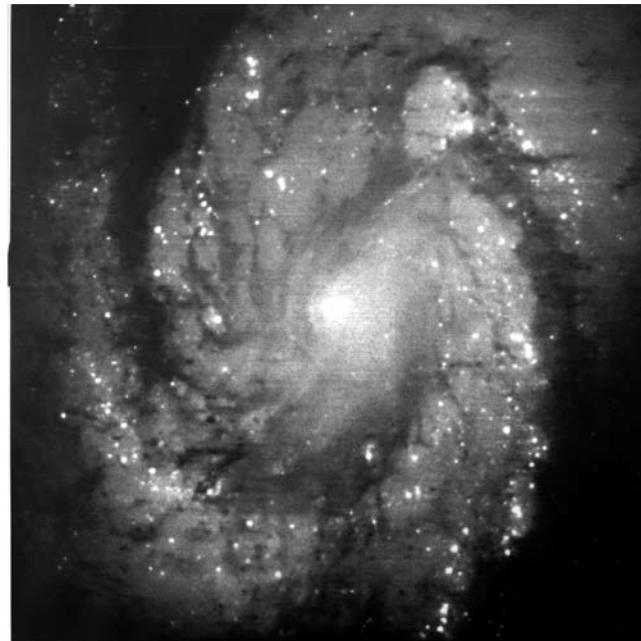


40 *Galaxie 510 - G13*, *ESA*, 157 x 500 cm, 2008





41 *Orion Nebel*, ACS, 2005, ESA, 157 x 260 cm, 2007



42 Galaxie M100, ESA, 1993, 157 x 157 cm, 2005



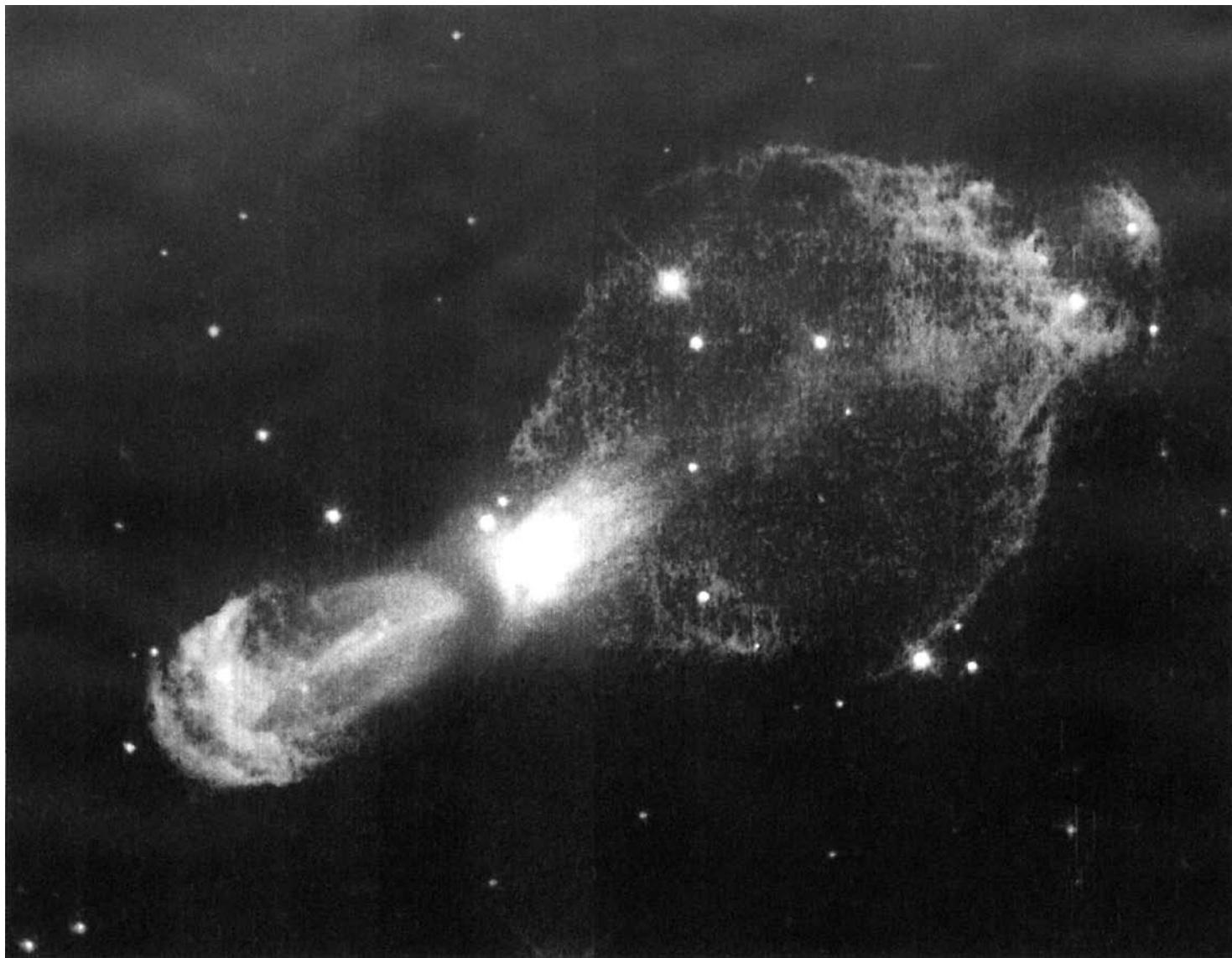
43 *Jupiter mit Io*, Esa, 1990, 165 x 157 cm, 2005



44 *Sagittarius Sternenwolke*, Esa, 1998, 157 x 157 cm, 2005



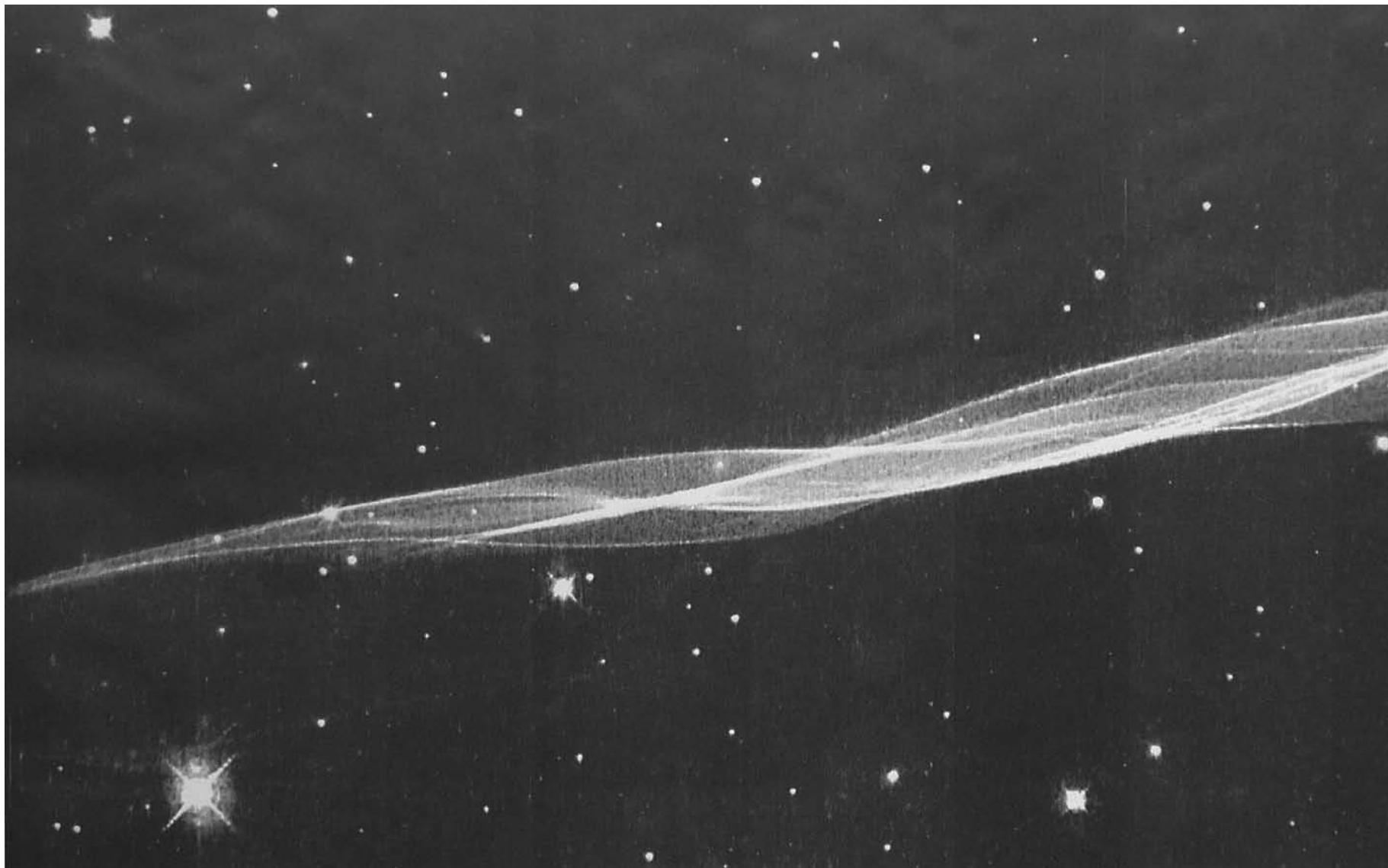
45 HCG 87, WPFC2, 1999, ESA, 157 x 280 cm, 2007



46 *Calabash Nebula*, WPC2, ESA, 157 x 200 cm, 2006



47 NGC 6302, Bug Nebula, ESA, 190 x 157 cm, 2007



48 *Veil Nebel, NGC6960, WFPC2, ESA, 157 x 300 cm, 2007*



## Biografie – Ausstellungen

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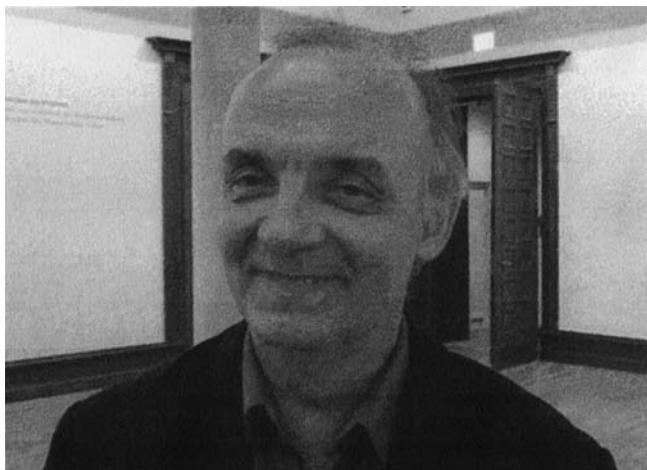


Abb. 11, *Zach*, Zeichnung, 30 x 40 cm, 2008

Wolfgang Zach 1949 in Bremen geboren

1969-72 Informatik-Studium in Karlsruhe  
1972-77 Kunstakademie in Karlsruhe bei Kalinowski  
und Neusel  
Seit 1979 freischaffender Künstler in Bremen.

### Ausstellungen

- 1974 Aktion mit Objekten,  
Wilhelm-Lehmbruck-Museum, Duisburg
- 1976 Galerie Haus 11, Karlsruhe
- 1980 Galerie Gruppe Grün, Bremen
- 1984 Galerie Vilsen, Bremen
- 1984 Institut für Produktionstechnik,  
Universität Bremen
- 1984 Galerie Voss, Dortmund
- 1985 Kunstfrühling, Galerie Vilsen, Bremen
- 1986 Galerie im Spieker, Borken
- 1987 Galerie K, Cuxhaven
- 1987 Kommunale Galerie, Bremen
- 1988 Galerie Sachs, München
- 1992 Galerie K \*, Cuxhaven
- 1992 Galerie am Lambertihof, Oldenburg
- 1996 Lichthaus \*\*, Bremen
- 1996 Galerie Kolo \*, Danzig, Polen
- 2001 Atelierhaus Friesenstraße 30 \*\*\*,  
Bremen
- 2002 Atelierhaus Friesenstraße 30 \*\*\*,  
Bremen
- 2002 Königin-Christinen-Haus, Zeven
- 2003 Galerie Voss \*\*\*, Dortmund
- 2003 Verein für Originalradierung \*\*\*, München
- 2003 Schloß Ritzebüttel \*\*\*, Cuxhaven
- 2005 „Ultra Deep Field“, KUBO, Bremen

### Preise

- 1992 „Computergrafik“, Karlsruhe (1. Preis)
- 2002 Kubo Kuntpreis „Der Große Ausdruck“ \*\*\*

## Ausstellungsbeteiligungen

- 1973 „Forum Junger Kunst“, Bochum  
1975 „Forum Junger Kunst“, Mannheim  
1977 „Forum Junger Kunst“, Bochum  
1978 „66. Herbstausstellung“, Kunstverein, Hannover  
1981 „Kunst-Landschaft“, Barkenhoff, Worpsswede  
1981 „Junger Westen“, Recklinghausen  
1985 „Prints & Plots“, Computermesse, Köln  
1986 „artware“, CeBit-Messe, Hannover  
1986 „Prints & Plots“, Computermesse, Köln  
1986 „Bilder Digital“, Galerie der Künstler, München  
1986 Kommunale Galerie, Bremen  
1988 Städtische Galerie, Wolfsburg  
1988 Sonderschau „artware“, Messe Forum Hamburg  
Siemens Museum, München  
Karl-Ernst-Osthaus-Museum Hagen  
1990 „Kunst und Technologie“, die GAK im BITZ, Bremen  
1993 Kunstforum Nord, Bremen  
1997 Galerie Kolo, Danzig  
2002 „formidable“, Galerie Voss, Dortmund  
2003 „Der Große Ausdruck“, Städtische Galerie, Bremen  
Kunst und Medienzentrum, Berlin Adlershof  
2004 „Zeichnung vernetzt“ \*\*\*, Städtische Galerie, Delmenhorst  
2004 SWB Galerie, Bremen

- 2005 Kunstfrühling, „Kooperationen“ \*\*\*\*, GAK, Bremen  
2006 „Menschenbilder“ \*\*\*, Kunstverein, Eislingen  
2007 Grafiktriennale Krakau \*\*\*\*, Stadtmuseum, Oldenburg  
2007 16/32, Galerie für Gegenwartskunst, Bremen

## Kunst im öffentlichen Raum

- 1981 Trojanisches Pferd, Schule an der Lessingstraße Bremen  
1987 Drahtskulptur, Computerzeichnungen, BITZ, Bremen  
1992 Tidebrunnen, Bremen  
1993 Laserskulptur über dem Congress Centrum Bremen  
1995 Leuchtenbogen, Bürgerweide, Bremen  
1999 Klangobjekt, Max-Planck-Institut für Physik komplexer Systeme, Dresden  
2002 kinetisches Brunnenobjekt, Vitusplatz, Zeven  
2005 „Ultra deep field“, Computerzeichnung auf der Liftaßsäule des KUBO, Bremen

\* zusammen mit Anna Solecka

\*\* zusammen mit Holger Bär

\*\*\* gemeinsame Arbeiten mit Anna Solecka

\*\*\*\* gemeinsame Arbeiten mit Karl Heinrich Greune

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Am Wall 207  
28195 Bremen  
To 42132908-0  
F 042132908-47  
[office@kunsthalle-bremen.de](mailto:office@kunsthalle-bremen.de)  
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