

Celtic Landsurveying in the Sundgau Area

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Abstract: This study explores Celtic landsurveying practices in the Sundgau area, situated in France west of the river Rhine. The region served as an important gateway for the Celts to access central France and the Mediterranean Sea. The Celts inhabited the area from the early Hallstatt Period and cultivated the fertile grounds of the Sundgau valley. The study focuses on the ancient landsurveying technique using the Pentagon-Dodecahedra, a geometrical body with drilled holes and knobs. The dodecahedron was used to stake out long straight lines with precise directions. The surveyors relied on star and direction-finding tubes to align their instruments and determine the line of sight. The study reconstructs the geometrical grid resulting from ancient landsurveying in the Sundgau area, with base-lines extending from Gempfen to Rosenau. It also identifies perpendicular axes and parallel lines that intersect at various points where ancient centers for worshipers, including chapels, churches, graveyards, and sacred sites, are located. The findings demonstrate the systematic and precise nature of Celtic landsurveying practices in the Sundgau area, with approximately 500 objects associated with the surveyed lines.

Key words: Sundgau/France, Celts, Surveying, Reconstruction, Visibility today.

1. The Sundgau-Area

The Sundgau-Area is situated in France, west of the river Rhine, between the southern hills of the Vosges and the southerly Jura-hills on the French-Swiss border. Already 2500 years ago this gentle and nearly flat Sundgau was an east-west gateway to the river Saône, to central France and further south to the river Rhône running to the Mediterranean Sea. Celts used to live here from the early Hallstatt-Period and thoroughly cultivated this region. Mostly, they lived on the near level grounds of this rather flat valley, bypassing the more thick-wooded flanks.

The area surveyed for this study -the Sundgau and the valley of the river Doubs- is extending from the river Rhine in the east as far as the villages of Cubrial, Villersexel and Lure some 30 kms west of Montbéliard / Belfort with a total acreage of about 5000 square kms.

2. The Celts within the Sundgau Area

In the 6.th century B.C. it is Hekataios of Milet,

who mentioned the Celts as living in the region north of Marseilles. From this ancient Greek Colony, travelling straight north, then eastwards along the river Saône und further east into the Doubs-valley, the Sundgau-area was within easy reach. A century later Herodot stated them more precisely as living near the sources of the river Danube in the vicinity of the village of Pyrene. According to the latest results of extensive excavations in this region, it can strongly be accepted, that the Celtic village of Heuneburg is meant, situated east of Sigmaringen, some 50 kms SW of Ulm.

Either from the West or from the East -or from both directions- already very early the fertile soils of this Sundgau-area were incorporated for agricultural purposes. Evidential findings of the pull-out of tree-stumps by draught animals verify a systematic action clearing the forests and claiming this fertile area for agriculture as early as the Hallstatt-Period.

This landscape was then systematically opened more and more, changing its long-lasting appearance.

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Fig. 1 Situation of the Sundgau-Area West of Basel / Switzerland.
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More information about the Celtic population can be found in Caesar's «De Bello Gallico».

Caesar writes about the Celtic priests (Druids), that their education/formation lasted up to 20 years. They studied many years in Greece, learnt the language, which they wrote and spoke between each other for a lifetime, so they could only be understood by the initiated.

In Greece, they studied also philosophy, mathematics and astronomy. «Daily, there were long discussions about the stars, planets and their movements» (DBG 6.14/6). It is also said, that they understood the movements of the stars and the planets (Pomp. Mela in Chorographia).

Timagenes (in Ammianus Marcellinus XV, 9) refers to their study of the free sciences and the secrets of nature and how they acknowledged Pythagoras as an expert and authority.

Hippolytus in Philosophumena I, XXV mentioned, how the celtic Druids studied enthusiastically Pythagoras'

philosophy. This opinion is also found in Clemens of Alexandria: Stromata I, XV, 71 when he writes, that he "studied the symbolic of Pythagoras from the Galater". So, it may be said, that the Druids were the direct intellectual and spiritual heirs of Pythagoras.

Caesar also mentioned: "The Druids were so highly esteemed and honored by the celts, that these priests in nearly all cultural, social and private disputes and conflicts had the last say in solving the differences and problems, emerging from various interpretations in cases of inheritance and/or boundary disputes. They also could set all fine sentences".

(DBG 6.13/ 4.5.6)

So it is clear that these Celtic priests undoubtedly must have known this old, forgotten and today "secret" system of landsurveying, the fixation of points along borders and the methods to split and divide the arable lands. This system can only be found in the correct use of the pentagon-dodecahedra as will be explained below.

3. Ancient Landsurveying with the Pentagon-Dodecahedra in the Sundgau-Area

The Pentagon-Dodecahedron is a geometrical body consisting of twelve five-cornered regular metal faces. Ten of these faces have drilled holes in the centre, each of variable diameter.

The last two faces -opposite to each other- have the largest holes and they are the only two of equal diameter. At each of the 20 corner points there is a small knob on a short stick.

In the two largest and equal wide openings at the right and left side of the dodecahedron one can put in a tenon of a little bit smaller diameter. In the centre

they are screwed in-side a square hollow section. Now the dodecahedron can be turned around this «semi-axis» and directing the line of sight horizontally, five times two round holes (one in front and one behind) rotate then in this line of sight. (Wear & tear is found just here in the dodecahedron of Besancon).

When winding a thin thread around the knobs all around the dodecahedron there are ten times little parallelogramms formatted in the centre of the holes; each of which gives the true direction of the line of sight. Repeating each foresight-reading five times (setting five staffs and then eliminating the four most eccentric positions) one can quite satisfactorily stake out a long straight line very exactly.

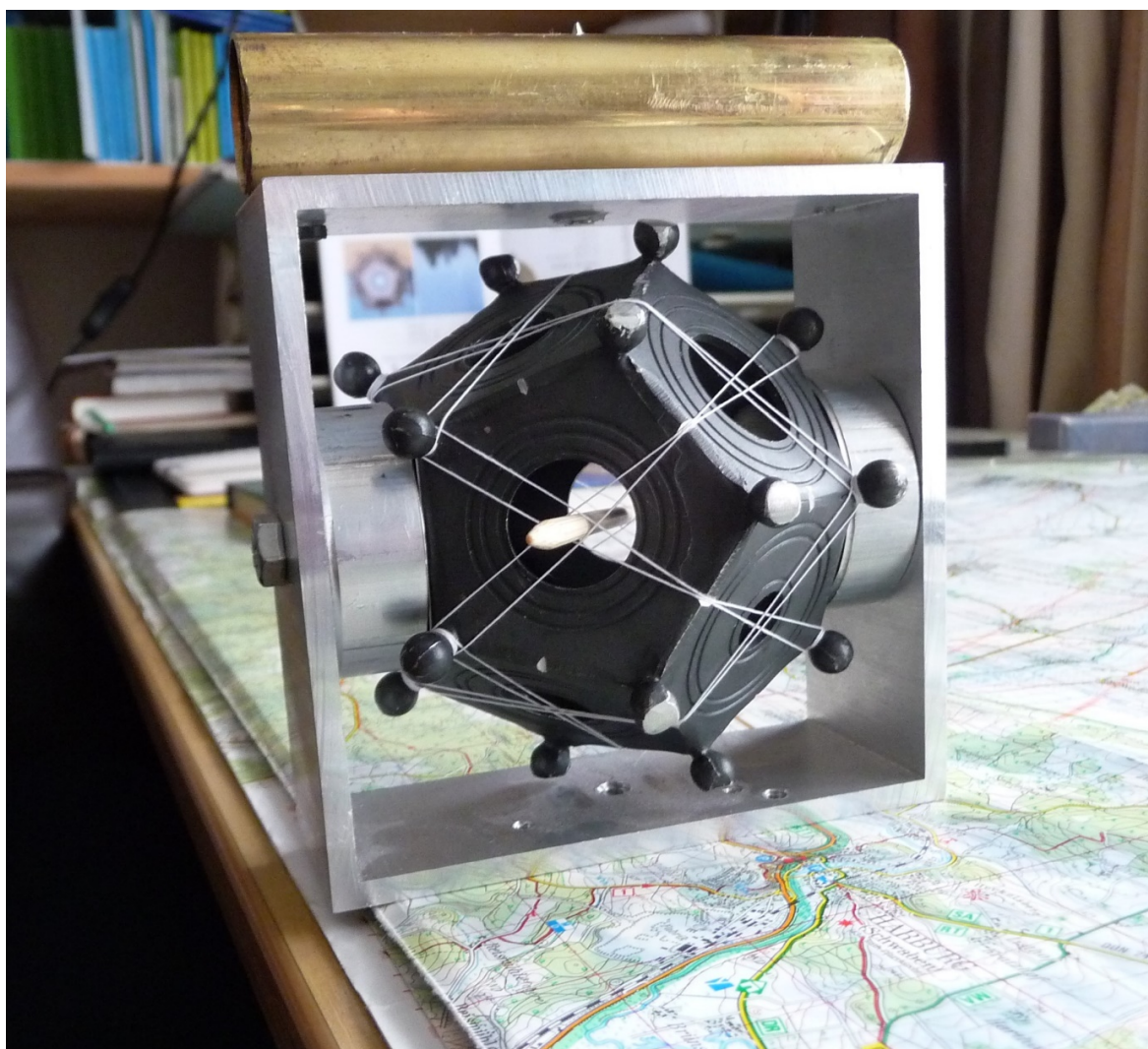


Fig. 2 Visible are here the two tenons fixed inside a square hollow section with a brass-tube fixed on top.

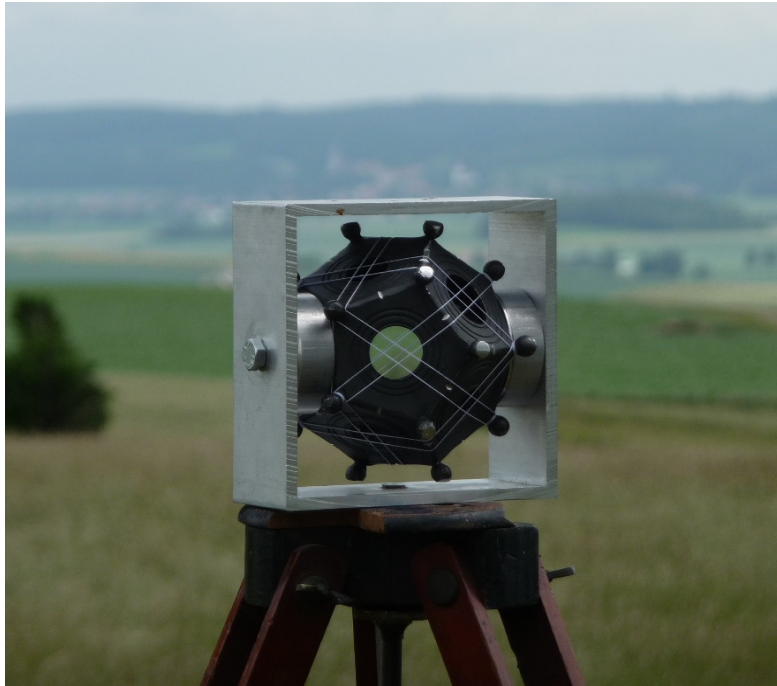
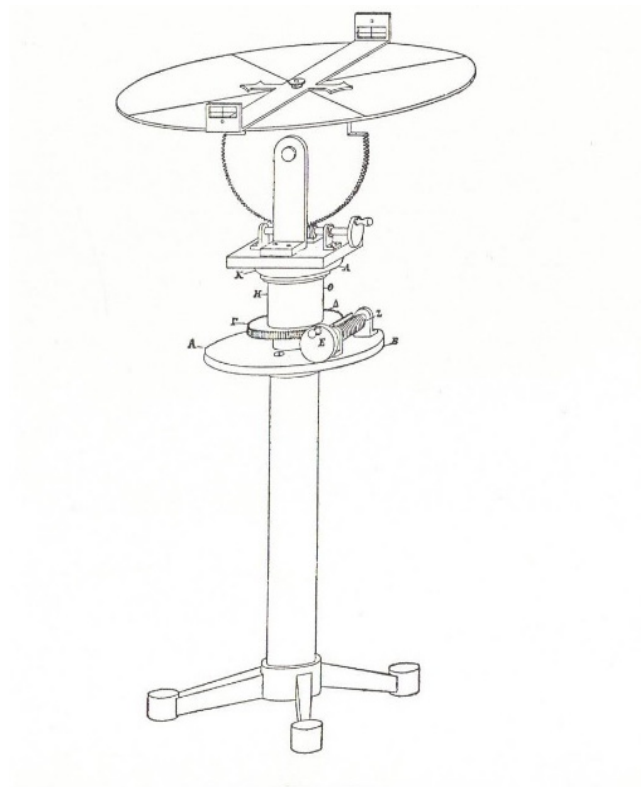


Fig. 3 Testing the dodecahedron on the fields of the Ries-Crater (Germany). A fix orientation N-S / E-W is not yet available.



Ein Dioptre als Stativ für das Pentagon Dodekaeder
nach der Beschreibung des Heron (Heronis Opera III)

Fig. 4 Schöne's reconstruction of the Dioptre as explained by Hero: Opera III.

Positioning is the only difficulty in those early days of surveying, some 2500 years ago, without “our” Polaris in the North. Then, only a night sky with very faint «polar stars» in Cameleopardalis is available.

Hence, Caesar is mentioning the frequent extensive discussions of the Celts during nighttime. (B.G.)

First of all, a handy «Heron-like» Dioptra-Tripod is necessary with an upper table to screw together with the square hollow section.

Also, a star- and direction-finding tube of brass has to be fixed on top of the square hollow section with two alternatives:

- 1: The axle of the star finder-tube is perpendicular to the rotation axle of the dodecahedron or;
- 2: The axle of the star finder-tube is parallel to the

rotation axle of the dodecahedron.

In both cases the centreline of the brass star finder-tube has to be lined up exactly in the same vertical plane as the dentated half-disk under the upper table. By night, this tube has then to be directed perfectly North to the “polar star” as precise as possible.

Position 1: Soon after sunrise the position of the upper table is now horizontalised.

The line-of-sight through the starfinder-tube looks now always true in northerly direction.

Observing from the right behind the square hollow section and by rotating the dodecahedron: five times the centres of two holes in the middle of the faces of the dodecahedron will appear in the eye of the land-surveyor to set posts in the direction: NNW at $26,565^\circ$.

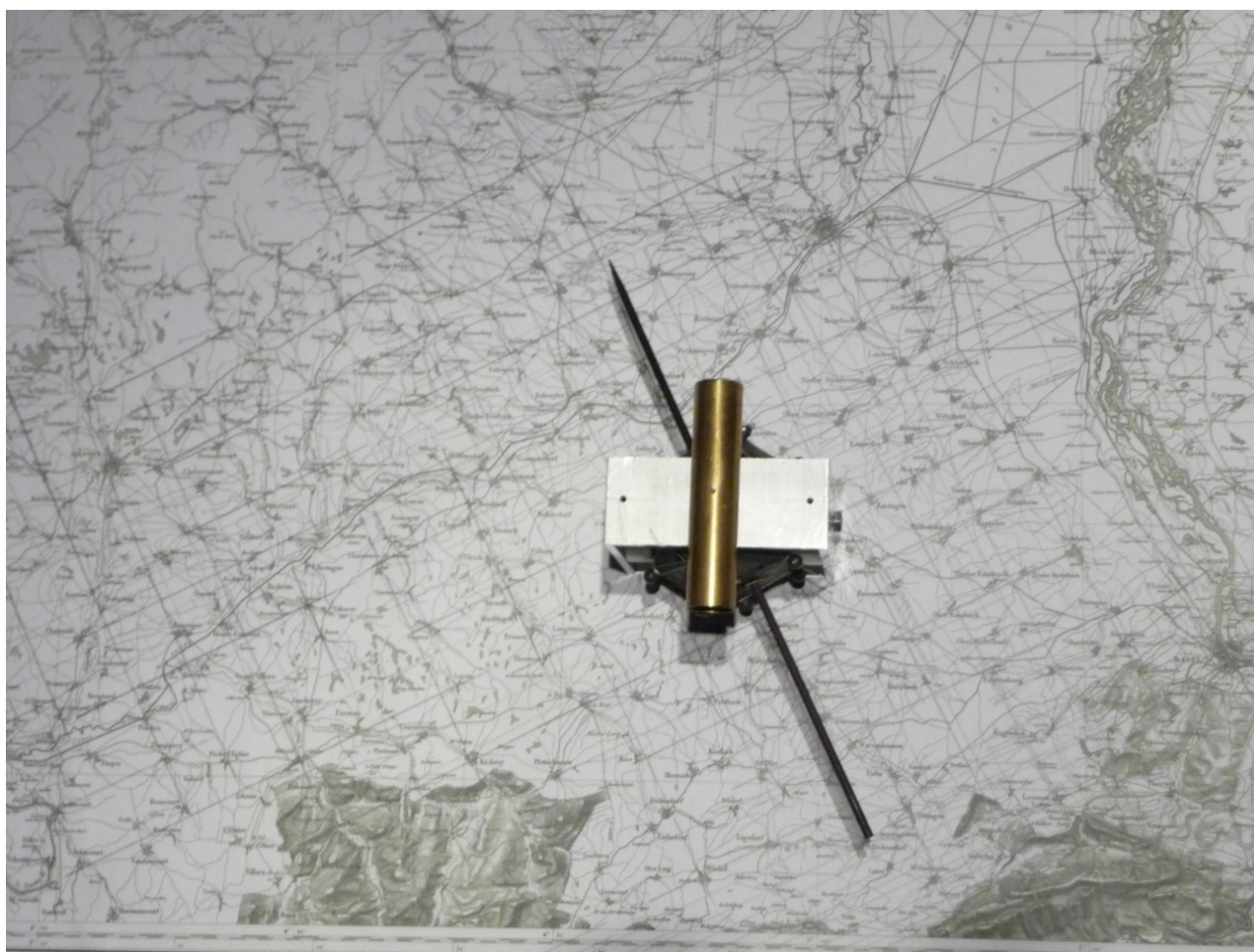


Fig. 5 Positioning the axle of the brass starfindertube perpendicular to the axis of rotation of the dodecahedron, will result in NNW- alignments of $26,565^\circ$ from N.

At last, the four most eccentric posts will be eliminated and the best one will remain.

This direction of foresight-reading is fix, unchangeable and typical for this art of surveying with dodecahedra.

As far as visibility is guaranteed, surveying of this main line can proceed. Otherwise a new station will be set out and after precise backside-reading the principle-line will guarantee further, correct geodetic surveying along this base-line in NNW-erly direction.

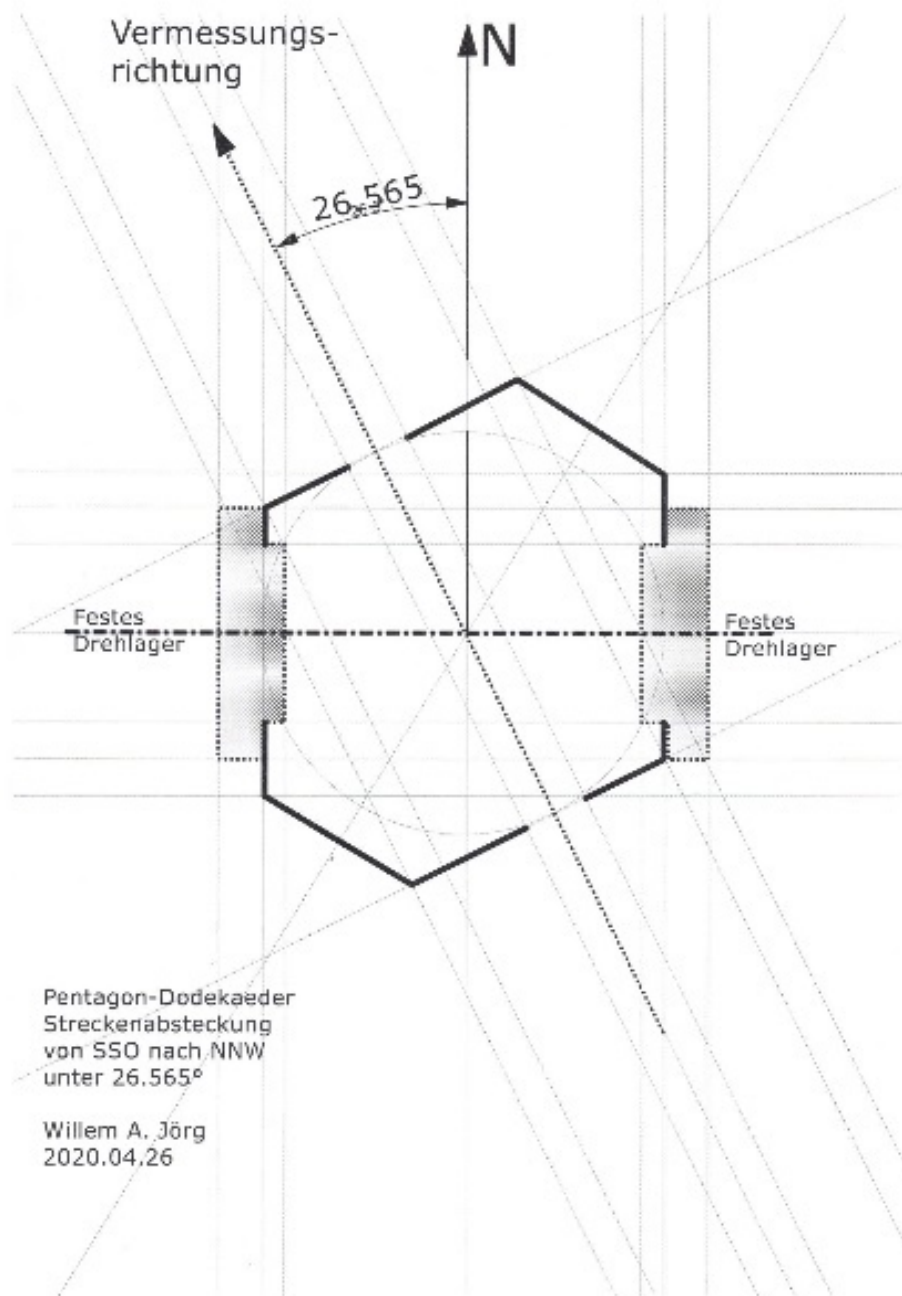


Fig. 6 Line of sight in the direction NNW under fix 26,565°.



Fig. 7 Positioning the axle of the starfinder-tube parallel to the axis of rotation of the dodecahedron will result in ENE-alignments of $63,435^\circ$ from N.

One or more stations behind the first surveyor, nr. 2 has also levelled his surveying instrument. His star-and direction-finding tube is also lined up true north, but observing from the left behind his dodecahedron he is setting out his line in a fix ENE-direction of $63,435^\circ$, in this way forming with his

partner nr.1 a perfect rectangular co-ordinated system.

And so on and so forth, week in, week out, year after year, maybe century after century, till the Sundgau-area from the river Rhine to some 100 kms to the west as a whole has been parcelled in a way, that is totally reconstructable today!

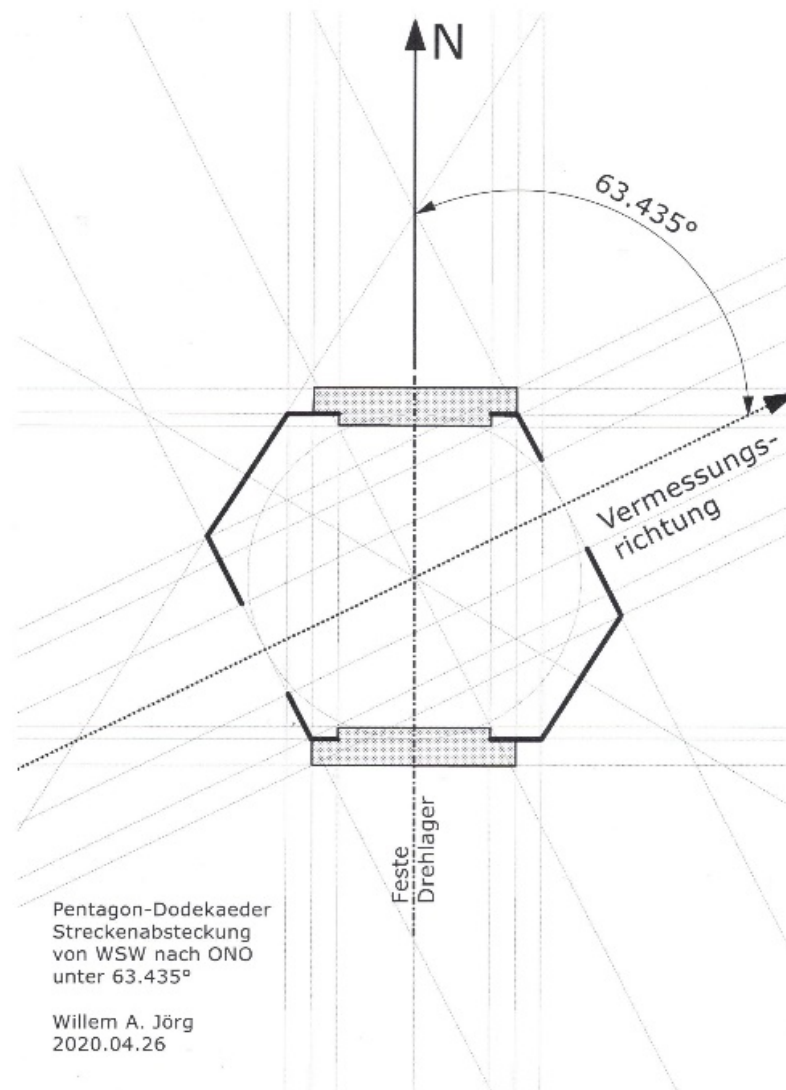


Fig. 8 Line of sight in the direction ENE under fix 63,435°.

4. The Geometrical Grid, Resulting from Ancient Landsurveying in the Sundgau-Area

The origin of this system we find in the hilly Jura environment some 25 kms SSE of the City of Basel. Here, the Bilsteinberg with an altitude of 1125 m. is visible from all directions.

From this height our base-line with 26,565° direction NNW, is crossing the hills of Gempen (760 m.; even today a Vista-Point), further over church and graveyard of Münchenstein to the “Pfalz” of Basel (today with a Cathedral here), situated high over the

river Rhine.

In the same direction further NNW we find an excavated old celtic settlement (“Fabrikstrasse” Basel) and at the end of this base-line the graveyard and chapel of the village of Rosenau just near the river Rhine. All points are perfect in the same straight direction.

Situated parallel to this base-line and with a few shorter, but mostly much longer lengths, we could rediscover some 90 lines parallel to this NNW-erly orientated main line within about 100 kms to the west. The origins of these lines -mostly in the south-eastern

area- are emerging from the tops of the Jura-Hills and ending frequently on the high tops of the Vosges, beginning north of Mulhouse and extending far west of Montbéliard.

5. Perpendicular to These Primary Axes; 88 Parallel Lines Were Also Discovered

Perpendicular to these primary axes; 88 parallel lines were also discovered and could be reconstructed; not only with their graveyards, oratories, chapels and churches etc., but also including hilltops, standing stones, sacred holy oaks, gallows hights, stèles etc. etc.

Here, directions are also $63,435^\circ$ ENE and $243,435^\circ$ from North pointing to the South-West.

Situated in the rectangle from Basle/Ottmarsheim to Lure/Gubrial -some 30 kms west of Montbéliard-, about 475 villages can be found.

The number of villages with chapels and/or churches is about 375.

Today, surveying with the dodecahedron, we can rediscover exactly, how these ancient centres for worshippers are mostly situated just on these resurfaced border-lines.

Today graveyards can be found here, next to 160 of these chapels and churches.

Still another 155 graveyards are situated farther away and may be from later times.

Sixty villages don't have graveyards.

In the Sundgau-area (Basle/Ottmarsheim - Lure/Gubrial) at least of 140 churches, chapels, graveyards, holy oaks and stèles can be found, situated exactly on the points of intersection of the

newly-discovered celtian surveying lines: SSE NNW and ENE WSW.

This is an amount of 30% of all nowadays inhabited cities and villages in this region.

Surveying this way, i.e. with this now rediscovered system of axis, it may be said, that a total of some 500 objects such as chapels, churches, cemeteries, wayside shrines, crosses in woods and meadows, holy oaks, hill-tops, ancient sites of bridges and community-borders, have got attention in the hypothesis of this system of celtic landsurveying.

All coordinates of these objects were determined from topographical maps 1:50'000 resp. 1:25'000, then using these data for calculating the directions to each other.

Straight mean value of the angle in NNW-erly direction from surveying 87 axes is $26,710^\circ$ (required is: $26,565^\circ$). With only $0,146^\circ$ difference, this is in very good correspondence.

The mean-difference using the RMS (RootMeanSquare) Method is $0,520^\circ$ and the Standard-Deviation is $0,538^\circ$, which is also clearly within tolerance.

Straight mean value of the angle in ENE-erly direction from surveyings 88 axes is $63,725^\circ$ (required is: $63,435^\circ$). With $0,285^\circ$ difference, this is also in good correspondence.

The mean-difference using the RMS (RootMeanSquare) Method is $0,485^\circ$ and the Standard-Deviation is $0,399^\circ$, which is also clearly within tolerance.

The total length of all 175 reconstructed lines 1 – 87 and A – J4 (88) is over 4600 kms.



Fig 9 Result of Celtic landsurveying in the Sundgau-Area (eastern part) between the cities of Montbéliard (below left), Belfort (in the middle left), Mulhouse (upper right) and Basel (below right) on map Dufour of 1850.

All considerations and reflexions mentioned above and the results of the over 175 calculations of the directions of all axis lead to the conclusion, that the Sundgau area already in the pre-roman Celtic period must have been surveyed during many centuries.

Here, in the Sundgau area, one can find back 1:1 the knowledge, following the early evolution of the Greek pythagorean mathematics. Very special is the early use of the dodecahedron and the application of the long-hidden mathematics for land-surveying, which one can find again in today's situation of lined-up chapels, churches, graveyards in many cities and villages plus many holy oaks, hillside tops, site of bridges and borderlines still existing between them.

After the conquest of the Roman Empire, installing their east-west / north-south orientation, the Celtic system waned and disappeared more and more with

the ages. But some very faint knowledge of an initial different system of border-lines may have survived as one looks today at the layouts of some city-districts in Mulhouse (Franklin/Fridolin) and Héricourt (Cité Dollfus).

It is in this way, that the author of the thesis above i.e. the use of the mysterious dodecahedra in surveying the Sundgau area, may have lifted the veil of the Pythagorean mathematics a bit.

Map page 1: © Mairdumont, Osterfildern: Authorisation pending.

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