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Author:
Nick Doe, 1787 El Verano Drive, Gabriola, BC, Canada V0R 1X6
Phone: 250-247-7858, FAX: 250-247-7859
E-mail: nickdoe@island.net

# Observing the winter solstice at DgRw 228

by Nick Doe

The supposition that the petroglyph at DgRw 228 is a calendar and was used to observe the altitude of the sun at the summer solstice[1] inevitably leads to a follow-up question. Was it also used to observe the sun at the winter solstice? The answer, for the benefit of those readers who can't wait, is somewhere between quite possibly and probably. But what came as a complete surprise to me is that the search for evidence of this also provided an explanation of how the calendar designer coped with the need for intercalation days—those 5¼ days that you need to add to the 360 days in a year made up of nine "months" of forty days.

The steps the new research followed were to first calculate where exactly one would have to stand in order to be able to see the reflection of the sun in the rain-filled central bowl of the petroglyph at noon on the day of the winter solstice. The second step was to get Jenni (who's 5 ft. 2 in. and who did the summer solstice experiment) to go and check it out. This was a success.[2] She had to stand exactly where we figured she would (without prompting).

The final step was to see if there were any markings to identify this spot—ideally, of course, there would be a wonderful petroglyph there. The final step turned out to be a two-stage process because we did not want to disturb too much the extensive mats of moss and organic matter around her feet, even though the area had clearly been severely disturbed before—we were standing right by a heap of old logging debris. So we lifted a small patch and marked the spot and returned in the late summer the following year when the moss and other bryophytes had dried out and were no longer adhering to the rock. It was then possible to lift the cover and return it without doing it any damage.

In the winter, exactly beneath her feet, we found a small groove in a natural fracture of the rock, but as you can see from the photograph, although highly suspicious, it was impossible to be absolutely sure that this was not a natural feature of the sandstone. There was also the worrying problem that it wasn't very big and so could easily have been "lost" if looked for by someone who was not very familiar with its position.

A return in the late-summer armed with several bottles of water to improve the visibility of grooves in the rock revealed a second "depression". This was bigger than the first and had the form of a bowl. In winter, this bowl would be filled with rainwater running down along the line of the fracture making it quite conspicuous. Again though, there was a problem. This bowl was

[1] Nick Doe, *A most unusual petroglyph*, *SHALE* 10, pp.25–32, 2005.

[2] How far away you have to stand depends on how tall you are and how much the ground slopes. For a summer solar altitude of 64°18' and a winter altitude of 17°25' and a downhill slope to the north of 5°, the geometry says that the ratio of how far away from the centre of the pool you have to stand in winter to how far away in summer is 5.397 (regardless of your height). The tip of the north pointing "petal" is 0.70 m from the centre of the pool and that is where Jenni needed to stand in summer. So in theory, she would have to stand 3.78 metres away from the centre in winter. We actually measured 3.10 metres from the tip of the petal, which is 3.80 metres from the centre. Within an inch of being exactly right.

0.34 m (just over a foot) closer to the petroglyph than the first mark. While this is “only” 9% of the total distance from the main glyph, it nevertheless constitutes a huge observational “error” if, as seems likely, the first mark is correctly positioned.

Ancient Gabriolan tradition? At noon, stand with your toes against this stick and look at the pool of rainwater in the middle of the petroglyph (arrow). If the sun’s reflection’s in your eyes —Jenni’s shielding hers, so we know it is—then it’s the day of the winter solstice. On every other day of the year, you can’t see the sun unless you move closer.

What then could the second mark have been used for? Well, consider this. If you stand at this second mark, then you will see the sun’s reflection in the central bowl at noon on only two days of the year. One day some time shortly before December 21,[3] and the other, some time shortly after. To be precise, on November 29 and January 13—a period of 45 days.[4] These are close to the two dates that are “missing” from the petroglyph. Forty days after October 19 is November 28;[5] and forty days before February 21 is January 10.[6]

The winter solstice mark. Jenni is standing where she can see the reflection of the sun at noon in mid-winter at DgRw 224. Her boot is 10 inches long. The water-filled hollow is in a natural fracture in the sandstone that on a larger scale runs about N15°E.

Here then is how it could have worked. Start from the position of the summer solstice, carefully observed (on June 21, say). The designer then counted 40 days to the end of the <u>first</u> “month” after solstice (July 31). Then to 80 days at the end of the <u>second</u> month after solstice (September 10). And again to 120 days at the end of the <u>third</u> month after solstice (October 19). Here the pattern was broken. A count was made of another 40 days to bring the total to 160 days, but the actual end of this <u>fourth</u> month was established by observing the sun from the second mark (approximately November 28). About 23 days later (give or take a day), the winter solstice was observed

[3] All the modern dates in this article are plus or minus a day depending on where you are in our four-year, leap-year cycle.

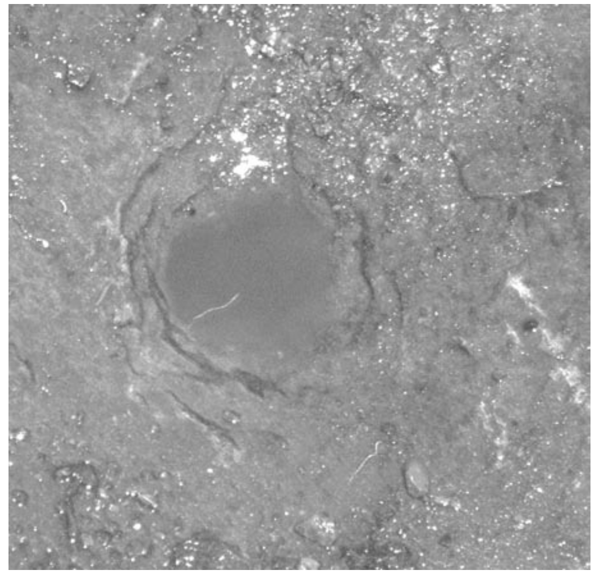
[4] The measured distance from the centre of the glyph was 3.80–0.34=3.46 m. This puts the sun’s altitude at 19º22' (allowing for a 5º dip to the north) and its declination at 21º29' S; hence the dates.

[5] I said Jun.21-Aug.01-Sep.10-Oct.21 in the *SHALE* 10 article, but this is a mistake. I should have said Jun.21-Jul.31-Sep.09-Oct.19.

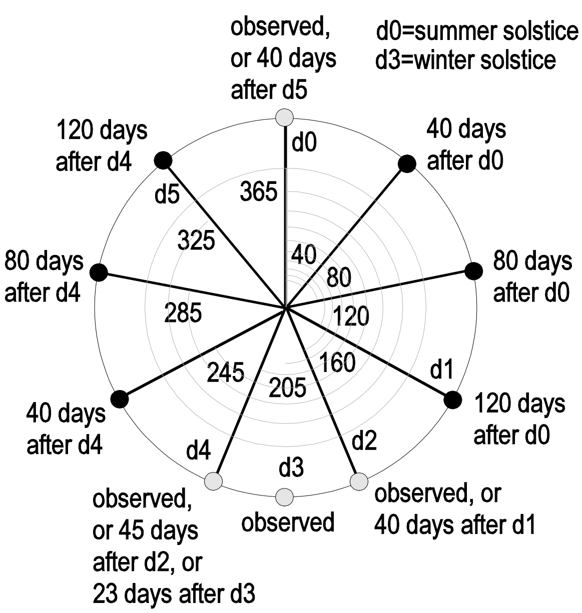
[6] I said Feb.20-Apr.01-May 11-Jun.21 in the *SHALE* 10 article, but this is a mistake. I should have said Feb.21-Apr.02-May 12-Jun.21.

(December 21, say). The half-year thus comprised a total of around 183 days. After another 22 days,[7] the sun was again observed from the second mark. This is the end of the <u>fifth</u> month (January 12, say). From then on it was a matter of simply counting off the 40-day months until the summer solstice—40 more to the end of the <u>sixth</u> month (February 21); 80 days to the end of the <u>seventh</u> (April 2); 120 days to the end of the <u>eighth</u> (May 12); and finally 160 days to the summer solstice (June 21) at the end of the <u>ninth</u> month. The flexibility in the duration of the fifth month allowed for a several-day correction to make the average, over time, of the complete cycle 365¼ days, exactly as we reckon today. This might be why the petals corresponding to the start and finish of the fifth month were never carved.

One of the added attractions of this method was that there were four opportunities each year to calibrate the calendar against the position of the sun compared to only one if only the summer solstice was used. This greatly reduced the risk of not being able to calibrate the calendar because of cloud cover. All the designer did was count days until he was within a couple of days of one of the calibration days, and then either he observed and adjusted his count as necessary, or, if it were cloudy, carried on



The second mark is a small bowl 3.46 m from the central bowl and directly north of it, about 10 cm (4 inches) in diameter. It too has a (sealed) fracture running directly through it. It is in exactly the right position to define an extra-long “month” of 45 days in mid-winter.



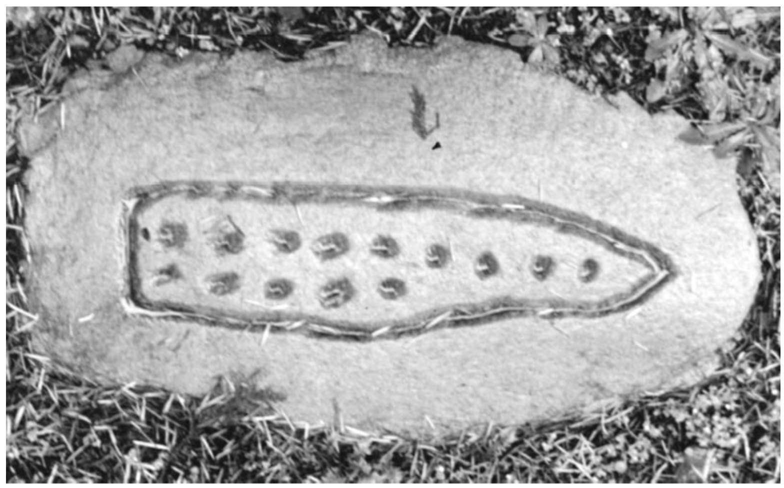

The petroglyph designer’s year was divided into three “seasons” of nominally 120 days. Each of the three seasons was divided into three “months” of nominally 40 days. To keep the calendar synchronized with the sun, one of the months, the midwinter “month”, was allowed to have an extra 5 or 6 days.

d0 at the top of the chart on the *left* corresponds to the summer solstice. Move around the circle clockwise to complete an annual cycle. d3 corresponds to the the winter solstice. If the sun was unobservable on critical days (the ones in grey), the designer just kept on counting. Eventually, an observation would be possible and the count would be in sync with the sun again.

[7] The earth moves relative to the sun slightly faster in January than November because it is closer to perihelion in its slightly elliptical orbit.

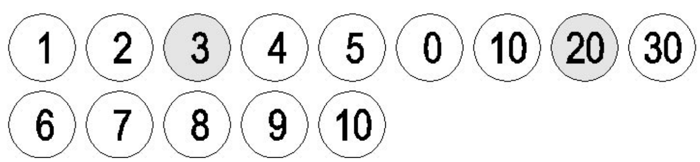
counting until the next calibration day.

One of the several interesting offshoots of this research is that it provides some evidence that in prehistoric times there was a winter presence on Gabriola. It certainly makes sense to me that in times of higher populations, there would have been a permanent winter-village on the island.[8] ◊



The pictures, *right*, show a petroglyph at DgRw 24 and its museum replica. It just might be that this was used to count the 40 days in a month. The principle would be to use two small pebbles, one which moves along "pits" 1→2→3→4→5 and then 6→7→8→9→10 (or it might have saw-toothed 1↓6↑2↓7... etc.), while the other moves 0→10→20→30, one move being made every time the first pebble moves from 10 back to 1. The shading illustrates day 23 in a 40-day count.

I have no evidence that this is how the glyph was used other than it fits nicely with the calendar at DgRw 228.




Totally crazy numerologists will also point out that since there are nine pits in the top row, you could use a third pebble to keep track of nine 40-day months in a year. Having completed the 9 × 40 = 360-day count, you could then use the bottom row to count off the extra 5 days to make 365. *Right*, a Mary Bentley rubbing of a glyph at DgRw-193. It only has 12 "teeth", but you could still use it to count to 40 (1→8, and 8→16→24→32). Us fanatics never give up.

Mary & Ted Bentley, *Gabriola: Petroglyph Island*, p.79, 1998 ed.

[8] I remember reading somewhere that more objects used in winter ceremonies have been found on Gabriola than on some Nanaimo winter-village sites.