Context:
Archaeology, petroglyphs, Gabriola

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Doe, N.A., Petroglyphs and equinoxes, *SHALE* 14, pp.10–14, September 2006.

Errors and omissions:

This original article puts too much emphasis on the use of tall trees for monitoring the movements of the sun. Their shadows would have often exceeded the bounds of a typical forest clearing. Much more likely is that something less tall was used, possibly a sapling, but more flexible yet a human figure, probably that of one of the observers. The location would have had to have been where the sun was still observable even though below the horizon defined by the tops of surrounding trees, but Douglas-fir, the most common tree around has the habit of dropping its lower limbs when in a crowded stand thereby allowing shafts of sunlight to filter through between the long clear trunks.

Later references:
SHALE 17, special issue on petroglyphs. See *SHALE* index for more.

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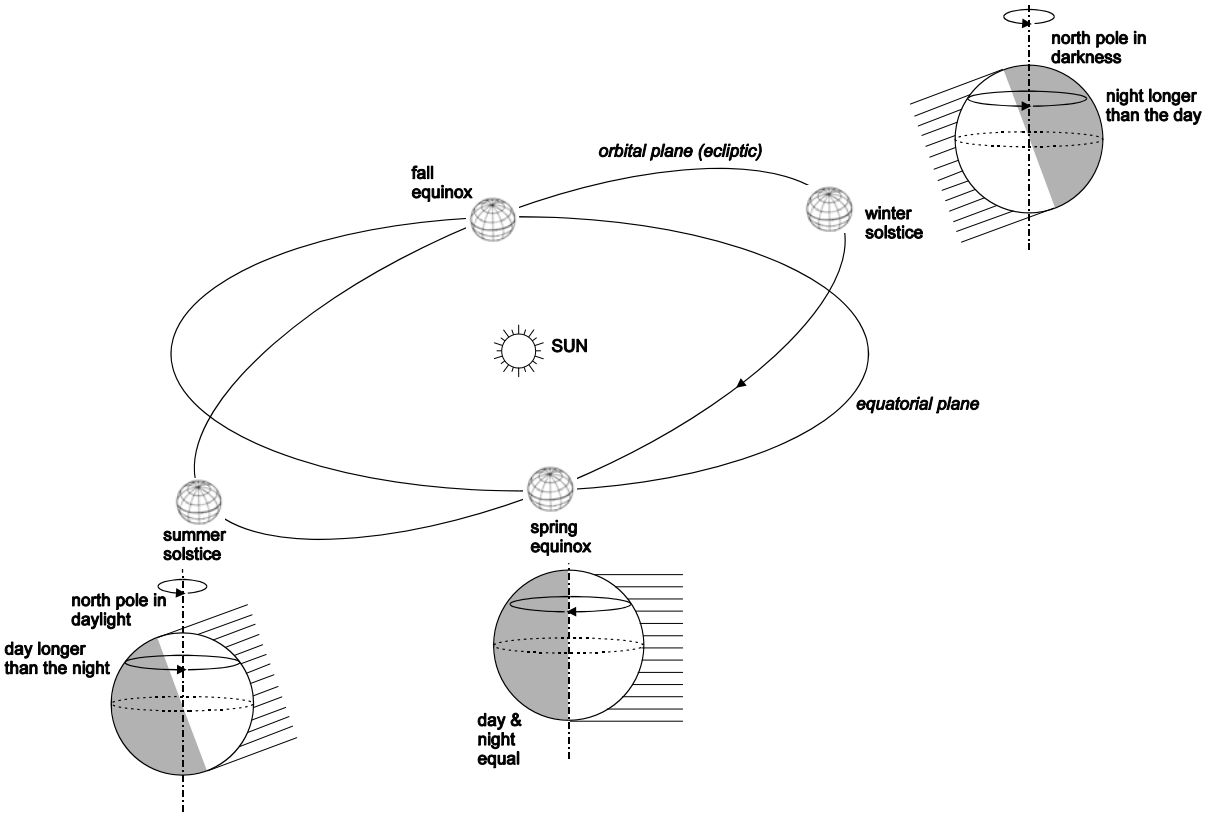
Petroglyphs and equinoxes

by Nick Doe

It seems possible that the orientations of at least a few of the petroglyphs on Gabriola are related to the movement of the sun, and possibly the stars, which raises the question, how, in a forest, do you know which is north, south, east, and west? One possible answer was, for me, quite a surprise, and doesn't involve the North Star.

The axis of the earth's annual rotation around the sun is tilted 23½ degrees to the earth's polar axis.[1] The direction of this tilt, relative to the stars, varies very little, so for half the year, the sun is directly overhead somewhere north of the equator, reaching its most northerly latitude—the Tropic of Cancer—at the summer solstice, and for the other half, it is directly overhead somewhere south of the equator, reaching its most southerly latitude—the Tropic of Capricorn—at the winter solstice.

The spring, or vernal equinox, which occurs every year on March 20 (±1 day), is one of the two days in the year when the sun is directly above the equator. The sun on that day rises exactly in the east and sets exactly in the west. On the day of the equinox, no



[1] Both the magnitude and direction of the tilt vary very slowly, which is one of the many factors that control very-long-term global climate changes.

matter where in the world you are,[2] the hours of daylight—twelve—exactly equal the hours of darkness. The spring equinox marks the end of winter, because, in our half of the world, thereafter the sun rises north of east and sets north of west; is higher at noon than the annual average; and there is more daylight than there is night-time darkness.

The fall or autumnal equinox, which occurs every year on September 22 (±1 day), is again a day on which the sun rises in the east and sets in the west; and again there are twelve hours of daylight and twelve of darkness. The fall equinox marks the end of summer, because thereafter the sun rises south of east and sets south of west; and, until the winter solstice in mid-December, the days become increasingly shorter, and the nights increasingly longer.

Now if you were living in the midst of a forest, as many readers might be, how would you determine, in the absence of a calendar, which days were the days of the equinoxes? Being surrounded by tall trees makes it impossible to see exactly where, and when, the sun rises above the horizon in the morning, and where, and when, it sets in the evening. How can you know it rose in the east; and how can you know that the hours of daylight are the same as the hours of darkness if you live among shadows?

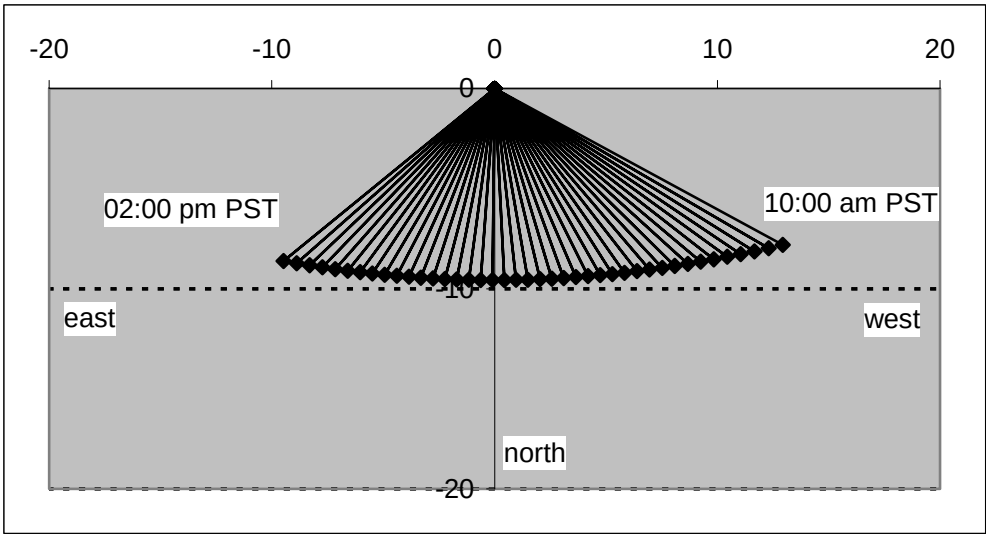
Until recently, I thought, as probably you do, that being surrounded with trees would make it impossible to make observations of the movement of the sun with the same precision that observers at sea, or in the desert, or in some other tree-less terrain are able to do. It took the petroglyph carvers of Gabriola to teach me that this just isn't so. They were rainforest astronomers. And a rainforest astronomer will tell you that the equinoxes are the days on which the shadows of the tops of tall trees move in a perfectly straight line.

The ***upper diagram*** on the next page shows the movement of the shadow on the ground of a tall tree (20m, about 65 ft.) on Gabriola, looking south, from 10 o'clock in the morning to 2 o'clock in the afternoon at the height of summer. The sun rises in the northeast, so the morning shadow is in the southwest (the *top-right corner* of the diagram); and the sun sets in the northwest, so the afternoon shadow is in the southeast (the *top-left corner* of the diagram)—remember we're facing south with our back to the north. The mid-summer sun is high in the sky and so the shadows are short (the scales on the ground are in metres).

Contrast this with the ***lower diagram*** on the next page, which shows the movement of the shadow on the ground of the same tree, looking south, from 10 o'clock in the morning to 2 o'clock in the afternoon, but this time at the depth of winter. The sun rises in the southeast, so the morning shadow is in the northwest (the *bottom-right corner* of the diagram); and the sun sets in the southwest, so the afternoon shadow is in the northeast (the *bottom-left corner* of the diagram). The mid-winter sun is low in the sky and so the shadows are much longer than in summer (note the different scales of the diagrams).

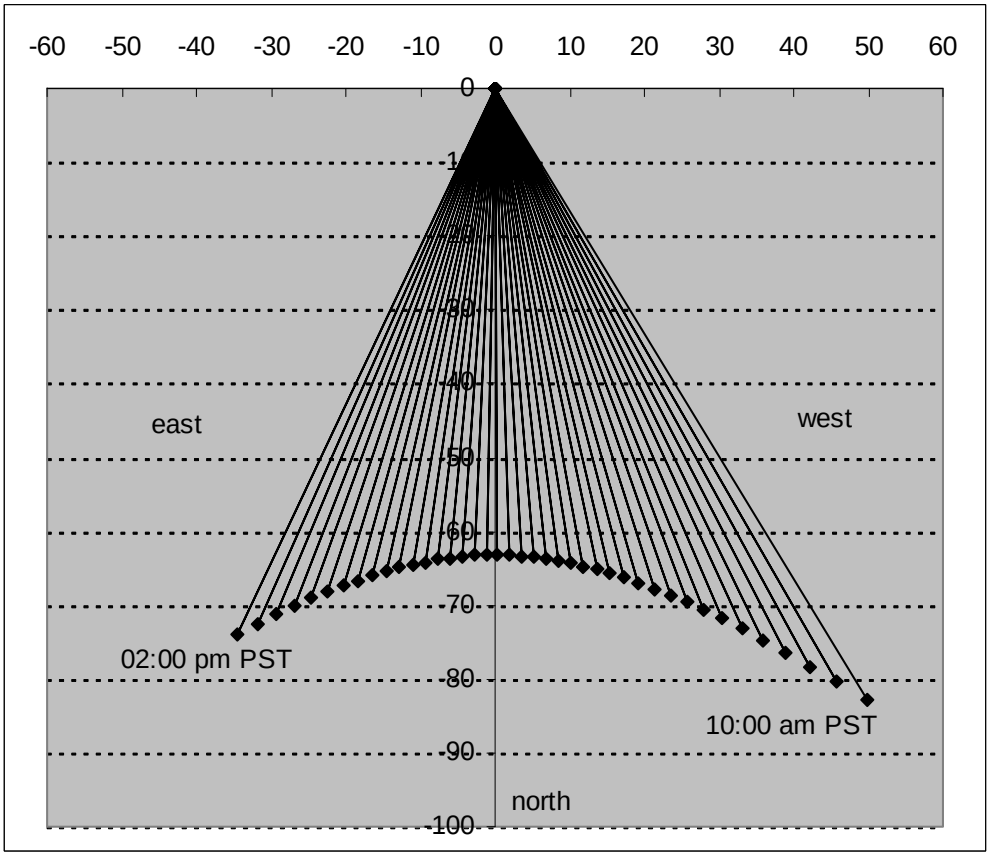
One of the several interesting things about these patterns of shadows, is that, by placing pebbles on the tip of the shadow as the sun

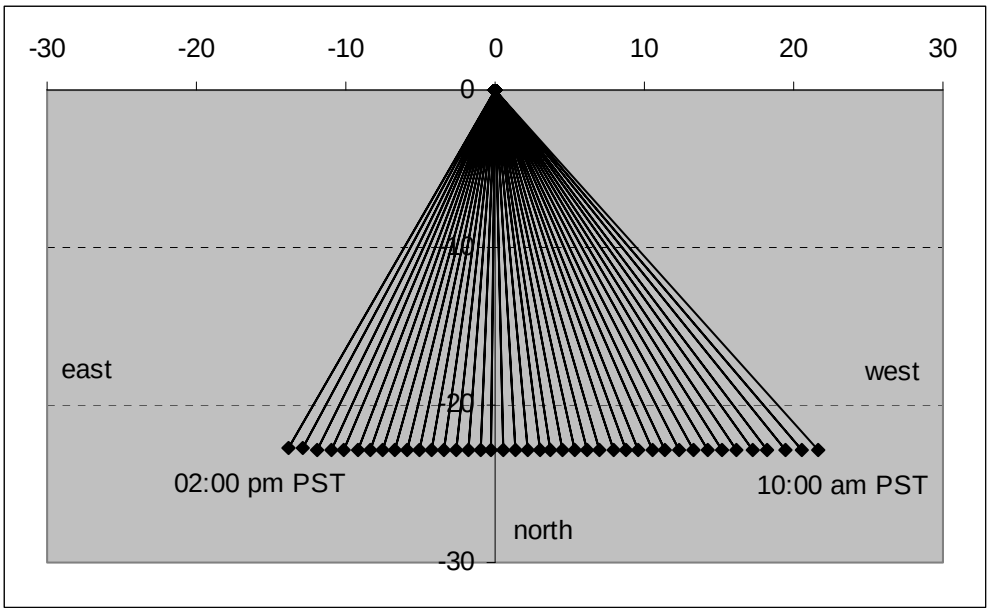
[2] Except of course at the poles. At both poles, the sun does a 360º circuit around the horizon with half of its disc above the horizon and half below it.



Above: Movement of the shadow of a 20-metre tall tree on Gabriola on mid-summer's day.

Below: Movement of the shadow of the same tree on mid-winter's day (*scale change*).





Above: Movement of the shadow of the same tree on the day of the equinox (*scale change*).

moves through the sky, you could tell whether it was winter or summer, even in the middle of a forest. In summer, the track of the shadow wraps around the tree at noon; in winter it moves away from it. And at the equinoxes? It does neither and moves in a perfectly straight line as you can see above.

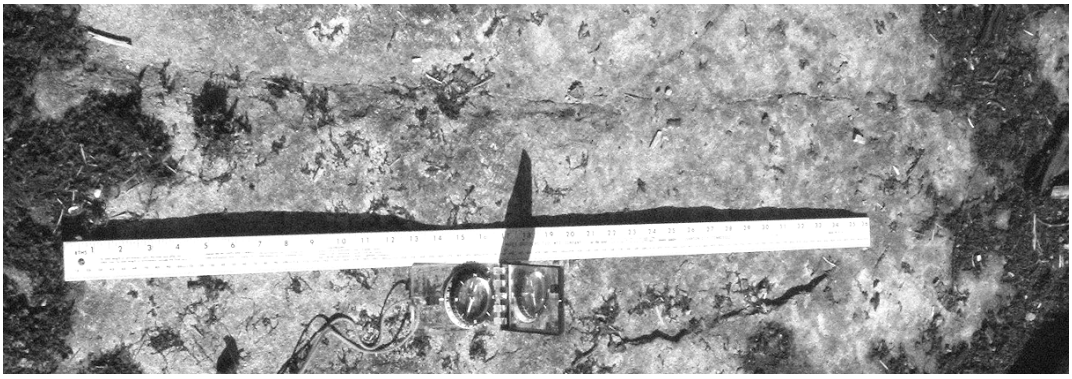
Can you orient yourself this way? You bet you can. One day in March last year, it took me not more than half an hour to lay out pebbles in an east-west line as well aligned as anything I could do with my magnetic compass.

Now, of course, the question is, is that what the petroglyph carvers did? I have a hunch that they did based on two observations.

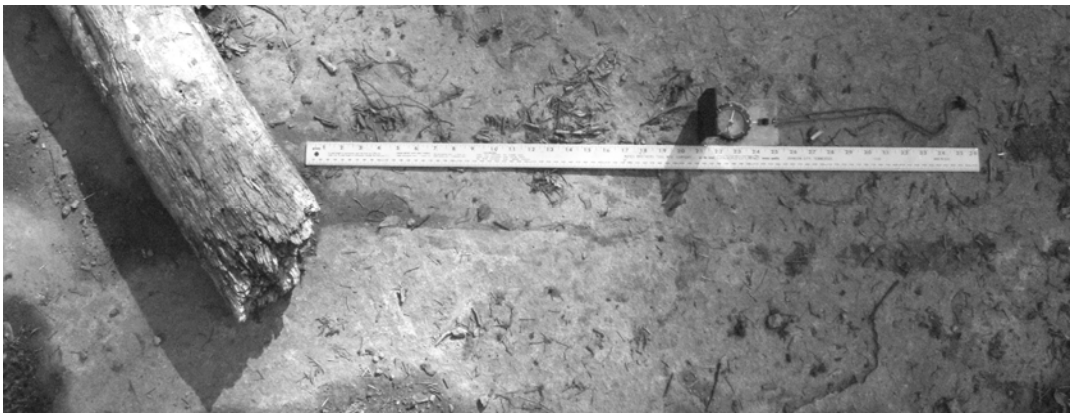
The first is that carved lines in Gabriola's petroglyphs that run exactly east-west are more common than lines that run exactly north-south. The second observation is that the lines that are carved north-south are generally less accurately oriented (assuming that that was the carver's intent) than those carved east-west.

I'll close now with a few pictures of astronomically aligned petroglyph lines, but these are possibly only a fraction of those that exist. In my own work to date, I have looked at only eight petroglyph sites on the Island in detail,[3] and, unfortunately, none of the site records nor any of the Gabriola Museum reproductions for the remainder contain sufficient information to be able to say if these are unique. I suspect that they aren't. At six of the eight sites, I was able to detect signs that the carvings had significant astronomical alignments. I'll have more to say about these in future articles. ◊

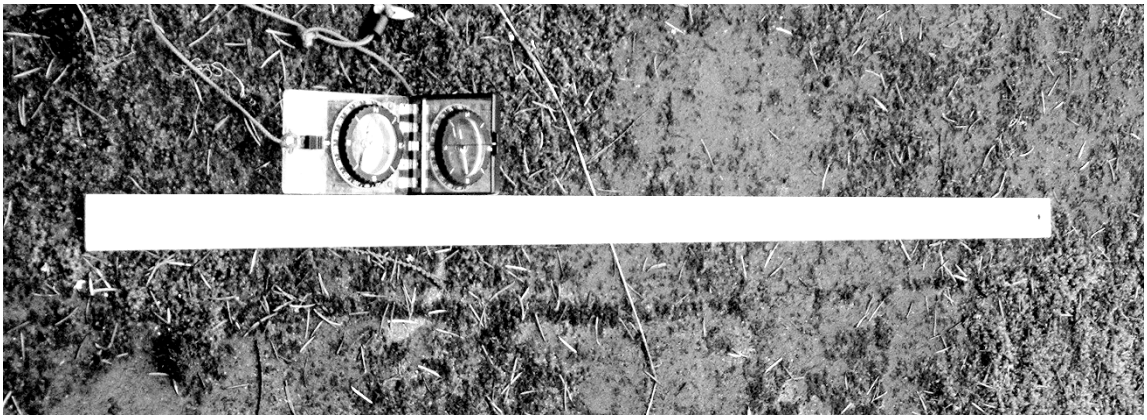
[3] DgRw193 (Boulton), DgRw198 (Stokes Road), DgRw201 (Lobo Spring), DgRw224 (Church outlier), DgRw228 (Kensington), DgRw229 (Kensington), DgRw230 (Kensington), and DgRw234 (Church outlier).



Above: DgRw 228. The shallow but unmistakable line above the scale runs from west (*left* but *bottom* of the original photograph) to east (*right*). The 36-inch aluminum scale is set exactly east-west. The petroglyphs at this site appear to have significant astronomical alignments.



Above: DgRw 229. This line below the scale seems not to be an integral part of the other petroglyphs at this site but it runs very closely east-west. The petroglyphs have sigificant astronomical alignments.



Above: DgRw 193. The moss-filled pecked line below the scale also seems not to be an integral part of the other petroglyphs at this site but it too runs very closely east-west. *Left* is the *bottom* of the original photograph.