THE VORTEX OF LIFE

SUPPLEMENT AND SEQUEL

VOL 2

LAWRENCE EDWARDS
The Phase-shift

We start this second volume of the Supplement and Sequel by bringing the history of the Phase-shift up to date (Summer 1994).

Volume I had taken the story up to summer 1992, by which time the phase-shift had progressed to -6 days, and two Oaks on which I was able to do short series in November and December seemed to be still re-acting with this phase-shift (page 2). However during that same Autumn three Beech trees in Strontian were clearly re-acting with phase-shift of 17 days, as was also a Beech near Stroud, (pages 3, 4 and 5). And in the following Spring and early Summer of 1993 we find the Primroses and Buttercups showing a shift of +6 days (pages 6 and 7). On page 8 we see the graph for the Geraniums. The arrows on this have been placed at a shift of +6 days but this is hardly meaningful. Mars was in alignment with Saturn at that time and this species was not re-acting to the alignments at all. The numbers on the top of the graph show the degrees which separated these two planets from day to day. We could equally well have placed these arrows at +5 days, and indeed only a few weeks later we find the Knapweed doing just this (page 9).

If we now examine the graphs for the Birch, Sycamore, Cherry and Oak for the Autumn of 1993 (pages 36, 43, 48, 72 and 78) ! we find they all agree with a phase-shift of +4 days, while the rest of the graphs in this book, for Spring 1994, are unanimous in requiring a phase-shift of about +3 days.

All these values have been added to the Phase-shift Chart printed on page 10 and this brings the matter up to the date of writing. We see that the general form and trend of this chart has been preserved, but the fact that the rate of change has increased in recent years is also confirmed. Whereas in the early part of the chart the length of the phase-shift cycle appears to be almost exactly seven years, this length of time now seems to be nearer six years than seven. We know that we can hardly ever find an exact figure for an astronomical periodicity. The best we can do is to find an exact figure for the mean periodicity and then watch the actual figure as it varies slowly just below and above that mean figure. It would seem probable that we have a similar phenomenon here. Whether the mean figure will in the end turn out at more than, less than, or maybe exactly, seven years is something that cannot be determined until we have many more years of observation behind us.

This matter of the changing phase-shift is a very strange one and I am beginning to think that the most truthful way to view it is as follows. There in the heavens we have the rhythm of the lunar/planetary alignments, and here on earth we have the rhythm of the A's of the plants, and these two proceed with close correlation in parallel; but the stream of time carrying the plants tends from time to time to move a little faster than the heaven-born one, although their speeds of movement tend to become equal approximately once every seven years. We have no evidence at the moment that this phenomenon affects any other purely astronomical relationships.
Two OAKS Strontian 1992
The Aggregate Graph

A very useful way to consider the results of many bud measurements is to put them on an Aggregate Graph (A-Graph for short). To make an aggregate graph for the Beech buds with regard to Saturn, we consider the interval of time between one alignment of Moon and Saturn, and the next such alignment, and we call this one Saturn-cycle. The actual day of the alignment we call Day-1 of the cycle, and the following days, Day-2, Day-3, etc. Clearly the last day of the cycle will be Day-14, and the 15th day will be Day-1 of the new cycle. We now plot on our graph, for each cycle-day the mean of all measurements we have made on that day of the cycle, usually over an extended period of time. Our graph then shows us the average behaviour of the species Beech with respect to Saturn over that period.

We then say that we have aggregated our Beech observations over the Saturn-cycle or, for short, that we have aggregated Beech over Saturn. When discussing these A-graphs we will in future write Day with a capital D when we mean a cycle-day, and day with a small d when we are referring to a day of the week or the month.

If the observations we are aggregating extend over several years, as will normally be the case, when calculating which Day a particular observation belongs to, we must obviously take into account the current phase-shift, otherwise the changing phase-shifts through the years will 'fight' and the results will be rendered invalid. In fact the technique of ignoring the changing phase-shift is a useful one for getting random results from which the standard deviation of a given set of observations can be determined, a matter which can be of considerable importance.

The top graph on page 12 shows the result of aggregating 8 years of Beech observations over the Saturn-cycle. It represents the best possible picture we can get of the average behaviour of this species during that time. The first thing to note is that in its general form it is just what we would expect from our experience through the years, although the amplitude of the variation—only about .13—is rather less; this is because the rule in making an A-graph is that ALL the observations made during the period under review must be included, and some of these will have been taken at a time when Saturn was aligned with Mars or some other body, and normal rhythms will have been inhibited. We note the beautiful consistency and smoothness with which the points lie on their curve, due to the fact that this represents the averaged essence of so many thousands of sets of measurements. An unexpected feature is the slight but very definite asymmetry which this curve displays, a feature which would probably have lain long unnoticed without the use of this aggregative technique. The difference in height between, say, Day-3 and its corresponding point at the other end of the curve is nearly twice as large as the standard deviation of these figures, suggesting that this asymmetry might be a matter of significance with a small degree of probability.
A moment's thought shows us that there is no necessity for these Beech observations to be aggregated over the Saturn-cycle. They obviously could have been treated similarly to the cycle of any other planet, but it is clear that if this planet is one with which this species has no correlation then the resulting curve on the A-graph must be expected to approximate to a horizontal straight line, and the greater the number of observations being aggregated the smoother and more exactly horizontal this line will appear. It was decided therefore to test for this by aggregating the same set of observations over the Mars cycle; the lower graph of page 12 shows the result of doing this. This result came as a great surprise. The general form is not as strong in its variation as that which we experience with the Saturn-cycle, but it is far from the horizontal straight line which had been expected. The question then arose as to how much significance ought to be attributed to this rather smaller degree of variation. Obviously we needed to have a clear idea of the standard deviation of the points on this curve.

The standard deviation of the Beech buds in Strontian varies from day to day from about .17 to about .3, giving us a mean value of approximately .24. During the first part of the period of observation I was picking ten buds per day, and each of these was photographed twice, from different points of view, so the daily values represented the mean of 20 sets of measurements. In the later part of the period these numbers were doubled; so it is safe to say that on a rough average the daily figures represent a mean of about 30 sets of measurements. When one comes to aggregate this set of observations one finds that each cycle-Day represents the mean of some 80 such sets of measurements i.e. of about 2400 sets of actual bud measurements. We begin to see why the aggregate curves of the Beech are so consistently smooth. By ordinary statistical theory the standard deviation we are seeking should be given by

\[ \text{S.D.} = \frac{.24}{\sqrt{2400}} = .0049 \]

This can obviously only be considered a very approximate result. I needed something much firmer to go on. I therefore decided to aggregate the same set of observations over the Mars-cycle, but this time ignoring the changing phase-shift, thus rendering the results as nearly random as would be possible. The resulting graph is shown in the upper part of page 14. At last we have, as nearly as we could expect, our exactly horizontal straight line. The actual figures for each Day of the cycle come out as follows:

<table>
<thead>
<tr>
<th>Day</th>
<th>Mean</th>
<th>Day</th>
<th>Mean</th>
<th>Day</th>
<th>Mean</th>
</tr>
</thead>
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<tr>
<td>1</td>
<td>2.582</td>
<td>2</td>
<td>2.585</td>
<td>3</td>
<td>2.586</td>
</tr>
<tr>
<td>4</td>
<td>2.587</td>
<td>5</td>
<td>2.578</td>
<td>6</td>
<td>2.579</td>
</tr>
<tr>
<td>7</td>
<td>2.572</td>
<td>8</td>
<td>2.572</td>
<td>9</td>
<td>2.570</td>
</tr>
<tr>
<td>10</td>
<td>2.577</td>
<td>11</td>
<td>2.586</td>
<td>12</td>
<td>2.587</td>
</tr>
<tr>
<td>13</td>
<td>2.584</td>
<td>14</td>
<td>2.581</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

These figures, when analysed, give a standard deviation of

\[ \text{S.D.} = .0059 \]
This result came sufficiently close to the previously calculated theoretical value for my peace of mind, and further experience has convinced me that a standard deviation of about .006 is a very fair and true value for this set of observations, and it has been used in making all the aggregate-graphs for the Beech. On these graphs the horizontal dotted lines show the limits, two standard deviations above and below the mean value, which can give us confidence that any feature lying outside them is a significant phenomenon with a reasonable degree of probability. We note that the Beech observations aggregated over the Mars-cycle go well outside these limits, many of them lying far beyond even the 3-standard-deviation limits, thus implying a probability of significance greater than 99.9%. We must be left with little possibility to doubt that, while Saturn is the major influence at work here, Mars also plays a subsidiary, but very real role in the process.

It is interesting to note that the curves for the Saturn and the Mars cycles are to a large extent opposite from one another, the one being high while the other is low. This means that when they are in alignment with one another they will be pulling in opposite directions, which may help to explain the strongly inhibitory effect which Mars has been observed to have on Saturn.

On the lower half of page 14 we see the result of aggregating the same set of Beech observations over the Sun-cycle. Here we see a smaller but real divergence from the mean values, especially on Day-7 and Day-12, where the points of the curve go well beyond the limits for 3 standard deviations.

I think these results give us definite evidence that the species, Beech, while responding in a major way to the Saturn-cycle, is also involved in a slighter way with the cycles of Mars and also the Sun. These things begin to look more complex than has hitherto been realised. And it is possible, nay, even probable, that other species are similarly involved with a group of planetary bodies. When one of these is of over-riding importance, its correlation is not hard to establish by the means which we have been hitherto using, but the lesser influences can probably only be found by aggregating very large numbers of observations. In the case of a species which responds more or less equally to two or more planets the truth might be very difficult indeed to establish.

On page 16 we see the results of aggregating the same set of Beech observations over the Jupiter and the Venus cycles. Here we have curves which stay very sedately within the dotted lines and from this we have to conclude that, as far as our present evidence is concerned, these two planetary cycles appear to have no connection with the growth of Beech. It is true that the curve for the Venus-cycle seems to go a very little beyond the dotted line just at one
place (Day-3) but this is so slight that I'm inclined to treat it as
being probably of no great significance. The standard deviation for
the Jupiter observations, at .0059, is exactly the same as that for
the Mars observations ignoring phase-shift which can be taken either
that Jupiter indeed has nothing to do with this matter, or as a con-
firmation of the reliability of the standard deviation arrived at
for these figures.

During the winter of 1991-92 my friend Graham Calderwood did some
work on the Beech, near Aberdeen, and results from this are shown
on pages c19 and c21 of Volume 1 of the Supplement and Sequel. The
number of observations with which we have to do here is not suffi-
cient to be able to draw very distinct conclusions from these graphs
but when they are aggregated they give an interesting result, shown
on page 18. The curve is jerky and uneven, because of the small num-
ber of observations; it has not been possible to continue the aggre-
gative technique long enough to sieve away all the random elements;
but if we compare this curve with the Strontian A-graph for this
species we cannot help being struck with the similarity of form,
even just possibly including the slight asymmetry already mention-
ed.

At this point we should examine the A-Graph found for the Beech in
Stroud in the winter of 1992-93; page 19. This again was made from
very few observations and cannot therefore be expected to give more
than preliminary indications, but in view of what came later they
should certainly be considered. We see a strong dip in the curve
round about Day-1/2 showing that in this respect they were behav-
ing similarly to the Strontian trees. But we see an equally strong
dip at Day-7, a phenomenon unobserved in either of the Scottish
graphs. Later in this volume, when we have seen the 1993-94 results,
the possible consequences of this will be examined.

An analysis as thorough as the foregoing is only useful to attempt
if one has a very large number of observations to hand, and at the
moment of writing (Spring 1993) this is the case for no other kind
of plant than the Beech. Nevertheless the A-Graph is well worth cal-
culating in other cases also. It represents a kind of distilled
essence of all the results previously attained, and from a certain
point of view is a good way of assessing them. It seems worthwhile
to show here A-Graphs of a number of other species made up
to the date of writing (Spring 1993). In each case the standard
development of the final results has been arrived at by aggregating
over one or more planetary bodies while ignoring the changing phase-
shift, and the corresponding dotted lines showing two standard dev-
iations above and below the mean have been added to the graphs as
in previous examples.
A-Graph BEECH over Saturn

STROUD

1992-93

2.80

2.75

2.70

12 13 14 1 2 3 4 5 6 7 8 9 10 11 12 13 14 1 2 3 4
OAK—here we see an A-Graph showing much stronger variation than with the Beech, but the standard deviation is also, at .033, over five times as high as with the Beech. The reasons for this are partly because the buds grow more erratically on the Oak, and partly because we have significantly less observations to work with. However the graph goes well beyond the two-standard-deviations limits and at its extreme points just about meets the three-standard-deviation levels (i.e. 99.9% probability of significance) so it gives good evidence for the reality of the correlation.

BIRCH—these buds are small and difficult to gather from different parts of the tree with strict comparability, and the results during the years have not seemed as unequivocal as with the two previous species described, but the A-Graph shows a surprisingly strong and clear variation, with the dips in particular reaching far beyond the three-standard-deviation limit. From this evidence alone one would have to say that the Birch shows stronger evidence of correlation than the Oak. There is a clear but unexpected asymmetry, the main feature of which is probably significant, although the minor corrugations are less likely to be so.

GERANIUM—These beautiful buds grow with great regularity, and although owing to the circumstances of their growth I have only been able to take ten buds per day instead of the usual twenty, their final standard deviation is very small compared with the amplitude of their variation, giving very strong evidence indeed of correlation.

PRIMROSE—here we see a very useful application of the A-graph. Through many years these buds have shown, it would seem, a clear correlation with the lunar alignments with the Sun, i.e. new moon and full moon, but owing to the fact that Sun, Mercury and Venus always stay so close to one another in the sky there was always some doubt as to whether the actual correlation might have been to one of the last two of these bodies. When during the period under review, two planets remain in a fairly stable relationship it must be clear to us that many of the qualities of the one A-graph will tend to brush off on to the other, without it being a matter of significance for that other. In such a case the effects will usually show much more strongly in the one graph than the other, indicating where the true correlation lies. If the true correlation lies with the Sun, then since Mercury never strays far from the Sun, the brush-off effect should be seen strongly in the A-graph for Mercury, but much less so in that for Venus, since this latter planet moves so much more freely to one side and another of the Sun. And this in fact is what we see in the three A-graphs in question; that for Venus shows as it were a rather pale 'shadow' of the form we are looking for, with an amplitude of variation of only about 0.1; that for Mercury has a much stronger variation, with an amplitude of 0.17, albeit with the dips somewhat displaced; while that for the Sun has, with perfect symmetry, an amplitude of no less than 0.27. My belief, held through the years, that this is indeed a true Sun correlation now has objective evidence to support it.
Following this we print two A-Graphs showing the behaviour of the leaf buds of the wild cherry, one in Strontian and the other near Stroud. Both these arise from comparatively few observations, so neither can in itself be considered as more than preliminary evidence but taken together with the 1993 results for the Cherry, shown later in this book, I think we have very good evidence that the value of these buds really undergoes an increase at every new and full moon (pages 27 and 28).

The importance of the aggregate-graph

The basic concept lying behind the A-Graph is not difficult or abstruse, but we must not allow its apparent simplicity to mislead us into undervaluing its importance. In the foregoing pages we have seen how it leads us to a very much richer picture than the simple one-to-one relationship between the planets and the various species which we might otherwise have held. We begin to understand how the Beech, for one species, must be seen as being intimately interwoven into a whole complex of planetary relationships; and a similar thing will probably be found, eventually, to hold for other species and planets.

We have seen also how it enables us to distinguish between bodies, such as Sun and Mercury, which normally stay close to one another, for instance in the case of the Primrose (pages 24, 25 and 26).

But there is more to the matter than just this. We must be clear that we can never hope to get a perfect correlation between the values and the lunar alignments. Were we to do so it would mean that the astronomical influences are the ONLY ones which are brought to bear on the growth and development of the plants. And when we consider how intimately the plants are integrated into their whole environment we can see that this could never be. Changes of temperature, humidity, strength of light, maybe atmospheric pressure and the whole manner of the growth of the tree, must be continually affecting the subtle forms of the buds. In any graph of the values of the buds there must always be a host of random elements at work as well as, possibly, a constant astronomical cycle. Our job is to eliminate the former in such a way that we retain the latter. And this task the A-Graph is eminently fitted to do. As we continue to aggregate cycle upon cycle the random elements gradually cancel one another out, while any constant variation gradually becomes reinforced. It is like putting our results through a sieve; the unwanted elements fall through and disappear. The A-Graph thus gives us the essence of the results for one or more whole seasons' work. And it also tells us for sure if there is no cyclic variation present. As we continue to aggregate, our curve becomes increasingly smooth, flat and generally formless. Such cases are seen on pages 14 and 18, and other cases can be seen among the results for the Oak and the Ash for 1993/94.
The Single-bud Method

The first work, dealing with consistent daily measurements of the buds, done in the Autumn of 1962, was done by the single bud method. In this method, each species is represented by a single bud which is photographed each day while it is actually growing on the tree. The difficulty here is to ensure that the bud is photographed from exactly the same point of view each day, since a very small change in this respect can seriously affect the final result. The method was adopted of strapping the bud down on to a small strip of transparent perspex with thin fuse wire and leaving this strip hanging on the tree. A box was then made for the camera, incorporating a small slot into which the strip of perspex would just fit, in such a way that when the perspex was slid into place, the bud would be in the centre of the field of view, would be in focus, and above all would be seen daily from exactly the same point of view. This method was used to good effect, and the graphs shown on pages 41 and 41 of Volume 1 of S & S were made by it. But there were disadvantages, not the least of which was that it was subsequently shown that the strapping down of the bud often seriously interfered with its natural development, even to the point in some species of actually killing it. Of the five species studied at that time in this way, only two, those already mentioned, gave positive results.

This method was therefore abandoned and the multibud method adopted, and all the rest of the work shown in Volume 1 of S & S was done by it. It has proved fruitful, but also some serious disadvantages have shown themselves. The need to gather some twenty buds per day has imposed a severe restriction on the species which can be studied, as many trees simply do not offer enough accessible buds. Also in order to get a reliable mean figure for \( \lambda \) it is necessary that the tree should be producing its buds with a certain degree of consistency; that is to say that the standard deviation of their \( \lambda \)s should be sufficiently low. Trees, and even districts, seem to vary widely in this respect. When this method has been tried in the south of England standard deviations have been consistently higher (often by a factor of 2, 3 or even 4 times) than with the trees at Strontian on the west coast of Scotland. Why this should be so is not altogether clear, but I suspect that it may be due to a slight background of electro-magnetic radiation in a countryside which is much more electrified than ours farther north. Here in Strontian there is definite evidence that trees growing under the high tension lines are not only cut off from astronomical correlations, but also produce their buds more erratically, i.e. with a higher standard deviation. Be this as it may, it is clear that it would be advantageous to employ some method which is less dependent on this matter of the standard deviation. For these reasons it was decided to try, in 1993, to refine the single bud method, and to try it again.

An improved optical system was used, giving sharper images, but the chief change was to get rid of the necessity to strap the bud down.
The apparatus decided upon looked, diagrammatically, rather like this:

B is a wooden block with a small hole bored through it, just wide enough to allow the stem of the bud to pass through it. P is a perspex window, and F is a flash which illuminates the white ceiling C. The bud, on its stem, is passed through the hole in block B, and will be exactly in focus when it is just lying on the surface of the perspex window. This of course cannot guarantee that the bud will always be seen from exactly the same point of view, but it is found that with care and practice, a very considerable degree of uniformity can be achieved. The photo can then be taken without removing the bud from its branch.

This method has some great advantages. It is not dependent on the tree producing its buds very consistently (i.e. with a low standard deviation) on the various parts of its branches. Provided the bud is handled with care each day, it is almost wholly non-intrusive into the life of the organism; whereas, with the multibud method, one has to ask whether the taking of 20 buds per day may affect the life and development of the tree over a long period. It allows us a much wider choice of species to study. And we retain the actual photographic images for future study and contemplation.

On the other hand it makes us completely dependent on the vagaries of the individual bud, and perhaps it is because of this that it sometimes seems that the exact timing of the dips in the L-curves is not quite as reliable as with the multibud method. And of course the single-bud method has the great disadvantage that it is completely inapplicable to the wide range of the flower buds.

However another advantage of the single-bud method is that new cameras are much cheaper to buy than sophisticated computer-visual systems, so when we wanted to get a small team working in various parts of the country, to investigate how these things work over a wider geographical range, we chose the single-bud method for our work, and called what we proposed to do, 'BUD-WATCH 1993/94'.
The participants would like to thank the Margaret Wilkinson Research Fund for assistance in defraying costs of cameras and photographic material used in the course of this project.
Project BUDWATCH 1993-94

Participants:

Isis Brook, Wray, 8 miles east of Lancaster ....... Photography.

Jenny Davis, Lynton, Devon ....................... Photography.

Lawrence Edwards, Strontian, West Highlands ...... Photography, Film processing, Measurement and Calculation.

Karin Meys, Humbie, 15 miles SE of Edinburgh ....... Photography.


During the winter somewhere in the neighbourhood of 1700 photos were taken, processed, measured and calculated, and the results of this are shown in the remainder of this report. They include nine different species, five of which have had little or no work of this sort done on them before.

The work met considerable difficulties in Devon. Again and again, after a few weeks, although treated with the greatest care, a bud would fall off its stem and have to be abandoned. Jenny Davis wrote 'We are most concerned about the health of many local trees—is it pollution, or long term drought?' For this reason not very many consistent results came from here, but many long and very fruitful series of photographs came from Lancaster, Humbie and Strontian. And we should here record our gratitude for the efficient and untiring work done by the participants.

The general aspect of the heavens has been somewhat unusual this winter and this has brought some special difficulties. Just about the New Year four of the seven classical planetary bodies, Sun, Mercury, Venus and Mars drew simultaneously into line with the earth and since these bodies were moving in the same direction at fairly similar speeds the effects of this multiple alignment lasted for a considerable time, both before and after its climax. Between December 25 and January 6 there were no less than six mutual alignment between them; and when the Moon came round to an appropriate place, on December 28, we find four lunar alignments all within the space of less than ten hours. Our knowledge of the effects of such mutual alignments is very imperfect, but it would seem from past experience to be usually inhibitory, and to last from about when the planets first come to within 5° of one another. Often the plant rhythms are not fully restored until the planets have moved up to twice that distance from one another; and this year's experience goes, on the whole, to confirm this. This meant that not only were
many alignments near to the New Year rendered null, but even when,
before or after, an alignment was operative, it often came so close
to other alignments that it was difficult to be sure which partic-
lar planet was involved in a given effect. When from past years' 
work the planetary sympathies of a species are already known this
is not a serious matter; we can say for sure whether it is, or is 
not, following a given rhythm. But when we are dealing with a spec-
ies which has not been studied from this point of view before, al-
though we can say with some certainty whether it is following the
14-day rhythms, it is sometimes difficult to determine with which
particular planet these are correlated.

MEASUREMENT.
Measurement has to take place with the greatest care to preserve
absolute comparability from one photo to another. The method adop-
ted, - seeing the bud against a brightly lit white background - leads
naturally to a silhouette-like result and this is excellent for get-
ting good accurate results. However each photograph will contain
tiny irregularities in its outline (sometimes referred to as 'land-
marks') and if a set of photographs is well taken (i.e. the bud has
been inserted into the camera frame always in exactly the same way)
these landmarks will always look alike for any one particular bud.
And it is with respect to them that the measurements will be made,
especially in the fixing of the level which we will accept as the base
of the bud. However the levels at which the various diameters
are to be measured are best fixed by measuring downwards from the
tip of the bud, this being the one feature which can nearly always
be unambiguously identified.

THE PHOTOGRAPHS.
One of the benefits of the single-bud method is that it not only
provides us with the figures which we need for our research but
also with the actual photographic images, from which we can SEE
the actual changes of form which are involved; and a selection of
these is shown in this report. In looking at these we must not ex-
pect to see violent or dramatic changes; there is no room for such,
as these buds are small, and mostly hard and woody. We have to
realise that we are not concerned here so much with form, as with
CHANGE of form. When we move from a function to its first differen-
tial it is always the case that a new element enters in. Two vel-
ocities may be identical in magnitude, but different, even perhaps
opposite, in direction. In the study of these things we are very
much in the realm of breathing processes. If we were to take two
X-ray photographs of a human thorax, one at the moment of greatest
inhalation and the other at the moment of complete expiration, we
should find very little obvious difference between them, either in
terms of size or form. Indeed it would need a practised radiologist
to see the difference between them. Yet they are polar opposites
in terms of both experience and function. We must learn to view
these things with an appreciation of the importance of the subtle
qualities involved in apparently small changes of form.
The Birch is a tree which has been traditionally associated with the planet Venus, and work done on it by the multi-bud method between 1987 and 1990, reported in the Supplement and Sequel Vol 1, strongly supports this, as does the aggregate graph for these observations shown on page 22 of the present volume. However this species is not really well adapted for study by the multi-bud method; the form of the buds varies very considerably from one part of the tree to another, and one is left with the choice of strictly confining oneself to certain small parts of the tree, thereby soon running out of available buds, or relaxing this selectivity, giving one a set of buds with a high standard deviation with its consequent inaccurate mean values.

It was interesting therefore to see how such a bud would fare when treated by the single-bud method. In fact, the final results were very similar to those which had been arrived at in previous years although the difficulties had been different. These buds are small and rather irregular in shape and it is therefore necessary to ensure that such a bud goes into the camera with the very greatest uniformity from day to day, and this is difficult because the bud grows on a very thin stem and can therefore easily be moved when it is placed in the perspex window of the camera frame. This tends to introduce a certain element of random variation to the results, but it has, I believe, been reduced to a bare minimum by the exercise of the greatest possible care. Two buds were studied, Birch 1 for a short period in October, and Birch 2 for a rather longer time later in the winter. They were both terminal buds.

On pages 36 and 38 we see graphs resulting from these observations. During the actual periods of observation there were six alignments of Moon and Venus and no less than five of them were acknowledged by significant dips in the curve, the alignment of December 15 being the only one which was not satisfactorily shown. There were however one or two dips at other times, and if we consult the graphs for the Birch observations of previous years in the Supplement and Sequel, Vol 1, we see that this tendency was seen there also. It may well turn out to be a significant feature of the Birch behaviour. These extra dips seem to come with special frequency about five to six days after the Moon-Venus alignment. On page 40 we see this year's observations aggregated over the Moon-Venus cycle, and we note the very obvious dip about Day-15 to Day-1, as might have been expected if the Birch behaviour is really correlated with the Moon-Venus cycle, but also another dip about Day-5. If we turn to page 22 of this volume we see the aggregate graph for all the observations of previous years' work on the Birch. And here also, although on a slighter scale, this feature is to be seen. In fact
these two aggregate graphs are remarkably similar. The fact that
the extra dip is so much more strongly marked on the later graph is
possibly due to its having been constructed from much fewer ob-
servations. The evidence for this extra dip is at the moment rather
thin, but it is something which needs to be watched for in future
work.

Pages 37 and 39 show us a selection of what these things mean in
terms of visible form. The upper row of photos shows us the bud at
normal times, i.e. with comparatively high $A$, and the lower row
at times of alignment. This is the practice which we will follow
generally in this book. We shall therefore expect to see the bud
more rounded and relaxed in the lower row; and by looking specially
at the upper part of the bud we shall see that these small and rath-
er shrunken-looking objects do indeed undergo marked changes of form
during the winter, consonant with what we would expect from a Moon/
Venus correlation.
Sycamore

The Sycamore produces beautiful buds, big, green, fat and easy to photograph, but reliable results are not easy to achieve owing to the fact that they are covered with scales, most of which adhere to the bud rather loosely at their upper end, and there appear as small excrescences, making the outline of the bud appear rather jagged and irregular. From some points of view some of the buds appear almost like a bishop’s mitre. In such cases it may be very difficult to get measurements which will lead to a reliable value of \( \lambda \). Nevertheless a careful consideration of the forms of these buds can lead to a strong conviction that the general path curve idea is really manifesting itself here, in spite of the many small irregularities which tend to obscure it.

This species is traditionally associated with Jupiter, and the small amount of work which has been done on it in the past has seemed to confirm this. By using the multi-bud method, and taking many buds a day, one can hope that the numerous small irregularities will even out in the final mean figures; and this has certainly seemed to be the case. However most of the branches in a mature tree are out of reach, and the supply of accessible buds is very limited, and this has meant that consistent work on any one tree could only be carried on for comparatively short periods. Thus the work was discouraging and with so much else needed to be done was not carried through with the persistence which was required.

Now however, with the single-bud method, we need only to find one bud which is growing in such a way that it offers itself to the camera with a viewpoint in which the little excrescences appear at a minimum, and which therefore allows reliable path curve measurements taken. In this Karin Meyes was successful and the set of nearly 100 photos which she contributed forms the best evidence we have to date of the behaviour of these beautiful little buds.

Page 43 shows these results. We note the general decrease in \( \lambda \) during the early part of the season; this is a not uncommon feature of such a graph and probably represents the general movement of the bud towards its final opening in the spring. But of more immediate interest to us at the moment is to see that this general movement is overlaid by a rhythmic fluctuation of about a fourteen day period, the dips in the rhythm coinciding closely with the arrows marking the days of the Moon-Jupiter alignments. The first dip, Oct 5th, is only weakly shown, and that due on Nov 3rd seems to have come a day or so late, but otherwise the record is clear. The dip
on Dec 14th seems to have been a very short one, lasting hardly more than a day, which is why it is not strongly indicated in the heavy, trend, curve, but looking at the light, daily, curve, we see that it was in fact quite the lowest value recorded until then and indeed one of the lowest values of the whole series. Obviously much more work is needed to be done here, but we have good evidence to support the idea of the Jupiter relationship.

Turning to page 44 we see these results aggregated over the Jupiter cycle. Comparing this with the A-graphs of other species one cannot help being struck with its general similarity to them, and also with its remarkable symmetry.

On page 45 we see a selection from some of the photos on which these graphs have been based. The three photos in the top row were taken at times between alignments, when was at a normally high level; whereas, for the sake of comparison, those in the bottom show the bud at times of alignment. Even with a comparatively casual glance one can see that those in the top row are rather sharper at their tips and wider at their base, than those printed below them; and by taking a ruler to them one can confirm this exactly. A careful contemplation of the subtle qualities of these forms can tell us much about the breathing rhythms of these buds which are being described here.
Traditionally the Cherry is a plant associated with the Moon. In 1962, when the task of recording the daily \( \lambda \) s of the buds began, and it fairly early became apparent that, in one species after another, these \( \lambda \) s were following the rhythms of the lunar alignments with one planet or another, this posed in the case of the cherry a definite problem: would it be possible to envisage the Moon coming into alignment with itself? At the time one had no possible clue as to this; one could only work ahead and see what would eventuate. During the winter of 1962/63 a long series of observations was made on a cherry leaf bud by the single bud method and from this it became clear that this particular bud at any rate was suffering an INCREASE in \( \lambda \) every time the Moon came into alignment with the Sun, i.e. at New Moon and Full Moon, see 'The Vortex of Life' page 217. After this the work was developed along the lines of the multi-bud method, and seeing that no cherry trees growing in this neighbourhood ever produce enough buds to follow this method, this purely empirical result was not followed up for many years. However, In 1993 a very short series of observations on a similar tree was made in Stroud, by the multi-bud method, see pages 27 and 28 of this volume, and although the series was too short to give any conclusive result, as far as it went, it seemed to confirm the previous findings.

Now, this year, developing the single bud method, it has been possible to return to the matter more intensively, and Karin Meys in Humble has contributed a very useful set of photos, results from which are shown on page 48. These buds are not easy to deal with, being small, hard, woody and rough, and rather irregular in shape. In such circumstances the \( \lambda \)-value which we get depends strongly on the exact point of view from which the bud is seen. The slightest change in the way the bud is inserted into the camera frame can make a considerable difference to the final result and it is only to be expected that the graph should exhibit a somewhat erratic appearance. Although much more work is obviously going to be needed on this difficult species I think a careful examination of this graph can satisfy us that the peaks in this curve are significantly coinciding with the dates of the upward-pointing arrows, which mark the times of New Moon and Full Moon.

On page 49 we see the result of aggregating these observations. If this is compared with pages 27 and 28 the general similarity of the forms is obvious, and re-assuring. The greatest difference is the small asymmetry, the highest point of the graph falling on Day 14 rather than Day 1, but this may well be due to the fact that we
have, in such a short season, so few observations to deal with.

On page 50 we show a selection of photographic images taken at crucial moments during this series. Here the same principle has been adhered to as in the rest of this Supplement, that is, that the top row of photos were taken at times when the bud was in its more normal state, in between alignments, which means in the case of this species with a comparatively low λ, while the bottom row shows its form at, or near, to peak time. We should thus expect to see the sharper forms below, and the blunter ones above. And an even cursory glance at the page will confirm that this is so.

Note:—on page 49 we see these figures 'aggregated over the Sun'. When we come to consider the Ash we will find that a similar case of aggregation leads us to speak of the Ash as being ruled by the Sun. Whether in the long run we decide that such a case of aggregation should lead us to say that this species is 'ruled by' the Sun or by the Moon is a moot point; some might consider it a matter almost of the way we decide to think about these things, perhaps even of the way we decide to use our words. The important thing at the moment is to investigate, with the greatest impartiality possible, whether, or not, this species is in fact behaving in this way. And a study of the A-graphs printed on pages 27, 28 and 49 can, I think, be taken as good preliminary evidence that indeed it is.
Cherry

1993-94
A-Graph
over Sun

Humbie
Bird Cherry

The Bird Cherry is an attractive small tree which grows wild in Great Britain from Yorkshire northwards. Its scientific name, Prunus padus, shows us that it is truly a variety of cherry, but when we come to work with it from the point of view of these studies we find it so different from the ordinary wild cherry, the Gean, that we are constantly tempted to treat it as a separate species. The fruit is small, black, and bitter. The leaf buds of the ordinary wild cherry are somewhat irregular in shape, rather dumpy in form, and with a gnarled bark-like exterior. Those of the Bird Cherry on the other hand are long, thin and tapering, with a smooth polished appearance. In form they are more like the leaf buds of the Beech than any other species. They can easily become brittle and fragile, and when dealing with a bud over many weeks it needs to be handled with great care.

This is a plant which has never been studied in this way before, and we have to start with no idea whatsoever of its possible planetary sympathies if indeed it proves to have any at all. On page 53 we see the graph of its $\lambda$-values during the period that it was under observation this winter; and this proves to be a very interesting study indeed. During January the curve shows two distinct dips, January 16th and 30th, just fourteen days apart. In February I had to be away from home quite a bit, but when I returned, in the middle of the month, just fourteen days later again, I found that the bud had swollen to give a very low level of $\lambda$ indeed. It seemed that here we had yet a third case of the fourteen/fifteen day rhythm showing itself. However, this time the bud never recovered; it continued to swell, became brittle, and a day or so later it fell off its stem; and had to be abandoned, (February 17th). A few days later I chose another bud, from another branch of the same tree, called Bird Cherry 2. This bud, in the succeeding weeks, then proceeded to pass through two further dips, fourteen/fifteen days apart and exactly in rhythm with the dips which had been shown by the previous bud described.

When we have work of this kind being done on a particular type of tree for the first time, one cannot expect to get more than preliminary results. Nothing conclusive can be said until the work has been tested and repeated in following seasons. However, as far as it would ever be possible at such a stage I think we can safely say that we have evidence that this Bird Cherry is really following a 14/15 day rhythm similar to the other species which have been studied during past years. Consider, for instance, the A-Graph made from these observations, shown on page 54, and compare it with the A-Graphs for the Oak, on pages 61 and 82, on one of which the rhythm is in evidence and the other where it is not; or with any similar graphs earlier in this Supplement. However, when it comes to fix-
ing which particular planetary body is fulfilling the function of ruling planet for this variety of tree the question is not easily answered. The downward-pointing arrows on our graph mark the morn-  
ents, with a phase-shift of +3 days, when the Moon was aligned with the remarkable multiple conjunction which dominated the aspect of the heavens during the end of 1993 and the start of 1994. On the face of it, and just from this, all we could say is that the Bird Cherry responds either to the rhythms of Sun, Mercury, Venus or Mars. But there is a little more we can say, if with less certainty. By the middle of March this conjunction was beginning to disintegrate; if we were to put arrows truly for Mercury and Mars, they would have to stand at midnight, March 12/13, and midday March 13, res-  
pectively; a glance at the graph can assure us that this renders these two planets unlikely contenders. Furthermore, we know from our work with the Ash and the Oak this year, that both the Sun and Mars appear to have been heavily inhibited in their activity during January. We are still far from fully understanding the effects of mutual alignments between the various planets, and the way they in-  
habit one another, but it does seem unlikely that just at this jun-  
cature either of these two planetary bodies could have been very ac-  
tive. Nevertheless just during this time the rhythm we are studying was showing itself quite strongly. If we attribute this to the Sun or Mars we put ourselves into an anomalous situation.

With Venus the situation is different. She was the first of the four bodies to start coming out of the multiple conjunction. Fur-  
thermore if one consults pages p1 and p2 of the Supplement and Se-  
quiel, Volume I, one finds a certain amount of evidence that whereas most mutual alignments between planetary bodies tend to inhibit the working of those bodies, with Mars and Venus it may be different. Indeed, at that time I wrote that it might even be found in due course that these two planets could enhance one another’s activi-  
ity rather than inhibit. The evidence for this could be considered slender and rather inconclusive, but it is there, and as such it would be wrong to ignore it. And since Mars was the principle inter- 
fering planet at that time it would be perfectly consistent to regard Venus as being relatively unencumbered, in which case one has a perfectly good reason why the lunar rhythms should have con- 
tinued unhindered through all of January.

To sum up the results of this year’s work, we have good prelim-  
inary evidence that the Bird Cherry follows the 14/15 day rhythm; this might just conceivably be found to correlate with the move- 
ments of either Sun, Mercury or Mars, but the balance of evidence lies fairly heavily in favour of Venus. Obviously much more needs to be done on this in coming years.

In this connection it is interesting to note that in some herbalist traditions an infusion made from the bark of this tree is used as a mild painkiller, a sedative, and as a diuretic, i.e. as something which stimulates the working of the kidneys.
Beech

The Beech presents something of an enigma in this work. It is particularly well adapted for study by the multi-bud method. A good mature tree will hold, literally, millions of buds, many of which are at eye-level, and easily accessible. They are good path curve forms, and easy to measure accurately. A great deal of work has been done on them over the space of more than ten years, and they have consistently followed the 14-day rhythms accurately and clearly all the time excepting when Saturn was encumbered by alignments with Jupiter or Mars. Thus when the Margaret Wilkinson Trust bought another computer suitable for working the multi-bud method, and set it to work in the south west of England it was perhaps natural that the major part of these efforts was expended on the Beech. From the Autumn of 1991 to the Spring of 1993 two separate workers got very similar results. From the start it became clear that the beeches around Stroud were growing differently from those near Strontian. The standard deviation of the buds gathered was markedly higher, as much as two, three or even four times. The trees were producing their buds much more erratically, and this meant that it was much more difficult to get reliable mean values for the daily λ. Such high deviations have only been experienced here in Strontian in a tree which was growing under the high tension cables. When a search was made to find a tree which was growing less capriciously things fell more into line with the Strontian experience. But they never became the same.

If we look at the pages 12, 18 and 19 we see the A-Graphs for Beech for Strontian, Aberdeen and Stroud respectively. Looking at these we must bear in mind that whereas the Strontian graph shows the essence of some 1400 observations taken over many years, the observations which have gone into the other two must be counted in tens rather than hundreds. The graph for Aberdeen differs from that for Strontian in that, covering a so much smaller time, it has failed to smooth away all the irregularities due to its random elements, but in its general form it is almost identical with the Strontian one. But the same cannot be said of the Stroud results. Here one also sees a strongly-marked dip in the curve round about Day-1 to Day-2; the buds were, in the main, responding to the Saturn alignments in a similar way to those in Scotland; but also one sees another equally strong dip round about Day-7, which is certainly not seen in the Scottish graphs. In fact, looking only at the Stroud graph one would be led to envisage not a fourteen day rhythm but a seven day one. All these remarks apply to observations made over the years by the multi-bud method. It is therefore of great interest to see what would be found by applying the single-bud method. This was done this winter by Isis Brook. On page 58 we see the result of this year’s work on a Beech growing some miles east of Lancaster. The arrows have been put in to mark the Moon/Saturn alignments. I think this is the only graph in this year’s work where the eye, confused by constant change, can not detect at first glance some evidence of the fourteen day rhythm. Obviously random elements play a tremendously large part here, and the only way to see whether a
constant cyclic element is also involved in to put the thing on to an aggregate graph. The result is seen on page 59, and the effect may surprise us. Most of the variation has disappeared; it was random. But something is retained. The amplitude of the variation is much reduced, but otherwise, in its general form, this is strangely reminiscent of the Stroud result. Again we see the very definite dip about the time of Day 1/2, as with the Scottish results, but also, as with the previous English results, a suggestion of another dip about seven days later. Again we meet this rather faint suggestion of a seven rather than a fourteen day rhythm.

I have no explanation for this apparent anomaly. I think that only much further work will resolve it. We know that all the plant world is intimately involved in, and influenced by, the environment in which it grows. In the case of these very delicate rhythms perhaps we might suppose that is specially the case. Is it perhaps the case that the Beech is particularly sensitive in this way? I do not know.

We have to ask whether, possibly, the Beech, while responding principally to the alignments of Moon with Saturn has also within it some tendency, normally hidden, to re-act to the square aspects of these bodies, i.e. when they are 90° and 270° apart, as well as the usual 0° and 180°. In such a case we would have to speak of a 7- rather than a 14- day rhythm. Can we envisage that such a tendency could be there, and unnoticed until some environmental factor brings it to the fore?

One asks whether one can find a significant difference between the Scottish and English environments. For instance, in Aberdeen and in Strontian, one is walking on granite; the soil, in the latter at any rate, has a strong element of peat, interspersed with granite dust; the environment must be strongly acidic. In both Stroud and the foot hills of the Pennines east of Lancaster one is walking on almost solid limestone; the environment must be strongly alkaline. I am not putting this forward as an adequate explanation, but perhaps these are things which should be taken into account when considering the matter. Also one should perhaps consider the difference in possible electro-magnetic pollution in a place like Strontian, where it is virtually non-existent, and in a highly electrified countryside like the south-west of England.

We must look forward to much further research here.
This is another species which has not previously been studied in this connection. The buds are smooth, regular, and are easy to photo and to measure. However the bud one is going to study needs to be chosen with care, as the tree carries two kinds, the leaf bud, and the catkin bud. The former waits until well into the spring before it starts to open, but the latter swells and begins to open about midwinter. If one wants a nice long season for one's study one therefore chooses a leaf bud, but in due course it is probable that we will need to have knowledge about both kinds. It takes some care to distinguish between them. Here on our trees in Strontian the leaf buds are slightly lighter in colour and somewhat flat in cross-section, while the catkin buds have a more circular cross-section.

The graphs on pages 62 and 63 show the results of this year's study. Willow 1, a leaf bud, was started on October 8 and continued until November 3, after which I had to be away from home for a time. Work on it was resumed on December 8, but on the 22nd of that month, quite unexpectedly and for no obvious reason, it fell off its stem, and had to be abandoned. The bud chosen to succeed it, Willow 2, turned out to be a catkin bud, and soon after the middle of January it started to swell, and on the 22nd of that month it burst open. A few days later, a further bud, Willow 3, was chosen, and this was then observed for the next six weeks, page 63.

The first thing that strikes one on looking at these graphs is the remarkable invariance which these buds have shown. Willow 3 appears to have been almost completely inert for the whole period of observation, and Willow 1 for a considerable period. (Note that the vertical scale has been doubled on these graphs from that which we have usually employed; if we had used the usual form they would have appeared even flatter still). Such smooth and flat graphs over such long periods are hardly to be found anywhere in the course of the past twelve years' work. This indicates either that this is a species which does not noticeably follow these 14-day rhythms, or that it normally does so, but that this winter its ruling planet was inhibited by other alignment for a large part of the time. It so happens that, during the winter of 1993/94, there was just one planet which fulfilled this condition, Mercury. At the end of September Mercury moved towards a conjunction with Mars. The two planets were moving side by side at closely equivalent speeds and they stayed near one another till the end of October. During November and the first three weeks of December they were clear of one another and Mercury was relatively unencumbered. However the conjunction with
Mars was resumed in the last days of December and lasted till near the middle of January. A few days later Mercury moved towards a conjunction with Saturn, and then stayed close to that planet until the end of March. So we see that during the whole of that winter, Mercury was burdened by, probably inhibiting, alignments except for the short period from early November till the last days of December. And it was during this short interregnum that one of the few noticeable dips in the curve occurred— that of December 15/16. The arrows on the graph have been put in to mark the times of the Moon-Mercury alignments, and we see that this dip in the curve is exactly in time with one of these. The three other arrows appearing on this graph all coincide with low points on the curve, but these low points are so inconsiderable that they can hardly be taken seriously; the most that could be said about them is that it rather looks as though dips were trying to form, but were held back by some inhibiting force.

To sum up the results of this first year's work on the Willow, we can say that this seems to be a species which will well repay further work. Present observations are consistent with a correlation with the Mercury rhythm, but at the moment the available evidence does not allow us to say anything more definite. We must look forward to the results of much further work on this species.
Rowan

Strontian

This beautiful tree, which enlivens the countryside with its orange red berries, is sometimes called the Mountain Ash. The leaf buds are large and their surface has a somewhat furry appearance; nevertheless they photograph with a sharp clear outline, easy to measure accurately, and they follow the path curve form very closely. This species has not been studied before from this point of view so we start with no preconceived idea of what to expect. What in fact was found was a decided tendency for $\lambda$ to rise in a fifteen day rhythm, and for these peaks in the curve to co-incide with the lunar alignments with the multiple conjunction which dominated the aspect of the heavens during midwinter and early spring.

On page 65 we see the graph of these results. The upward-pointing arrows show the times of the lunar alignments with this multiple conjunction, more particularly with Sun and Venus, since by early March, Mercury and Mars were already beginning to dissociate themselves from it, and the timing of the last peak (March 15) rather strongly suggests that they were not involved. We see then that of six alignments, five were accurately accompanied by peaks in the curve, with just the other one (January 29) coming about two days early. This is enough evidence to give a preliminary judgement that this species is associated either with the Sun or Venus. The evidence adduced thus far does not allow us to distinguish between these two, but in this connection it is interesting to note that in at least one herbalist tradition an infusion from this tree is used to treat menstrual and kidney disorders.

The page of photographic images is arranged similarly to that for the wild cherry, i.e. the top row of pictures shows the bud in its more normal state, with a comparatively low $\lambda$, while the lower row is at times of alignment. We would thus expect to see the sharper, and tenser, forms in this lower row. Near the lower end of the bud there was a loose shuck which did not seem to bear any part in the true form of the bud, and this has been ignored in the measurements.
Oak

LANCASTER OAKS 1 and 2. Photographed by Isis Brook.

The beautiful buds of this species were studied during this season at one time or another from five different trees, at Lancaster and Strontian. We start by considering the particularly interesting set of photos taken at Lancaster whose results are shown on pages 72 and 73. The photographs reveal good path curve forms, the deviations from the perfect form being on most days only slightly greater than 1%. Notice that, during the first two months, apart from a few days in the middle of October, the thin line showing the daily observations clings quite closely to the heavier (trend) curve, showing that the element of random variation from day to day was very small. And as a result of this the record is clear and reliable. Between the end of September and early November there are three alignments of Moon and Mars, and each of these is clearly shown by a dip in the curve. During November we had some bad luck with the photography, and the record grows rather thin, leading to a small dip, not very convincing, but coinciding exactly with the alignment of December 2nd/3rd. However at this point the whole character of the curve changes completely; the 14-day rhythm which it had been following so nicely is quite broken; the subsequent several alignments are not acknowledged by any significant dips in the curve; instead the curve fluctuates wildly, while rising to an unprecedented peak on December 26th followed by a dramatic fall, and then some further quite wild fluctuations. This is a graph which bespeaks agitation. It seems that the bud simply does not know what to do next. And if we consult the ephemeris we think we can see the reason why. During December Mars was starting to pass behind the Sun. The conjunction with the Sun was already 5° complete by December 7th and on the 28th it became exact. At that moment Mars was at its furthest possible distance from the earth and was completely lost in the Sun’s rays.

Work over several years in the past has shown that when the ruling planet of a species is encumbered by an alignment with some other planetary body the effect is usually seriously to inhibit the normal rhythms, and this certainly seems to have been the case here. The alignment with the Sun has completely broken the normal Moon/Mars rhythm.

A simple way of getting an objective assessment of the amount of agitation is to calculate the Standard Deviation of the \( \lambda \)-values, and the result of doing this is shown on the lower graphs of these pages. Each point shows the standard deviation calculated for a 5-day interval. It will be seen that this deviation was about 0.06 for many weeks during the early part of the period of study, but from the first week of December it rose sharply, reaching a high point of fully four times its normal value towards the latter part of the month. One would not wish to be over fanciful but it is hard to resist the idea that if one considers the \( \lambda \)-graph to be 'Temperature' and the deviation-graph to be 'Pulse Rate' (agitation) then these graphs could well represent the medical chart of a patient passing through the crisis of some feverish disease.

We felt that we were seeing the earthly shadow of a small cosmic drama, and were filled with interest as to what would happen next.
We could only watch, wait, and see. In the past, over many years' work with the multibud method, the rule has seemed to suggest that an inhibiting influence by another planetary body becomes effective from about the time when the alignment is 5 degrees exact, but that its after-effect often continues for something like twice that time. It seemed probable that normal rhythms would not be restored until after the end of January. The sequel, shown on page 73, shows that this proved to be the case. The standard deviation remained high until the start of February, and then a great calm set in, the deviation falling, if anything, to an even lower level than it had before. The upper graph is quite chaotic until the end of January, when a pronounced dip (Jan 26/27th) is shown. This does not coincide with a Mars alignment, and it was not acknowledged by other buds being studied at that time and I do not think it is part of the ordinary rhythms. Similarly the succeeding fluctuations in the curve during February are too small to give much confidence that they are significant. It is not until the end of the month that a really significant dip occurs (Feb 27th). We shall see later that this was echoed by several other buds; it occurred exactly on time with the Moon/Mars rhythm, and it can be considered with a fair degree of confidence to show the resumption of normal working. This being the case the hope was felt that the last few weeks of the season would produce concrete evidence that the rhythms were really back to normal. Alas, however, this was not to be. Another look at the ephemeris shows that Mars moved into conjunction with Saturn on March 14th, and from about the 7th of that month no further effects could be expected. And this can be seen from the graph. The next two alignments are not acknowledged and the curve becomes quite chaotic. Simultaneously the standard deviation again rises.

Page 75 shows us what these changes imply in purely visual terms. These are straightforward photographic images, the upper pictures showing the bud in its high-λ form and the lower ones when λ is low. The fact that the upper pictures are sharper in their upper part than the corresponding lower pictures can be seen at a glance and this can be confirmed by taking a ruler to them. But a careful examination can suggest something more. Looking at the picture for Oct 13 we see a form which is obviously sharp and tense, but equally obviously, I think, regular and symmetric. But with the picture for December 26 a new element has entered; the form has become subtly but definitely, asymmetrical. To speak of the bud here as writhing in agony would be to use foolishly exaggerated words but as I contemplate this form I feel it bespeaks what I can only term a sense of unease. As soon as I realised this I got the other photos out again, over 150 of them, and went most carefully through them. This slight element of asymmetry showed in a batch of about ten of them, all taken about the turn of the year, that is when Mars was passing behind the Sun, and in none of the others. One can see traces of it still in the picture for January 13th. This prompted another line of thought and that is to take into account the MRD (mean radius deviation). This is the parameter that tells us how far the form deviates from the true path curve form. During all of October and November the MRD ranged between approximately 1% to 2%; in other words the bud was an almost perfect mathematical form. But during December and January this figure ranged up to 3.5%, 4% and even 4.5%, returning to its accustomed 1% to 1.5% in February and March. We have already seen from our study of the standard deviation that
the day to day behaviour of this bud was disturbed during December and January. Now we find that its actual form was in some way debased during the same period. It would be unwise to generalise wildly on such frail evidence, but these things should be born in mind when proceeding to further research. We need to cultivate a fine sensitivity to these very subtle nuances of form.

Towards the end of January Isis Brook added a further Oak bud to her studies, Lancaster Oak 2. We must remember that apart from the period from the middle of February to about March 8th Mars was encumbered by inhibiting alignments during the whole of this time. When we add to this that on the crucial dates of the actual Moon-Mars alignment, February 27th and 28th, by great misfortune, the photographs failed, we might be excused for wondering whether anything of interest could be expected from this second set of photographs. However it is worth studying as there are some points of distinct interest. This bud was considerably more 'lively' than Lancaster Oak 1, the standard deviation being on the whole between two to three times higher. The first two alignments, (Jan 30th and Feb 12th) are not acknowledged, as we might have expected. We have no way of finding out how much lower the curve might have been carried if the failed photographs of February 27th and 28th had been successful, but even as it is this dip represents the lowest values of the whole set, except for the values of March 7th and 8th, when the disturbing effects of the coming Saturn conjunction must have already been showing themselves; so to this extent the graph yields some small evidence for the correlation. The rest of it appears at first sight to be quite wild. However, if a careful comparison of the two graphs is made it will be found that many of the features of the second coincide quite remarkably with their companions in the first. How far this is really a matter of significance must be left to the judgement of the reader. If this judgement is positive it is a matter of interest as showing that even small features of these graphs can be taken as significant, but since these two buds were growing on the same tree it could not be taken as evidence for a planetary correlation; the changes might have been due to purely local influences coming to bear on that tree.

STRONTIAN OAKS, 1, 2 and 3. Photographed by Lawrence Edwards.

Strontian Oak 1. The results for this bud are shown on page 76. Since I had to be away from home during a large part of November this was necessarily a short series covering the space of only 3 alignments. The first of these was strongly acknowledged, but the next two, although surely shown, less certainly. This bud proved to be a very difficult one to measure, and when I was able to resume work on this species in December I discarded it for another one on a younger tree, Strontian Oak 2.

Strontian Oak 2 proved to be an interesting and responsive bud. Even in mid December, page 77, when Mars was passing towards its conjunction with the Sun, and Lancaster Oak 1 was failing in its rhythm, this bud responded strongly and punctually, on December 17, and it seemed to retain this responsive attitude through a large part of the season. Then, just before Christmas, bad luck struck. My camera broke down (shutter failure) and with the extended Scott-
ish Christmas-cum-New-Year holiday it was not possible to get it replaced until the crucial New Year period was passed. Page 77 shows the sequel. Note the steady decrease in $\lambda$ towards the final opening of the bud in the Spring, and also the fact that dips in the curve coinciding with the downward pointing arrows are only found from the end of February onwards, thus confirming the Lancaster result. What is new here is that a marked dip is shown for the mid-March alignment, in spite of the Saturn encumberment, thus showing that this bud retained its very responsive character right to the end. What this responsiveness has meant in terms of visible form can be seen by looking at page 78, where, as usual, the higher $\lambda$ forms are shown on the top row, with the lower $\lambda$ forms below them.

It is my ambition to obtain sets of observations of some species, say the Oak, over a long period at widely differing places, so that the behaviour of the buds can be compared over a considerable geographical range. This year it has not been easy with the Oak. During the Autumn, for various reasons the record from Strontian was very broken, and from early December onwards Mars was heavily encumbered, first by its conjunction with the Sun, and then Saturn. However for a small space, from the middle part of February to the first week of March, Mars was unencumbered, and it happened that during that short period we had four oak buds under observation, separated by some 300 miles. The graphs for these are shown together on page 79, for easy comparison and this remarkable result gives us the best evidence we have so far that the phase-shift remains constant over such a distance, and that for Spring 1994 this phase-shift was, as nearly as we can expect to find, just +3 days.

To sum up the results of a rather disturbed season we would wish to aggregate all our Oak results. To do this we must answer the question: 'When does encumberment by an inhibiting alignment start, and finish?' Here we cannot seem other than somewhat arbitrary. Experience over a good many years has suggested that the effects of an inhibiting alignment are felt from the time when the alignment has still some 5° to go to completion, but that the after effects often last longer, maybe until the alignment is some 10° beyond completion. Using these figures we would have to say that this winter Mars was free until December 8th and from February 6th to March 6th, but encumbered at all other times.

Thus we need to make two A-graphs to show the final results of this season's work, - the Oak observations aggregated over Mars-free (page 80) and the Oak observations aggregated over Mars-encumbered (page 81). The first of these should be compared with the A-Graph made in previous years, page 21 of this book. It will be found that this early A-Graph is almost identical in form with the present one. It is this kind of evidence which can give us the strongest possible reasons for trusting the significance and truth of this phenomenon. On page 81 we see the A-Graph for the Oak observations aggregated over Mars while that planet was heavily encumbered. Examination of it shows that this is exactly the sort of result which one might expect if there were no true correlation with the Mars cycle. The graph lumbers uneasily across the page, more or less horizontally, but without any discernably visible form.
1993-94
A-Graph over
Mars Encumbered

Oak

Strontian and Lancaster
Ash

The leafbud of the Ash is an interesting but particularly difficult form to deal with. A large and mature tree will have a multitude of buds, but the majority of them will be high up and very hard to reach; on a sapling the buds are easily reached, but there are only a few of them. In either case, if one is working with the multibud method the supply of accessible buds soon runs out, and this is the reason why very little work has been done in the past with this very important species. Working with the single-bud method the difficulties are different, but just as serious, and this is probably the reason why, in the winter of 1982/83, when the single-bud method was tried on it, this species did not show any sign of rhythmic variation. Since then no significant work has been done on it until the winter of 1993/94.

Firstly we must realise that this bud is a complex multiple organ, consisting of at least four component parts—a little budlets, pressed closely together at right angles to one another in an approximately cruciform shape. These budlets do not appear to have a good path curve form individually, but they have the power to merge together into a total shape which is a good, and sometimes almost a perfect, path curve form. This total form has two aspects, a narrow and a broad.

It is the broad aspect which is preferable to work with, and which has been used in the work described here.

The thing only has a good path curve form when the budlets are pressed very tightly together, and the degree to which this happens varies considerably from one bud to another. One needs therefore to be very careful in one's choice of the bud one is going to study. It needs to have a very low M.R.D. (mean radius deviation), but unfortunately such a bud does not always retain this throughout the winter. Cases are not uncommon where the bud starts to fall loosely apart. It then becomes unmeasurable with sufficient accuracy for our purposes, and has to be discarded. The work last winter was considerably impeded by this happening.
For instance, here is a photo of an Ash bud on October 15th at Humble, with \( \lambda = 2.7 \) and MRD = 6.3%. It is far from a good path curve form. Notice how broad and square-looking it is in its upper part, the component buds there only comparatively loosely cohering. In such a case it is difficult to get an exact value for \( \lambda \), and the resulting uncertainties in our results are considerably greater than the very slight and subtle variations we are looking for.

At about the same time another bud was selected, at Strontian; on September 8th it looked like this. Here \( \lambda \) was 3.31, and with an MRD of only 3.9% this might have been considered a more hopeful subject for study. However, perhaps one ought to have been warned by the very marked notch at the tip of the bud. This bud seemed for several weeks to be following an approximately fortnightly rhythm, but then, quite unexpectedly, and without any apparent reason, it started to disintegrate, the component parts near the tip starting to separate from one another.

The second photograph printed here shows how far this process had proceeded by November 1st. Notice how much wider it had become near the tip. \( \lambda \) had fallen to 2.38 and the MRD had risen to 5.0%. As this process continued this bud rapidly became too loose and untidy for accurate measurement and had to be discarded.

A further bud, chosen at Strontian soon after this, went through a similar process and by the early weeks of January this also had to be discarded.

The work with the Ash can thus prove to be disappointing and discouraging. But it need not always be so. This further bud, selected near Lancaster had a quite different history. Notice that the tendency for a wide and square top is much less marked here. This bud had a \( \lambda \) of 2.62 and an MRD of only 0.5%. Its separate parts cohered much more closely together, and as a result it presented an almost perfect path curve form. And it preserved this quality intact from the end of September until the start of the following April.

Even so the work was not easy. Notice that the sides of the bud, as they approach one another near the tip, do so at a very obtuse angle. As a result, as one measures downwards from the tip to find the various levels at which the di-
ameters are to be measured, the very slightest error in the plac-
ing of this level makes a disproportionate error in the measured
diameter. And it is these measured diameters, especially those
near the tip, which are vital for the final results we shall get.
Combine this with the fact that the rhythmic variations in the Ash
are very slight and subtle, and we see why it has been considered
necessary for all measurements of this species to be made independ-
ently by at least two workers, working separately. This being done,
It is found that the agreement between the two sets of measurements
is sufficiently close to ensure that the variation thus found is
safely significant provided that its amplitude, from one maximum of
the curve to the succeeding minimum, is at least 0.1 and preferably
more.

Thus we see that it is important that the bud chosen for study is
one where the component parts are strongly pressed together, and the
sign that this is so is that it should be as perfect a path curve
form as possible. With the last bud illustrated here (Lancaster) the
MRO stayed below 1% for the whole of the six months during which it
was being observed. This being understood we can go on to study the
very interesting graph which eventuated.

The Ash is a species which is traditionally associated with the Sun,
and the arrows have been put into the graph marking the dates of the
Moon/Sun alignments (New moon and Full Moon) consonant with the cur-
rent phase-shift (+4 days for the Autumn of 1993 and +3 days for the
Spring of 1994). We note that all the alignments of October and Nov-
ember are acknowledged by well-marked dips in the curve, but this
rhythm ceases entirely through December and January. The rhythm is
not resumed until the middle of February, with the alignment of the
16th of that month; and thereafter the rhythm is well-marked with
the exception of March 1st, which is only weakly shown. This is of
great interest, especially compared with the graph for the Oak. If
we look at the graph for the Oak we see that the fortnightly rhythm
ceased in early December when Mars started to move behind the Sun.
Here, with the Ash, we see a similar thing, at the same moment. The
presence of the Sun disturbed the Mars rhythm of the Oak, and now we
see the proximity of Mars disturbs the Sun rhythm of the Ash. But in
an opposite way. Mars was moving BEHIND the Sun, but the Sun was
moving IN FRONT of Mars. The Oak—λ climbed to an unprecedented high
point at the end of December; the Ash—λ went into decline; both of
them completely ceased the 14-day rhythm. The downturn for the Oak
and the upturn for the Ash, came at almost exactly the same moment,
co-inciding with the time that the Sun/Mars conjunction was exact.
The two graphs are here mirror images of one another. This is not to
say, of course, that it must always be like this in such circumstan-
ces; obviously much more observation would be needed before we could
say this, but in this case it certainly was so.

We thus see that the Sun, which in a sense has been proving itself
to be a ruling body for the Ash, just as Mars has proved itself for the Oak, was during the winter of 1993/94 in a somewhat similar predicament to Mars. From early December until early February these two bodies were disturbing one another by their close proximity; they were each 'encumbered' by an alignment other than the fortnightly lunar ones. But before, and after, this period the Sun was free. We therefore print here separate A-graphs for these two periods, for the time when the Sun was 'free' and for the time when it was 'encumbered'. These are well worth careful study. In the first we see a graph which is full of form and meaning,—compare it with most of the other A-graphs published in this book,—and in the other we see a graph which bespeaks only random and meaningless variation. It is valuable to compare these graphs with the similar ones published a few pages back for the Oak.
Knapweed 1994

The Knapweed has been under observation since 1985 and during that time has shown a quite characteristic pattern of development each year. At the beginning of the budding season (end of June to start of July) the $\lambda$ of the buds is low, around 1.3, and then during the succeeding weeks it undergoes a progressive rise until at the end of the budding season, in mid August, it has reached a value of about 1.7. This rise is accomplished in a series of fortnightly leaps, the maximum points of which correlate with the rhythm of the Jupiter alignments. The evidence for this is shown in the Supplement and Sequel, Volume 1, pages 01 to 05 and in the graph for Knapweed, 1993, printed earlier in this volume. When it was predicted that this summer Jupiter would be bombarded by the relics of a comet it became of special interest to know how these buds would behave.

For the purpose of comparing this with past experience we need to have a reliable $\lambda$-graph of the way these buds have characteristic-ally developed during the period 1985 to 1993. Because the normal level of $\lambda$ is so different at the end of the season from the start the ordinary method of preparing an $\lambda$-graph is hardly valid here. The following method has therefore been used. Looking at our graph we follow the curve marked 'mean', and at Day-1 we find the mean of all observations made on the day of the Jupiter alignment falling nearest to July 15th in each year. At Day-15 we find the mean of all observations made at the time of the Jupiter alignment succeeding this, and similarly at Day-29 for the Jupiter alignment following that one. When the figures calculated like this were put on to the graph they gave a curve so closely consonant with all that one has experienced through the years that I am satisfied that it gives a true and reliable picture of the normal development of these buds. Above and below the mean curve are dotted curves showing the outer limits of what individual buds did during that period. This means that of all the hundreds of observations made between 1985 and 1993 none will be represented by a point lying outside the space between these curves.

On the same graph we show the individual observations made in 1994, plotted in the same way. Right from the start we see that they are quite different. No single observation has a point lying within the dotted curves, and from the first days of observation $\lambda$ was higher than it had ever been before at such a season; although to a superficial view the buds appeared much as normal, they were in fact displaying a much greater degree of tension in their form than in any previously observed years, and in the days immediately following the moments of impact with the cometary particles (roughly about Day-1 to Day-4), $\lambda$ rose higher still. The behaviour of these buds was at that time quite unprecedented— not only in the height to which $\lambda$ had risen, but also in the fact that the fourteen day rhythm which was seen so clearly in all the earlier years was completely lacking. Nevertheless one would judge that this is hardly evidence for the kind of cosmic catastrophe which some of the more sensational papers had been predicting. From about Day-13 onwards $\lambda$ started to decline and by the end of the budding season it was apparently returning to the general level of its normal value.