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Electronic Device-Mediated pH Changes in Water

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Abstract — Exploratory experiments have been carried out on commercial bottled waters to test the efficacy of a specific human intention to influence the pH of these waters. Two different electronic devices are utilized as the carriers of this specific intention. Experiments comparing (a) the device-absent condition, (b) the device-present, but unimprinted with the specific intention, condition and (c) the physically identical device-present, but imprinted with the specific intention, condition have been carried out. A clear, but somewhat small, effect of the specific intention imprinting has been recorded and studied for Evian water. Ca/Mg carbonate crystal formation occurred in this water during the experiments and somewhat obscured the main purpose of the study. A pH-stable 50/50 solution of a commercially available bottled water and ASTM Type I purified water and a 100% Type I purified water were used for further experiments. The pH–time course of these solutions was monitored for the three conditions (a), (b) and (c) mentioned above. Both short-term and long-term pH behavioral differences were noted between exposure of these solutions to the intention-imprinted devices and the physically identical unimprinted devices. Very robust effects have been recorded with the maximum pH change achieved being 1.0 ± 0.05 pH units, exactly the value programmed by the imprinted intention.

Keywords: intention — pH — water — imprinting — oscillations — non-local effects

Introduction

Although it has been a long-standing postulate of the general scientific community that there is no meaningful interaction between human experimenters and their experiments, a variety of recent studies (Dossey, 1993; Keller, 1986; Krieger, 1973; Quinn, 1984; Quinn & Strelkauskas, 1993) suggest that it is perhaps time to seriously question this postulate. Effects associated with what have been termed "subtle energies" (Tiller, 1993) appear to indicate that humans can, at times, produce robust changes in physical phenomena (Jahn & Dunne, 1987; Tiller, 1997). However, since most humans generally exhibit a

fluctuating internal condition of both physical and subtle energies, they may not be the appropriate test vehicles for investigating such a widely accepted postulate.

An alternative, and less passionate, test vehicle might be some type of electrical device to act as an intermediate between the human and the experiment. In such a case, the human energy field interaction would produce some subtle level effects in the device that are not distinguishable by any physical detectors presently available. The chosen experimental system would then be exposed to this "charged" device to determine if any statistically significant changes occur. Of course, one should also compare this experimental result with a control using a physically identical device, but one not exposed to the human involved in the "charging" process.

A valid test of the postulate would be to use two identical physical devices, "charge" one and isolate it from the other which is "uncharged," and then perform the identical experiment with each. This protocol provides a stringent test condition since most scientists would argue that it is not possible for a human's energy field or intention field to produce physically detectable differences in a commonplace laboratory measurement. Even if it were somehow possible, to capture such a remarkable effect in a physical device would be clearly impossible since the probability would be the product of two highly improbable events. The present authors challenge this conventional wisdom and choose to let the experimental data speak for itself.

The selected experimental platform is a very simple one, which is merely the measurement of pH of a commercial bottled water. Evian water was selected for the initial tests because of its published composition data and ready availability. Initial measurements on Evian water revealed large pH excursions as the water equilibrated with atmospheric CO_2 (it lost CO_2) followed by precipitation of Ca/Mg carbonate crystals. Subsequent experiments using a pH-stable solution allowed pH measurements to be made on a system not precipitating solids.

In the present paper, our initial exploratory experiments with the Evian water demonstrate a clear but somewhat small effect of the "charged" device *vs.* the control on the pH excursion with time. Our experiments with pH-stable water are then presented which indicate robust and reproducible changes of pH associated with the "charged *vs.* "uncharged" device. In what follows, we have chosen to call the "charging process" intentional imprinting and the "charged" device an IIED (intentional imprinted electronic device, see Appendix A). Most of the experimental data are with an IIED for pH-lowering but later work was with an IIED for pH-raising.

Experimental Procedures

pH Measurement

pH-values were measured using Accumet 50 and 150 pH meters (Fisher Sci-

entific, 1997) and fast-response, high-performance, glass combination electrodes. The measurement equipment (Fisher Scientific, 1997) included automatic temperature compensation. Calibration involved using two buffer standards (pH 7 and pH 10 or pH 4 depending on the pH range) to determine both the slope of the linear relation between pH and meter electrical output and the slope efficiency which involves a comparison with the ideal slope. Slope efficiencies ranged between 99.5% and 100.2%. Measurement accuracy was ± 0.01 pH unit. The pH values reported here were obtained after placing the electrode in solutions and measuring pH over a period of time. Normally the pH increases monotonically and approaches the reported value in 20–40 min in unstirred solutions (see Figure 1).

Water Sample Preparation and Experimental Protocol

The Evian water was obtained from retail outlets. This naturally occurring spring water has an initial pH of around 7.00. The first step in its use was to drive out excess CO_2 by stirring which increases pH. Evian water is a Ca/Mg bicarbonate solution with total dissolved solids (TDS) of 300 mg/l

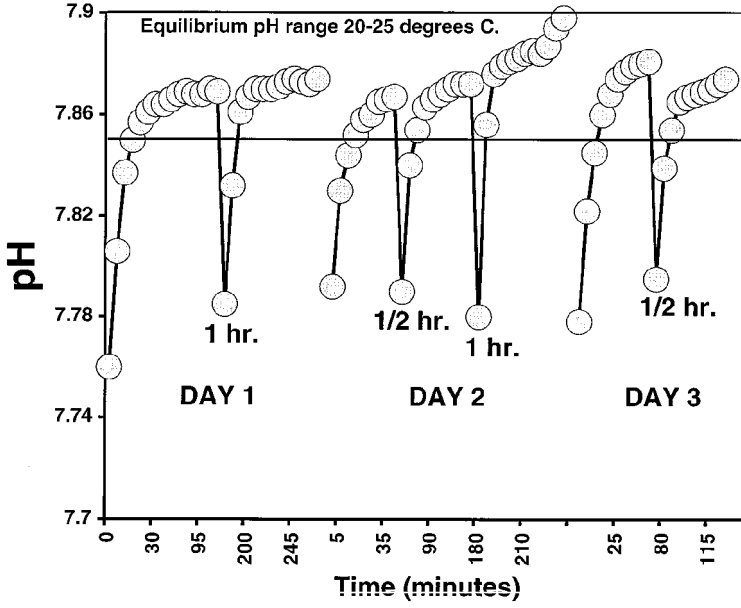


Fig 1. pH *vs.* time for 50/50 dilution of Castle Rock water with ASTM Type I purified H_2O. The solution was in a closed bottle inside a Faraday Cage with a device. After exposure, the bottle was walked several hundred yards to a different laboratory where pH measurements were made. Exposures of varying duration to both types of *unimprinted* devices were performed. Downward spikes represent exposure intervals (duration marked). pH measurements were done on three consecutive days using solution prepared two months earlier in the same 125-ml PP bottle. Horizontal bars mark the equilibrium pH range for temperatures between 20°C and 25° C. Note that the pH values enter the equilibrium range just a few minutes after the electrode is placed in the unstirred solution.

($[Ca^{++}]/[Mg^{++}] = 3.2$). After stirring, the solution is supersaturated with Ca/Mg carbonates. The experimental conditions (temperature, pH and initial calcium concentration) used here are similar to those used in controlled calcite precipitation experiments (Koutsoukos & Kontoyannis, 1984). The prepared solution was placed in plastic containers (125 ml clear polypropylene bottles) and, just before exposure to devices, had a pH in the range 8.35–8.55.

Device exposure was performed as soon after sample preparation as practical since nucleation of fine-grained carbonates can occur soon after stirring. Induction periods are a function of supersaturation (Koutsoukos & Kontoyannis, 1984), which was relatively uncontrolled. Nucleation and growth are also affected by the sample container used and whether the container was open to the atmosphere or capped. The solid precipitate formed in these experiments has not yet been thoroughly characterized.

After sample preparation, the solution was poured into two or more bottles, with at least one of the bottles being a control container while another being exposed to a device. For storage and waiting testing, each bottle was placed in its own electrically grounded Faraday cage constructed from #20 mesh (0.016 in. diameter) copper screen. To evaluate a device effect, a powered device was placed in a Faraday cage with the bottle for periods ranging from 30 min to several hours. Soon after exposure to a device, the bottle was walked several hundred yards to a different laboratory where repeated pH measurements were made over a period of about two weeks. In addition, some "seeded" experiments were performed in which stirred Evian solution was placed in bottles that had been used in previous experiments and contained carbonate precipitate. The bottles were rinsed with deionized water before the new Evian solution prepared by stirring was added. In these experiments, no device exposure was done as a test of possible "memory" of previous exposure retained in the solid or bottle. Also, the freshly prepared solution was placed in new containers as a control.

The pH-stable solution utilized Castle Rock water obtained from retail outlets. This naturally occurring spring water has an initial pH of around 7.10 and a total dissolved solids (TDS) of about 95 mg/l. Castle Rock water is a Ca/Mg bicarbonate solution ($[Ca^{++}]/[Mg^{++}] = 2.0$). Prior to bottling, it is ozonated and filtered through 0.2 μ pharmaceutical grade filters. The first step was to dilute it (50/50) with ASTM Type I purified water that lowered calcium and magnesium concentrations to insure that no precipitation reactions could occur. The next step was to drive out excess CO_2 by stirring which increases pH. The prepared solution was placed in plastic containers (125 ml clear polypropylene (PP) bottles) and has a stable pH in the range 7.875 $\pm$ 0.025 in equilibrium with atmospheric CO_2 between 20°C and 25°C.

After sample preparation, the solution was poured into two or more bottles, with at least one of them being saved as a control bottle and another being ex-

posed to a device. For storage and waiting testing, each bottle was placed in its own electrically grounded Faraday cage constructed from #20 mesh (0.016 in. diameter) copper screen. The experimental set-up for the continuous measurement and exposure experiments is depicted in Figure 2.

Device Construction and Imprinting

The two EM devices used in this study are essentially identical to those of commercial origin (Williams,1997). The single oscillator device of frequency 7.3 MHz is powered by a 4.5 W, 9 V DC, 200 mA transformer from a wall plug and enclosed in a plastic package of dimensions approximately 4 in. × 2.5 in. × 1 in. The three-oscillator device (circuit diagram shown in Figure 3) of frequencies 5.0 MHz, 8.0 MHz and 9.3 MHz is powered by a 6.75 W, 9 V DC, 300 mA transformer from a wall plug and is enclosed in a plastic package of dimensions approximately 7 in. × 2.5 in. × 1 in. When not in use, the devices are encased in Al foil to prevent exposure to light and stored in grounded Faraday enclosures. For the experiments, the device was either continuously connected to its power supply transformer or the Ni–Cd battery was charged overnight and the device was used without its transformer connection to the 110 V line. The imprinting process plus the specific intention used for these experiments are given in Appendix A.

Results

Evian Water

A group of six 125 ml bottles of Evian solution were prepared as described

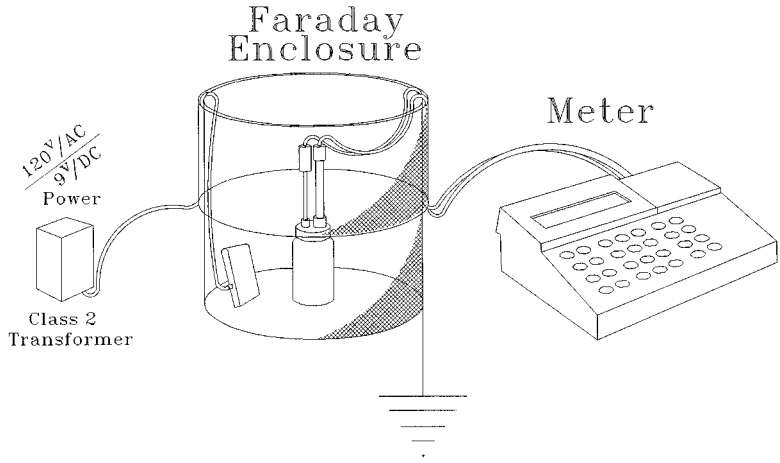
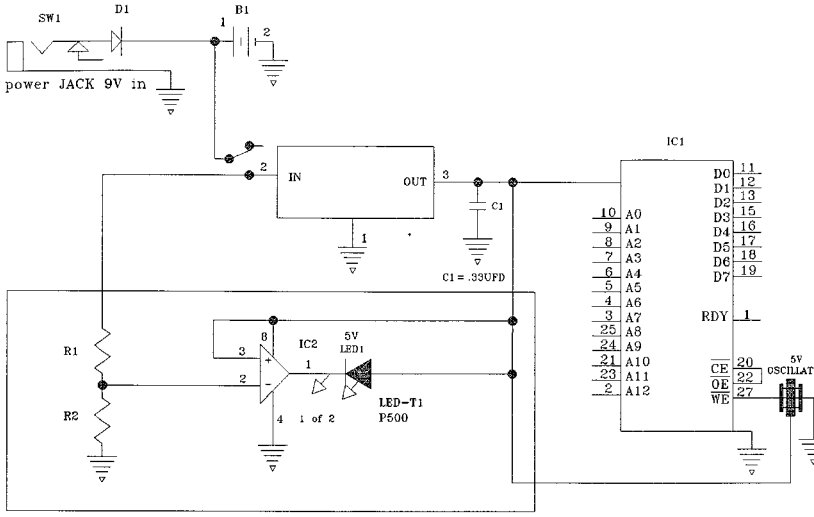


Fig. 2. Schematic drawing of experimental set-up used in simultaneous exposure and pH measurement experiments.



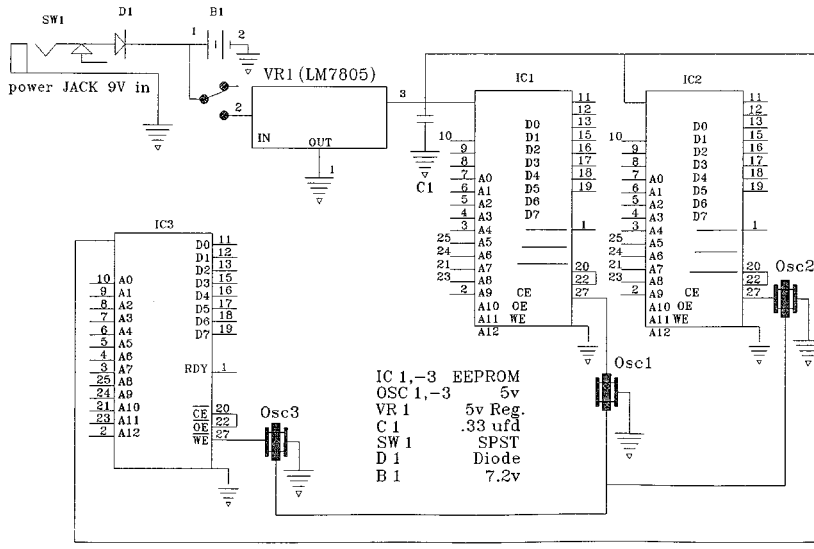


Fig. 3. Circuit diagrams for single- and three-oscillator devices used as the host devices for intention imprinting.

and the pH was measured at approximately regular intervals over several days without any exposure to the devices. The pH *vs.* time data show that the pH long-time asymptote drops exponentially to a value of about 8.00 in six days with a spread in pH values between samples of ± 0.05 pH units. This pH behavior is illustrated with Figure 4 that shows the pH-time course of the control solutions as they asymptotically approach pH_{∞}.

Other similarly prepared solutions were exposed to powered imprinted single-oscillator IIEDs soon after the preparation with one bottle reserved as a control (Figures 5a and 5b). In all cases, the pH drops in the device-exposed solutions exceeded the drops in the control solutions in accord with the imprinted intention. In some cases, pH changes of 0.25 pH units lower than the control solutions were measured. Qualitatively, the rates of pH decline (crystal growth rate) were also greater (Figure 5a) in the IIED-exposed solutions.

In seeded experiments, freshly prepared Evian solution was added to bottles that had previously been used and contained carbonate precipitate after exposure to imprinted devices. There was a small departure from the control pH (pH less than control) only in bottles containing precipitate formed during and after exposure to imprinted devices. When the same bottles were acid-soaked and the experiment repeated, no departure from controls was noted suggesting that there is a "memory" of previous device exposure stored in the crystals.

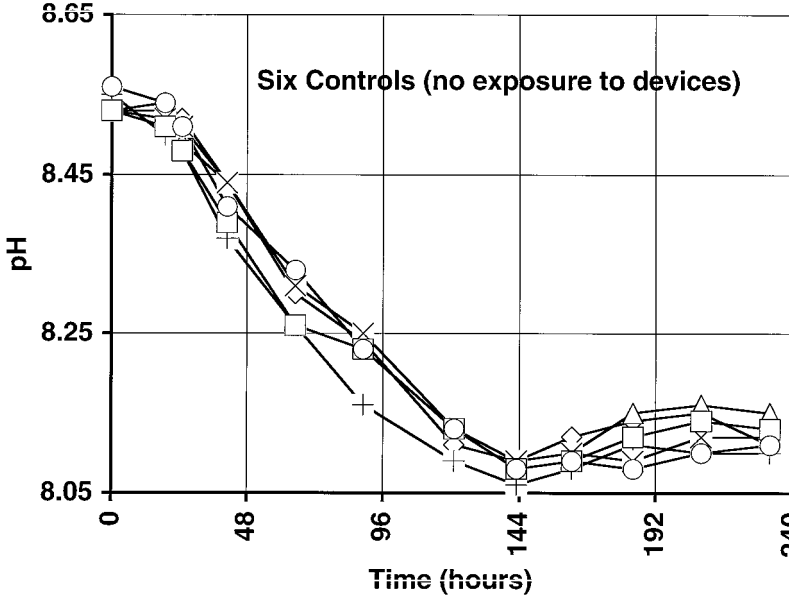


Fig. 4. pH *vs.* time for stirred undiluted Evian water in six control bottles. No device exposure was performed. Stirring removes excess CO_2 from this fluid and causes the pH to increase to a level at which, after a short nucleation induction period, Ca/Mg carbonates crystallize. This crystallization causes the pH to drop to the levels shown. The magnitude of the drop in pH and amount of carbonate crystallization depends strongly on the initial pH among other factors.

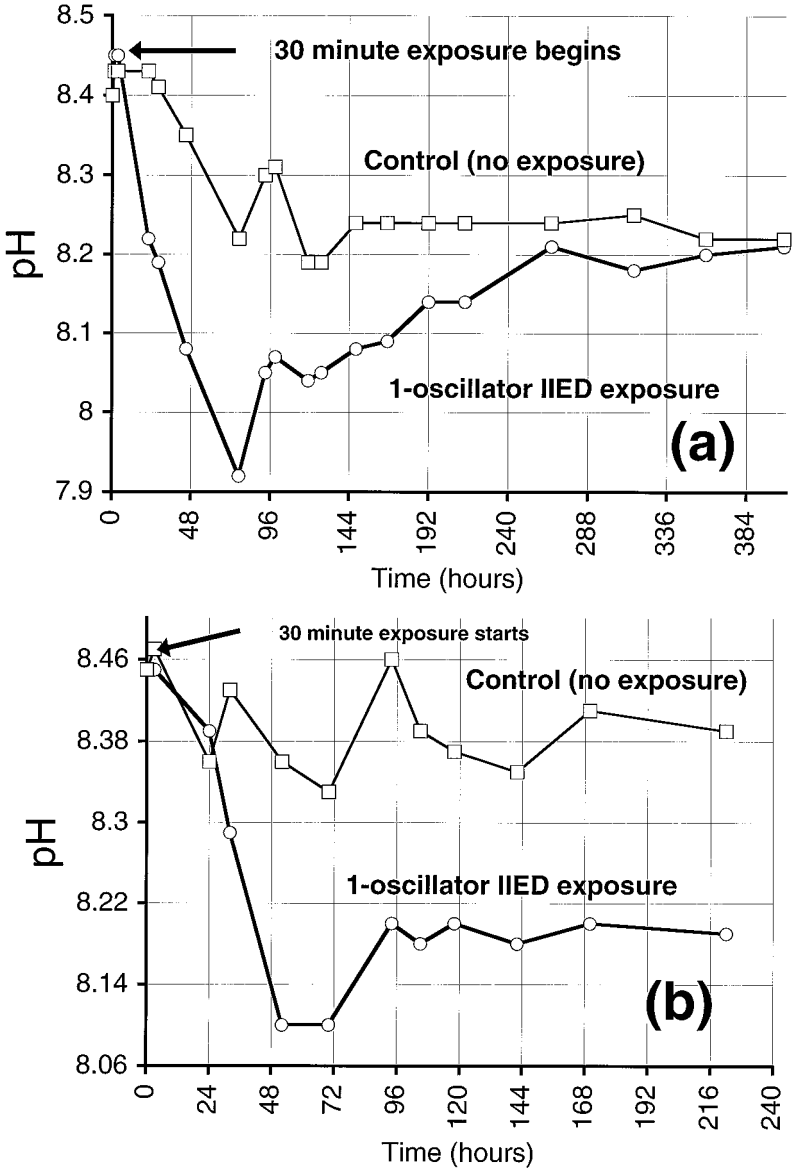


Fig. 5. pH *vs.* time for stirred undiluted Evian water. (a) One bottle was a control and the other was exposed to the single-oscillator IIED for 30 min. Note that the pH of the exposed solution dropped to a value lower than that of the control and the controls shown in Figure 4 even though the starting pH was lower. The initial rate of pH drop was also considerably greater than that in the controls. (b) Another single-oscillator IIED exposure. Another freshly prepared solution was exposed for 30 min and compared with a control solution that was not exposed to devices. Again the pH of the exposed solution dropped to a value lower than that of the control but not lower than that in the control experiments depicted in Figure 4.

These preliminary results suggest further experiments are warranted to evaluate the transfer of imprinting to precipitated crystals.

Castle Rock Water

Four sets of experiments are described below, each with a different experimental protocol. The experimental solution used in each set is the same, however. The pH-time course of the control solution exposed to *unimprinted* devices is shown in Figure 1. pH measurements were carried out on three consecutive days using solution prepared nearly two months earlier in the same 125 ml PP bottle. The dynamic pH values enter the equilibrium range in just a few minutes after the electrode is placed in the unstirred solution (see Figure 1). *The pH values remain in this range for months in the absence of exposure to imprinted devices or to solutions previously exposed to imprinted devices.*

In the first set of experiments using *imprinted* devices and diluted Castle Rock water, sample bottles were exposed to devices at some distance from where the measurements were made (similar to previous experiment on Evian water). Soon after exposure to a device, the bottle was walked several hundred yards to a different laboratory where repeated pH measurements were made over a period of several hours.

Results depicted in Figure 6 show that a small but measurable effect of the *imprinted* devices was observed. Compared with the control measurements

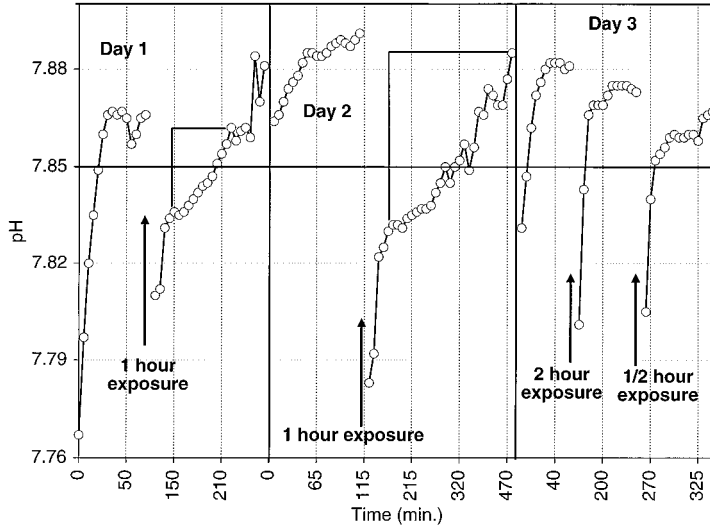


Fig. 6. pH *vs.* time for 50/50 dilution of Castle Rock water with purified H_2O. After exposure to a device, the bottles were taken to another laboratory where pH measurements were performed. Exposures of varying duration to an *imprinted* single-oscillator device were performed. Horizontal bars mark the equilibrium pH range for temperatures between 20°C and 25°C.

depicted in Figure 1, we observed a much-delayed approach of pH to a stable value in the equilibrium range on days 1 and 2 of this experiment. Areas delimited by lines intersecting pH data points for these two days represent the total effect of the device exposure on the pH measurement. The effect increased on day 2 but nearly disappeared on the third day.

In the next set of experiments, exposure of diluted Castle Rock water to devices was done simultaneously with measuring pH so that the pH electrode and the measuring system were also a part of the device-exposed environment (see Figure 2). The pH electrode, once exposed to a device, was subsequently only used with that specific device. Six pH electrodes were eventually used, each for a specific measurement situation.

In the first experiment of this set, we used the same solution that was exposed to the unimprinted devices of Figure 1. The results shown in Figure 7a indicate very little change in pH as a result of imprinted device exposure. Since that particular solution was, by this time, over two months old, there was some concern about the effect of using aged solutions in recording effects of imprinted devices. Also, there was some indication in a previous experiment (Figure 6) that repeated exposures might also produce diminished effects. Fresh solution, therefore, was prepared and this experiment was repeated.

Exposure of freshly prepared diluted Castle Rock water to the *imprinted* three-oscillator device was done simultaneously with measuring pH. The result shown in Figure 7b demonstrates a much greater effect of device exposure on solution pH than seen before. Also observed is a curious "structure" to the pH-time behavior with shoulders, maxima and minima reminiscent of more conventional "spectra". This behavior was also observed in subsequent experiments. In the two days following the last measurement shown on Figure 7b, the pH approached a value of 7.700 (or slightly below) asymptotically.

The experiment described above was repeated three weeks later using 250 ml of the same prepared solution but stored as a "control." The remarkable result shown in Figure 7c shows a similar pH–time behavior but with the structure reduced in magnitude. Note the similarities in the measurements depicted in Figures 7b and 7c. In the first 200 min, there is an initial pH drop followed by two "shoulders," the second being somewhat subdued compared to the first. The pH decline then goes through a maximum rate, followed by another shoulder and another decline into a minimum. Following this minimum, the pH never reaches a lower value but slowly declines in time (several hours) to a value just above it. In the case of the experiment depicted in Figure 7c, the pH increased daily to slowly approach the equilibrium range after seven additional days.

A week after the previous experiment, measurements were repeated using the same solution and device. The result shown in Figure 7d indicates the effect of the device exposure to be waning, but some suggestion of the previously observed structure can still be seen. An additional week later, this experiment was repeated using the same solution and device. The imprinting effect

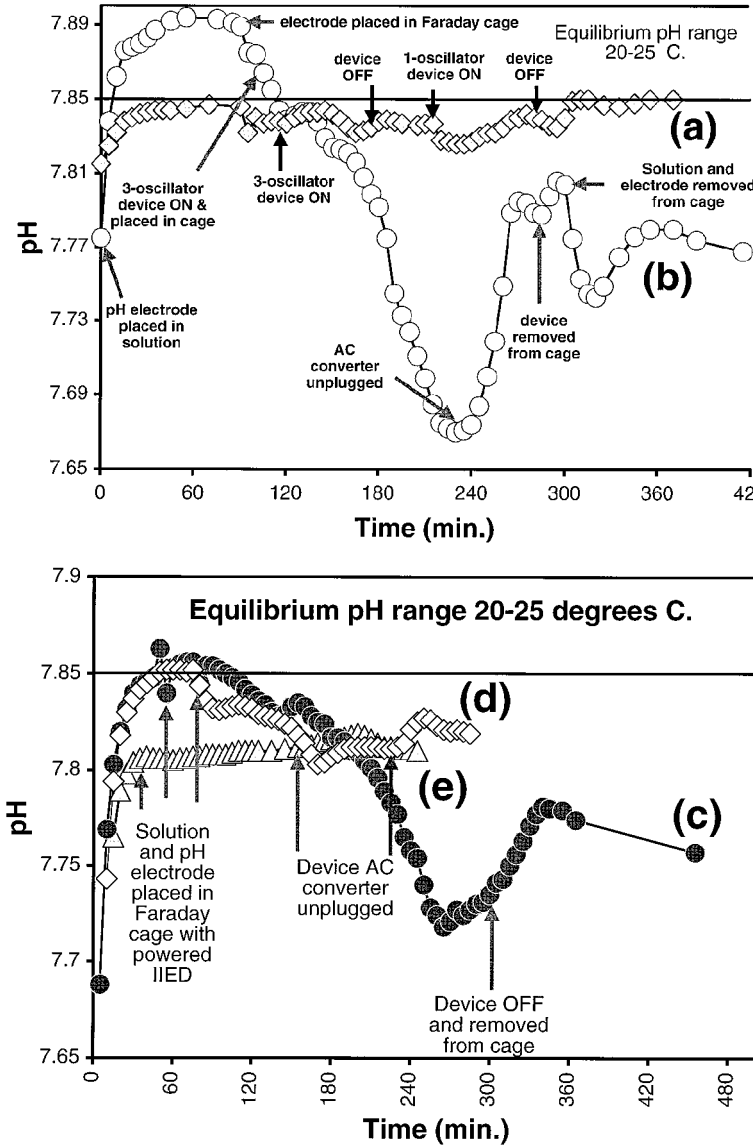


Fig. 7. pH *vs.* time for 50/50 dilution of Castle Rock water with purified H_2O. Top: (a) Measurement of pH was done simultaneously with one-hour sequential exposure to both single-oscillator and three-oscillator imprinted devices. The solution used was identical to that used in the experiments depicted in Figure 1 (prepared on April 11, 1997); these measurements were made on June 12, 1997. (b) Measurement of pH was done simultaneously with two-hour exposure to an imprinted three-oscillator device. The solution in a 125 ml PP bottle was prepared three days before measurement and exposure which began on June 23, 1997. Bottom: Measurement of pH was done simultaneously with exposure to the *imprinted* three-oscillator device. 250 ml of solution in a 500 ml PP bottle was prepared on June 28, 1997. (c) 4-h exposure on July 13, 19997; (d) 2.5 h exposure on July 20, 1997; (e) 1.5 h exposure on July 27, 1997.

iment was repeated using the same solution and device. The imprinting effect was completely gone except for a slight pH lowering.

After simultaneous exposure to devices and pH measurement in experiments such as those discussed above, the solution pH continued to evolve with time in the days following exposure. To track these pH changes, measurements were made on solutions that had previously been exposed to devices. In all cases, the electrode that had been exposed to a particular device was used to measure the pH of a solution exposed to the same device.

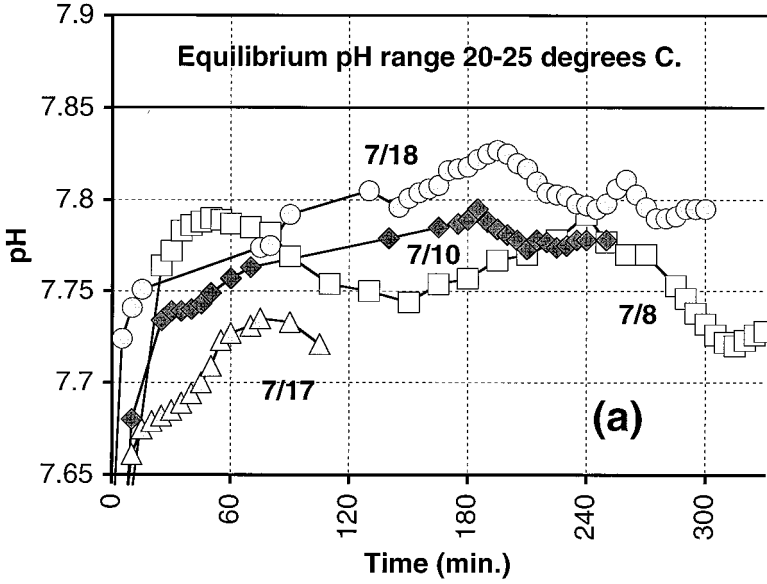
Following the experiments discussed above, an exposure of the previously unexposed "control" solution to the *unimprinted* three-oscillator device was performed simultaneously with pH measurement (result not shown). An initial pH decrease below the equilibrium range was noted followed by an irregular increase in pH on succeeding days. pH measurements were subsequently made on this solution by placing the electrode in unstirred solution and recording the pH–time course until a stable value was approached. Figure 8a shows the result of these measurements on the days following exposure. Not only does the pH vary with time on the scale of days, but a significant variation is observed on the scale of hours as well.

One can contrast this result with exposure of the same initial solution to an *imprinted* three-oscillator device about one month later (see Figure 8b). Measurements were made the same way as before. Note the monotonically increasing pH behavior and steady increase in pH in the days following exposure. This contrast in pH behavior with time was consistently observed. The monotonically increasing pH behavior that is shown in Figure 8b became a consistent marker for solutions exposed to imprinted devices. On the other hand, solutions exposed to unimprinted devices typically displayed irregular pH–time behavior to varying degrees.

The last set of experiments is similar to the second set in that exposure to devices was done simultaneously with measuring pH (see the experimental setup shown in Figure 2). However, the results differ somewhat from that set as described below. As before, the electrode that had been exposed to a particular device was used to measure the pH of a solution exposed to the same device.

In the experiment depicted in Figure 9a, a battery-powered single-oscillator *imprinted* device was exposed to freshly prepared solution and pH was measured during exposure. The pH declined slowly and asymptotically to a constant value several days after the battery had lost its charge. Recharging the device's battery produced an even further decline to another steady value. *The total pH decline was about* 0.50 ± 0.05 *pH units.* The relatively large uncertainty is due to the long measurement period without pH calibration. The pH of this identical bottle of solution, measured after exposure at a different location using completely unexposed equipment, ranged between 7.50 the next day and 7.60 one month later verifying that the profound pH change brought about by exposure to the imprinted device had, in fact, occurred.

Exposure of solution to an unimprinted device and also exposure of solution



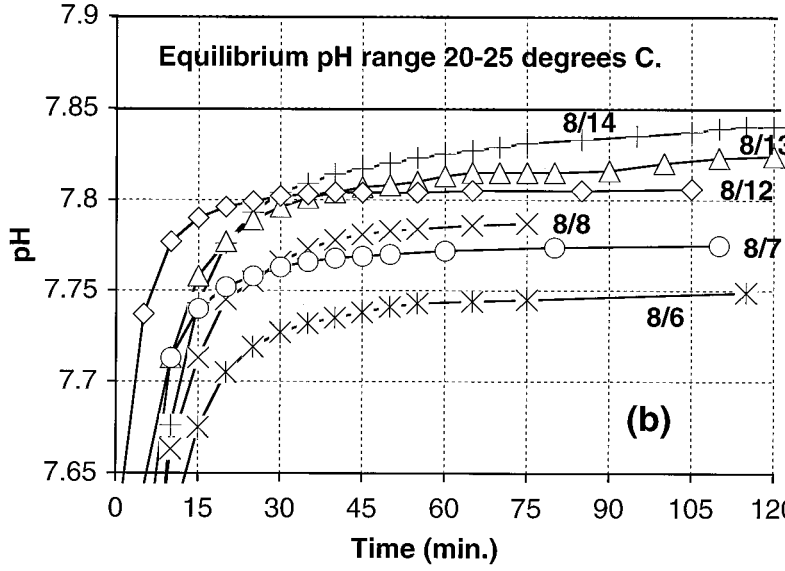


Fig. 8: pH *vs.* time for 50/50 dilution of Castle Rock water with purified H_2O. (a) Measurements were made on a solution that had been exposed to an *unimprinted* three-oscillator device on July 7, 1997. Note irregular pH behavior and oscillation of pH in the days following exposure (solution prepared on June 28, 1997). (b) Measurements were made on a solution that had been exposed to an *imprinted* three-oscillator device on August 5, 1997. Note monotonically increasing pH behavior and steady increase in pH in the days following exposure (solution prepared on June 28, 1997).

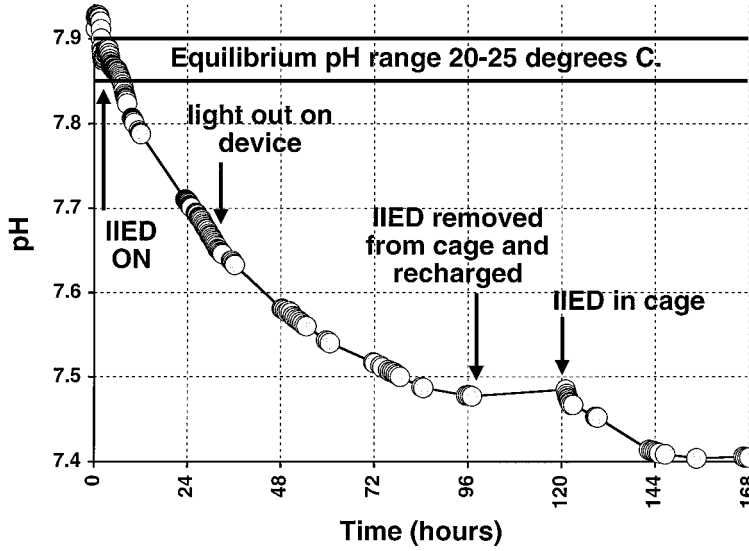
with no device, simultaneously with pH measurement, were also carried out as a check on the results obtained using imprinted devices discussed above. The results shown in Figure 9b indicate a similar pH–time behavior to that shown in Figure 9a except that the pH-lowering effect is much more pronounced using the imprinted device. If the variation in initial pH is accounted for, the result using the unimprinted device in a Faraday cage is almost identical to that using no device (with only the solution and pH electrode in a Faraday cage). Note that, even though the initial pH values are different for the two experiments where no device exposure occurred, the pH values approach each other in time.

In these experiments there may have been some "contamination" of the unimprinted devices from the imprinted devices or from the already exposed solutions causing decreases in pH values. The solution for the two experiments where no device was used was prepared at the same time but, by the time the second experiment was performed, the initial pH had already dropped. It is also important to reiterate here that pH excursions out of the equilibrium range are significant and meaningful. These results should be compared with the results depicted in Figures 1, 6 and 7. The solutions used in the no-device and the imprinted-device experiments were prepared at the same time. Exposure to the single-oscillator imprinted device was occurring at a remote (perhaps not remote enough) location at the same time that the no-device experiments were carried out.

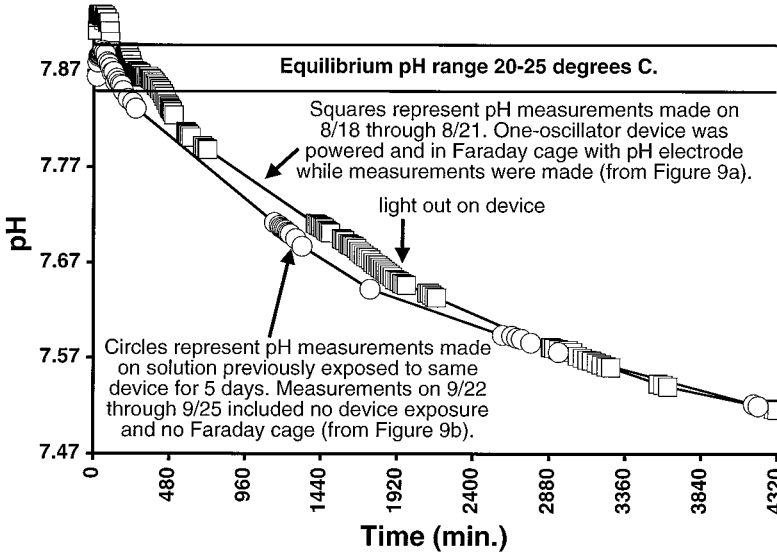
A major surprise was the result shown in Figure 9b for the experiment using the imprinted device. This solution was exposed to the powered, imprinted device for five days in a closed container. The device was then removed and the pH was then measured immediately after exposure. Note that the initial pH starts in the equilibrium range and only begins to decline after the pH electrode is placed in the solution. The pH electrode used in this measurement was previously unexposed to devices. This result is nearly identical to the previous experiment shown in Figure 9a, except that the *pH decline did not start until the electrode was placed in the solution and measurement readings began.* A comparison of these two experiments is shown in Figure 9c.

Preliminary pH-Increasing IIED Experiments

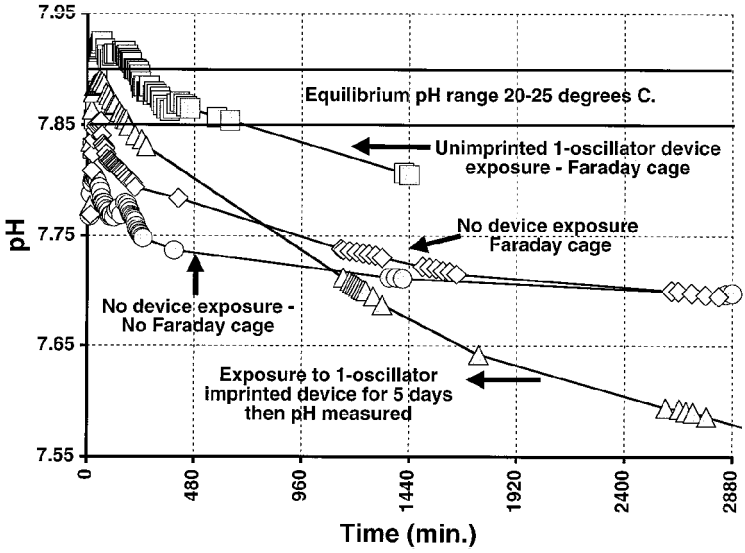
Using the experimental set-up shown in Figure 2 and the same measurement protocol, identical devices were imprinted with the intention that they raise the pH of water by 1 pH unit. The water used here was 100% ASTM Type I purified water in equilibrium with laboratory air. The devices were imprinted on April 4, 1998, and the experiment began on April 14, 1998. . 11ure 10 shows the first five days of data collection. The initial relatively rapid drop in pH is associated with the electrode equilibrating with the very dilute unbuffered water. The initial pH of this water is 5.57 that is consistent with pure water in equilibrium with the CO_2 in laboratory air. This pH drop is followed


Equilibrium pH range 20-25 degrees C.
light out on device
IIED ON
IIED removed from cage and recharged
IIED in cage
pH
7.9
7.8
7.7
7.6
7.5
7.4
0
24
48
72
96
120
144
168
Time (hours)

(9a)


Equilibrium pH range 20-25 degrees C.
Squares represent pH measurements made on 8/18 through 8/21. One-oscillator device was powered and in Faraday cage with pH electrode while measurements were made (from Figure 9a).
light out on device
Circles represent pH measurements made on solution previously exposed to same device for 5 days. Measurements on 9/22 through 9/25 included no device exposure and no Faraday cage (from Figure 9b).
pH
7.87
7.77
7.67
7.57
7.47
0
480
960
1440
1920
2400
2880
3360
3840
4320
Time (min.)

(9b)



(9c)

Fig. 9 pH *vs.* time for 50/50 dilution of Castle Rock water with purified H_2O. (a) Measurement of pH was done simultaneously with exposure to *imprinted* single-oscillator device starting August 18, 1997. Its internal battery only (which loses charge in about 30 h) powered the device. The device's battery was recharged and the device was placed back in the cage with the solution and electrode (solution prepared on August 16, 1997). (b) Measurement of pH was done simultaneously with exposure to *unimprinted* single-oscillator device. The imprinted device-exposed solution shows the greatest pH decline, eventually declining below 7.50. This solution was exposed to the imprinted device for five days in a closed container. The pH measurement was begun immediately after exposure. Note that the initial pH starts in the equilibrium range and only begins to decline after the pH electrode is placed in solution. (c) Measurement of pH was done simultaneously with exposure to the *imprinted* single-oscillator device for the data points depicted by squares but only after exposure for the data points depicted by circles. These curves were extracted from (a) and (b) above.

by a steady rise in pH values that asymptotically approach a pH of 6.6 five days later.

Discussion

Evian Experiments

The chemical evolution of the Evian solutions during these experiments is important to understand before meaningful comparisons can be made between solutions exposed to IIEDs and those not exposed. The Evian solution used in these experiments is a Ca/Mg bicarbonate solution that is oversaturated with CO_2 compared with the same water in equilibrium with the atmosphere. The amount of CO_2 in solution, above that in equilibrium with atmospheric CO_2, is

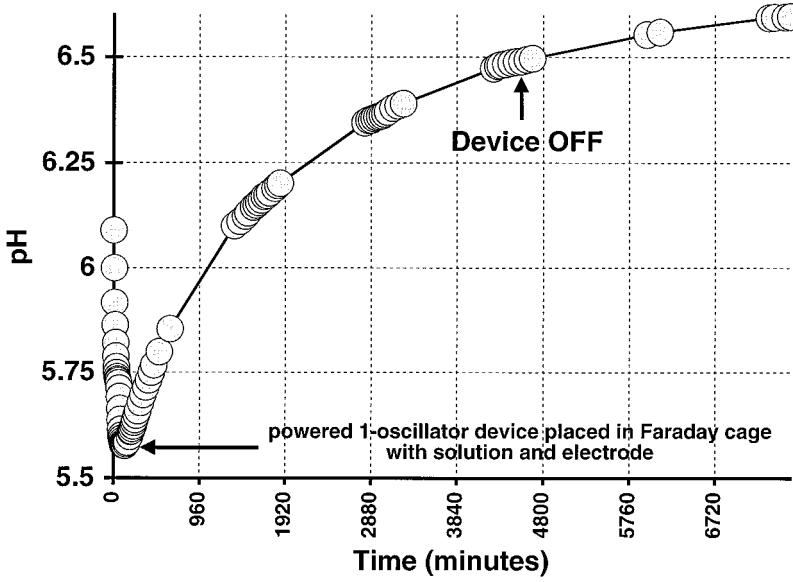


Fig. 10. pH *vs.* time of pure water in equilibrium with laboratory air.

termed "excess" CO_2 in the discussion below. It should also be noted that dissolved CO_2 is actually in the form of carbonic acid (Stumm and Morgan, 1996). In the observed pH range, stirring removes the excess CO_2 *via* the following reaction (Dreybrodt *et al.*, 1996):

$$HCO_3^- + H^+ \Rightarrow H_2O + CO_2 \uparrow \quad (1)$$

As excess CO_2 is removed, the pH increases (H^+ decreases *via* reaction (1)) and eventually produces supersaturation with respect to crystalline Ca/Mg carbonates. In fact, if the pH approaches or exceeds about 8.6, a carbonate precipitate forms while stirring, an observation consistent with the precipitation threshold established by others (Koutsoukos & Kontoyannis, 1984). Such precipitation was avoided by not exceeding that pH while the solution was being stirred. The control solutions approached this pH most closely (see Figure 4) and showed a greater pH lowering than other control experiments consistent with a greater degree of supersaturation with respect to carbonate phases. If the Evian solution is not stirred enough to raise the pH to a value where carbonates crystallize spontaneously, then the solution (1) *remains oversaturated* to varying degrees with CO_2 and (2) for a time does not precipitate carbonates. If the supersaturation is below a certain threshold, nucleation induction periods can be very long (Koutsoukos & Kontoyannis, 1984).

The dissolved excess CO_2 itself can contribute to supersaturation with respect to Ca/Mg carbonates. Reactions that produce both stable (calcite) and metastable (hydromagnesite) phases are shown in Appendix B. Once excess

CO_2 is removed from solution either by stirring or by precipitation of solids or both, the change in solution pH is consistent with a reaction such as

$$Ca^{2+} + HCO_3^- \Rightarrow CaCO_3 + H^+ \quad (2)$$

with the rate of pH decrease, $d[H^+]/dt$, being approximately equal to $d[Ca^{++}]/dt$ which, in turn, is directly related to the total mass rate of calcium carbonate formation. The carbonate crystallization rate is relatively uncontrolled in our experiments because of the variable heterogeneous nucleation on the walls of the container, the variable degree of supersaturation which is a function of both pH and dissolved CO_2 and the effects of Mg and other ions on the kinetics.

The drop in pH from 8.55 to 8.05 shown in Figure 4 parallels the drop measured by Koutsoukos and Kontoyannis (1984) in solutions with similar starting compositions (pH and total $Ca^{++} + Mg^{++}$). However, their reaction was complete in hours as opposed to the several days in our experiments. The presence of Mg^{++} in our experiments probably accounts for the decrease in rates. Although other factors may be involved, Mg^{++} is known to inhibit crystallization of $CaCO_3$ (Katz, 1973). In any case, the retardation in rates compared with strictly controlled "pristine" $CaCO_3$ growth experiments (Koutsoukos & Kontoyannis, 1984) allowed us to observe very easily the effect of the exposure to IIEDs on growth rates. If the rate of pH drop had been as rapid as in more conventional $CaCO_3$ growth rate experiments, there would have been no opportunity to observe the long-term effect of IIED exposure on these rates.

When not in use, both the unimprinted and the imprinted devices are stored in individual electrically grounded Faraday cages in order to minimize energy/information transfer between devices. Although imprinting is thought to occur at non-spatial, non-temporal domains of nature (Tiller, 1993, 1997), some evidence exists to support the proposal that subtle domain substance changes can alter the local magnetic vector potential state which, in turn, produces changes in the local electric and magnetic fields (Tiller *et al.*,1995). This electromagnetic leakage and contamination potential is reduced by Faraday cage storage.

The initial pH values in experiments depicted in Figures 5a and 5b are lower than in the control experiment (Figure 4) which means that supersaturations and rates should be lower. In fact, the pH decreases of the control solutions depicted in Figures 5a and 5b did not approach those in the control solutions shown in Figure 4. *However, the significant result of these experiments is that the more pronounced pH drops occurred in the solutions exposed to intention-imprinted electronic devices.* An interesting feature of this effect can be observed in Figure 5a by the slow approach of the two pHs to the same value. This behavior suggests that a device-exposed solution precipitating more solids than the control can re-equilibrate with time.

The data of Figures 5a and 5b compared with that of Figure 4 suggests at

least two things: (1) The imprinting effect somehow initiates the carbonate precipitation at a smaller solution supersaturation than is found with the control solutions and (2) some type of aging process may be occurring with respect to the family of heterogeneous nucleation catalysts present in the initial solution. The first point has already been noted above since it leads to more rapid pH drops. The second is undoubtedly involved in the starting and ending pH-value differences between the various control solutions. The starting pH values will be strongly dependent upon the degree of initial stirring that occurred before the pH measurements were initiated and, in turn, strongly influence the final pH. Establishment of the final pH also involves equilibration with the local atmosphere and the availability of metastable/stable solid phase particles in the solution that can readily exchange atoms (unpoisoned kink sites) with the solution. Only future experiments can resolve the details of these speculations.

Castle Rock Experiments

To summarize the results for the Castle Rock water presented above, we observed significant pH lowering of solutions exposed to intention-imprinted electronic devices when the measurement and exposure were performed simultaneously. Some pH lowering also occurs in solutions where the measurement is performed in one location after prior exposure to devices in another. There may also be some pH lowering as a result of exposure to solutions that had already experienced prior device exposure or to imprinted devices operating in a remote location. In all cases, the pH drop was observed to be the greatest for solutions exposed to nearby imprinted devices.

The consistent result of these experiments is that a pH lowering was produced by the imprinted devices, although this did not always occur for reasons that may relate to the history and aging of the solutions. Also, the details of the observed pH lowering changed during the course of the experiments making it difficult to ascribe reproducible characteristics to the pH–time behavior. The fading of the pH lowering effect illustrated in Figures 7b–7d may relate to the leakage rate from the device or to the fact that an aged, previously exposed solution becomes more refractory with time in regard to recording effects of imprinted devices.

The results described above may relate to the slow conditioning of the experimental system to the effects of imprinting. As such, this conditioning may still be occurring leading to slightly different results with time. It may also be possible that the devices somehow "drive" the output of the pH electrode and meter producing a significant pH lowering that is merely an artifact. This possibility seems to be ruled out by the results shown in Figures 9b and 9c where no device exposure occurred while measurements were made (the solution having been exposed previously) producing an almost identical result to the experiment characterized by simultaneous measurement and exposure. Some

"cross-talk" between measurement system and devices cannot be totally ruled out, however.

There is also a possibility that, in long simultaneous exposure and measurement experiments, the slow flow of KCl filling solution may cause a decrease in pH. Measuring the pH of this solution and calculating the pH effect of the small observed drop in the level of filling solution indicates that a slight pH lowering can be expected but cannot account for the large drops observed within experimental error. The maximum pH lowering effect achieved in the Castle Rock experiments was 0.5 ± 0.05, a factor of two less than that set by the imprinted intention.

Pure Water Experiments

The final experiment (Figure 10) using a device imprinted with an intention to raise, rather than lower, pH shows conclusively that the pH changes induced by imprinted device exposure are not an artifact of the measurement system. Here we see the pH increasing by almost exactly one pH unit. A factor of 10 decrease in H^+ content *via* an intention-imprinted device is a robust signature indeed!

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Appendix A

Imprinting Treatment

In an attempt to objectify the effect of human intention on the generation of energy/information fields that might influence physical processes, devices of a particular electronic nature were selected as "host" vehicles to be "charged up" with some presently undefined quality. We arbitrarily call the charging up process "imprinting" so that, in essence, what then became available as an experimental variable on any physical measurement was (a) the device-absent condition, (b) the unimprinted device-present condition and (c) the imprinted device-present condition. These two devices differ, if at all, only with respect to the unconventional energy/information changes in the imprinted device as a result of the imprinting treatment. Since commercial devices, reportedly useful for this kind of treatment, were readily available (Williams, 1997), they were duplicated for our initial experiments.

Tiller (1997) has given a suggested theoretical model for the imprinting process in a recent book. The actual imprinting procedure is a follows: (1) place both the single-oscillator and the three-oscillator devices along with their current transformers on a table around which the imprinters sit, (2) four people (two men plus two women) who were readily capable of entering an ordered mode of heart function and sustaining it for an extended period of time, sat around the table ready to enter a deep meditative state, (3) a signal was then given to enter such an internal state and, shortly after having achieved that internal state, a signal was given by one of the four to put attention on the table-top objects and begin a mental cleansing process to erase any prior imprints from the devices, (4) after 3 or 4 min another signal was given to begin focusing on the specific prearranged intention statement for about 10–15 min, (5) next, a final signal was given to shift focus to a closing intention designed to seal the imprint into the devices and minimize leakage of this essential energy/information from the devices. This completed the process and the four people withdrew from the meditative state and returned to their normal state of consciousness.

It should be made clear that a wide variety of options and variants exist with respect to the erasing, imprinting and sealing phases of this treatment process for these devices. The specific imprint definition for the present experiments

was "to activate the in-dwelling consciousness of the system so that the IIEDs decrease (or increase) the pH of the experimental water by one pH unit, or increase (decrease) the H^+ content of this water by a factor of 10, compared to the control."

Appendix B

Stable and Metastable Carbonate Phase Formation

Any or all reactions (B-1) through (B-3) could remove CO_2 and cause a decrease in solution pH:

$$CO_2 + H_2O + Ca^{2+} \Leftrightarrow \underset{\text{calcite}}{CaCO_3} + 2H^+ \qquad \text{(B - 1)}$$

$$CO_2 + H_2O + xCa^{2+} + (1-x)Mg^{2+} \Leftrightarrow \underset{\text{magnesium calcite}}{Ca_xMg_{1-x}CO_3} + 2H^+, \; x > 0 \qquad \text{(B - 2)}$$

$$3CO_2 + 8H_2O + xCa^{2+} + (4-x)Mg^{2+}$$
$$\Leftrightarrow \underset{\text{Ca - bearing hydromagnesite}}{Ca_xMg_{4-x}(OH)_2(CO_3)_3 \bullet 3H_2O} + 8H^+, \quad x < 1 \qquad \text{(B - 3)}$$

Before excess CO_2 is removed from solution, expressions such as these probably represent the dominant pH-lowering reactions in the experiments described above as evidenced by the fact that the pH decrease can be *reversed* by opening the container to allow the escape of CO_2. The relative rates of CO_2 exsolution *vs*. Ca/Mg carbonate growth determine the eventual fate of excess CO_2 in these solutions. The rate of CO_2 hydration (or dehydration) is much slower than dissociation of carbonic acid (Dreybrodt *et al.*,1996) and, depending on the supersaturation, may be slower than nucleation and crystal growth rates as well.