ANON. May 76
Smithsonian
Phenomena, comment & notes

With no carbon in the fuel, the only pollutant would be oxides of nitrogen, but these are avoided by inducting tiny droplets of water (condensed from the exhaust) into the combustion chamber.

With visions of Hindenburgs dancing in the public's heads, the hydrogen bus makers, the Billings Energy Research Corporation, have stored the fuel in non-gaseous form in metal hydrides. The bus, Billings claims, will go 100 miles without refueling. And the hydrogen, they say is cheaper to produce—from low-grade coal—than the cost of refining gasoline.

It seems that, indeed, this is a bus worth waiting for.

A poise for silence

Last month we heard about Ambisound, a British invention whereby the listener is totally surrounded by sound. This month brings news of an even more sophisticated intrusion that is on the drawing boards: holographic television.

Holography is the technique whereby, with the use of lasers, one can produce a three-dimensional image. Its inventor won a Nobel Prize for it, but holography is still in its developmental stages and appears to many to be a technology in search of a function. Now *The Futurist* (Volume X, Number 1) suggests that in 15 years we may be able to "create an endless variety of pleasantly ambiguous or structured forms which float through the room bobbing to piped-in electronic music." The lonely shut-in may be able to create a host of friends. Harvey the rabbit will become more than an image in Elwood P. Dowd's mind.

The Futurist goes on to say that " the teen-ager may lose all poise when his favorite rock group is optically created in the living room complete with quadraphonic sound." All very well, yet one cannot but think that it will be the parents, and not the teen-agers, who will lose all poise.

The turtle as compass needle

Legends abound in Central America about turtle-shaped rocks that face the sea but occasionally turn like compass needles to face inland. At such times, the sea turtles return to their traditional nesting beaches. The legends are no doubt ancient, and one wonders if their source may not have been found by

Feb 5, 76

Vincent H. Malmstrom, a geographer at Dartmouth College. p390

He reports in *Nature* (Volume 259, Number 5542) the discovery of "strong circumstantial evidence" that the pre-Columbian people of Izapa, in Chiapas state on the Pacific coast, knew about magnetism and may have associated it with the navigational abilities of sea turtles. (Other scholars have found such things as a shaped piece of hematite, which the Olmecs must have used as a magnet.) The Mayans were familiar with mercury, in which one can float magnets.

Dr. Malmstrom's evidence is a large stone turtle head. No matter where a compass is moved along the perimeter of the head, the needle points to the turtle's snout. Other nearby sculptures include a representation of an upturned turtle shell, an excellent bowl for floating a magnetic needle on a piece of wood. "It may be interesting to note," writes Dr. Malmstrom, "that the theory that turtles navigate by magnetism has not yet been discounted."

Is magnetism hazardous?

Elsewhere on the magnetic front, *Science News* (Volume 109, Number 13) reports some speculation that reversals in the Earth's magnetic field may have led to extinctions of species on a grand scale. Species of radiolaria, foraminifera, even mollusks, vanished for good during the times of magnetic reversals.

No one knows the mechanism: it might be that with weakened magnetism, more cosmic rays strike the Earth, or that the climate changes drastically, or that the ozone layer is reduced, permitting an excess of ultraviolet to hit the Earth. Some say there is no mechanism, no cause and no effect.

Perhaps the sea turtles know. After all, if they do navigate by magnetism, things must have gotten pretty confusing for them during times of reversals.

Trivia

Farm Journal has one for the folks who produce the Guinness Book of Records. A North Carolina farmer named Edward E. Weeks has just broken a 40-year-old record by growing a watermelon that weighs 197 pounds. The melon contained 1,717 seeds.

JAMES K. PAGE JR.

The critical Reynolds number for oscillatory flow is frequency dependent[2], and the parameter which determines the variation from the steady flow case is the Valensi number, N_V, where $N_V = \omega r^2/\nu$.

According to Park and Baird[3] the critical Reynolds number increases from 2,000 when $N_V > 30$. In the apparatus described this happens when $\omega > 7$ so that, for the frequency range in which the drag reduction occurs, the critical Reynolds number should still be about 2,000. It would seem that anomalous results are obtained when comparing the reduction of pipe wall drag for steady and unsteady laminar flows.

We draw attention to this because of its possible application. It is a small part of a more fundamental study under the direction of Dr W. D. McComb[4], to whom grateful acknowledgement is made.

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Knowledge of magnetism in pre-Columbian Mesoamerica

That the pre-Columbian peoples of Mesoamerica were familiar with the property of magnetism has been suggested by numerous researchers, among them Coe and Fuson[1]. Indeed, a flattened oblong piece of haematite discovered by Coe during the excavation of the Olmec site of San Lorenzo in southern Veracruz state in 1973, has been thoroughly examined by Carlson[2], who suggests that it probably was manufactured for use as a compass. Fuson has argued that the varied alignments of architectural complexes in many Mayan ceremonial centres may be explained by their having been oriented to compass directions which changed through time; and further, that the Mayas' knowledge of mercury would have permitted them to use vessels filled with this liquid, as well as the water-filled calabashes, to float their 'needles' or lodestones. In January 1975 during field studies at Izapa, in the Pacific coastal plain of south-eastern Chiapas state, I discovered strong circumstantial evidence that the people of this Late Formative ceremonial centre not only knew about magnetism but possibly even associated it with the homing instinct of the sea-turtle.

Fig. 1 Carvings of snake and turtle heads at Izapa, located 30 m SE of the main pyramid.

While examining astronomical alignments of various of the structures at Izapa, I took a bearing along the axis established by two large sculptures located ~30 m south east of the main pyramid (Fig. 1). In common with the river cobbles that make up the facing of the pyramids and platforms of the site, the sculptures consist of dark brown basalt. Apart from the fact that they are larger and have been specially carved, they are in no way distinguished from the other exposed rock at the site. The smaller of the two sculptures measures 89 cm in length and is unmistakably a representation of a snake head. Some 114 cm behind the snake head, that is, further SE, stands an upright stone stela, roughly squared off but having no discernible carvings on any of its faces. A further 256 cm SE is a second stone sculpture, this one measuring 114 cm in length and 122 cm across at its widest point. This stone unquestionably depicts the head of a turtle. When a Brunton compass was brought near the turtle head a sharp deflection of the needle was observed, of more than 60°. No matter where the compass was moved along the perimeter of the sculpture, the needle continuously pointed to the snout of the turtle (Fig. 2). Discovery of this magnetic field prompted the testing of all other exposed rock at the site for magnetic properties, but no others were detected. This would suggest that the Izapans knew about magnetism in that they had reserved a basaltic boulder rich in iron for their carving of the turtle-head, and had executed it so carefully that the magnetic lines of force all came to a focus in the snout of the turtle.

Fig. 2 Close-up of turtle head, with compass needle pointing toward snout.

The magnetic turtle-head is not the only representation of this creature found at Izapa. Overlooking the western end of the ceremonial ball court is a large altar carved from a single piece of basalt which is also unmistakably a turtle. A few metres to the south of this altar, adjacent to the wall of the main pyramid, is another sculpture, which has the appearance of an upturned turtle shell, again carved from a single basalt boulder. The latter would obviously have become filled with water during the rainy season, and may well have provided the frictionless surface needed for a shaving or needle of lodestone, floating on a small piece of wood, a leaf, or a straw, to serve as a compass. Clearly the Izapans, a sea-faring people, were impressed by

the navigational ability of turtle[2], which are common in this area. It may be interesting to note that the theory that turtles navigate by magnetism has not yet been discounted[3].

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Fish kill at low *p*H in a Norwegian river

THE decline in freshwater fish populations in parts of southern Norway is associated with increasing acidity in rivers and lakes[1]. The salmon has been eliminated from many rivers, and hundreds of lakes have lost their trout populations. The chief cause of increased acidity is acid precipitation which is the product of the emission, oxidation and long-distance transport of air pollutants, particularly sulphur dioxide[2,3]. Similar observations of acid rain and the disappearance of freshwater fish populations have been made in the United States, Canada and Sweden[4–6].

Few cases of massive fish kill due to low *p*H have been documented in natural environments. A massive fish kill in the Tovdal River in southern Norway in the spring 1975 provided an opportunity to investigate physiological changes in the affected population. Formerly a major salmon river, the Tovdal River is now devoid of salmon, *Salmo salar* L., but still has a population of brown trout, *Salmo trutta* L. The catchment area of the river is characterised by highly resistant bedrock, mainly granites and gneisses with thin and poorly developed soils. The valley is sparsely populated and has no industry. When the fish kill was noticed, the river was partly covered with ice and the bottom was littered with thousands of dead trout over a stretch of at least 30 km. The fish kill was apparently associated with an influx of pollutants during early phases of snow melting[3].

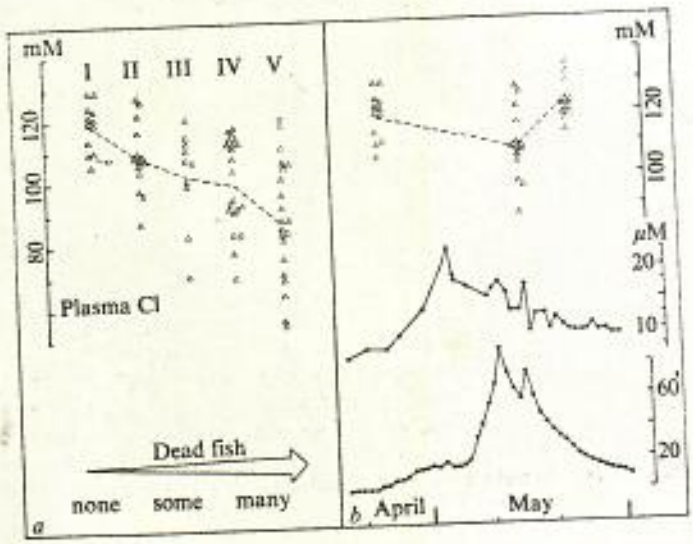

Fig. 1 *a*, Chloride content in the blood plasma from *Salmo trutta* collected from different localities along the Tovdal river. The field stations are ranged in order of increasing fish mortality: station V had many dead fish, station I had none. The fish are a fairly representative sample of the population at each locality. Their weight varied between 17 and 250 g. Blood samples were taken by heart puncture in heparinised syringes within 30 min after capture, and the plasma was separated immediately by centrifugation. Chloride was determined coulometrically on 20-μl samples. The analyses were performed in a mobile field laboratory. *b*, Water flow in the upper part of the river (station I) before, during and after the major snow melting, April 16 to May 30 ($m^3\ s^{-1}$, lower curve). Acidity of the water was measured as *p*H and recalculated as μM H^+ (centre curve). Plasma chloride (△) from the trout population at station I taken on April 23, May 15 (0 °C) and May 23 (6 °C).

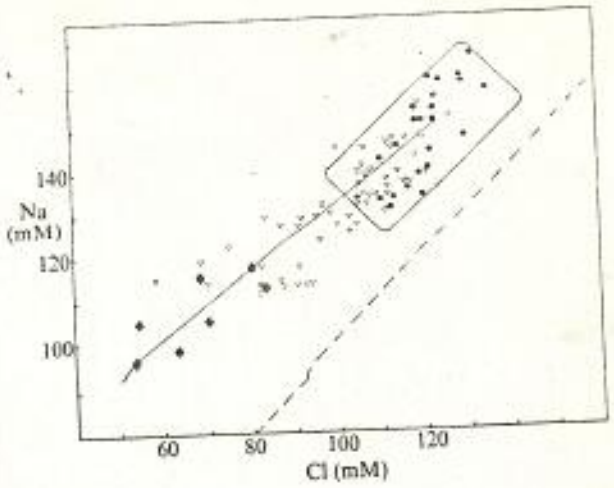

Fig. 2 Plasma sodium plotted against chloride from field localities with different degrees of fish mortality. The frame at the upper right corner indicates animals from station I, with no dead fish. Aberrant behaviour includes: lack of avoidance reaction, spiral swimming, and loss of equilibrium at the moment of capture. Plasma cations were determined by atomic absorption spectroscopy at 1/200 sample dilution. The linear regression line drawn has been calculated: $Na = 0.746Cl + 55.35$, $r_{xy} = 0.89$. – – –, Equimolar concentration for sodium and chloride. Temperature 0–6 °C. ●, No dead fish; △, many or some dead; diamond, aberrant behaviour.

Live trout were captured in shallow water by electrofishing, and blood samples were drawn immediately. Blood plasma was analysed for Na, K, Mg, Ca and Cl. The fish population in the upper reaches of the river was found to be unaffected, and we were thus able to compare this population with samples of surviving trout from the area of severe fish kill. Figure 1 shows that most of the surviving population at the location with the highest incidence of dead fish (station V) had lower plasma chloride contents than those from the unstressed locality (station I). Fish from localities with fewer dead fish show intermediate values (station II, III, and IV). In Fig. 2 the plasma chloride has been plotted against sodium for all the field data. As might be expected, the decrease in plasma chloride is accompanied by a reduction in sodium. The calculated regression shows that for each chloride ion lost there is a decrease in sodium of 0.75 ions.

At the upper reaches of the river (station I) the snow started to melt on April 21, and continued at a moderate rate until May 6 (Fig. 1*b*). The increased acidity shown in Fig. 1*b* during the early phase of melting was accompanied by a similar increase in sulphate and other components associated with acidic precipitation. During this early phase of melting, pollutants accumulated in the snow pack are leached out[3] and may reach the river unchanged because of frost in the ground. Blood samples taken on May 15, contained significantly less plasma sodium and chloride than samples taken before and after the snow melting. The *p*H had dropped from 5.2 to a minimum of 4.65 (23 μM) in the early phase of melting, but values as low as *p*H 4.0 (100 μM) was registered in some of the small tributaries to the main river.