Lead toxicity from water

SIR — In your discussion[1] of the merits of controlling various sources of lead, you suggest that greater importance should be given to the control of lead in dust. No method of dust control is specified, nor can we think of any feasible method. Our evidence suggests that the control of water lead by water hardening could be of greater general benefit than the control of dust.

Table 1 shows data for representative samples of children aged 1–3 years with their mothers, living in an area of very high soil-lead contamination from old lead mining, alongside a major road, in a *cul de sac* and in a small village. The subjects may be ordered according to the levels of house-dust lead to show the relative importance of dust in the blood lead of children and parents. The difference between the house-lead levels of dwellings on major roads and those in *culs de sac* is only 13 per cent. If dust on children's hands, estimated by a "wet wipe" technique[2,3] is also considered, there is no consistent pattern between children living alongside a major road and those in *culs de sac* or a village. Only in the area of exceptionally high lead contamination is there any large and significant correlation between dust and the lead on children's hands. On dietary lead, as it is

Fig.1 The relationship of blood and water lead in women in a soft water area and in a hard water area.

hibitors, neither of which has much appeal.

On water lead, several studies suggest a curvilinear relationship between water lead and blood lead[7-9]. Figure 1 shows data for two random samples of women, one sample from a hard water area ($n = 83$), the other from a soft water area ($n = 106$). In addition to indicating a difference in blood lead in the presence of raised water lead levels, these data suggest a difference in subjects in dwellings with negligible water lead. This suggests that hard water may reduce the absorption of lead from sources other than water, such as food.

These conclusions have been supported by an intervention study[10]. A random sample of women stratified by water lead level

in a plumbosolvent area showed a reduction of blood lead with hardening of water. A reduction in blood lead was shown even where initial water lead levels were negligible; no reduction was shown in a nearby area where water was not hardened.

In general, the highest blood lead levels seem to occur in soft water areas[11], so our data suggest that the hardening of soft water supplies could make a substantial contribution to the general reduction of blood lead in this country.

J. GALLACHER
L. HARRIS
P.C. ELWOOD

MRC Epidemiology Unit,
4 Richmond Road,
Cardiff CF2 3AS, UK

1. *Nature* 302, 641 (1983).
2. Sayre, J.W., Charney, E., Vostal, J. & Pliss, I.B. *Am. J. Dis. Child.* 127, 167-170 (1974).
3. Charney, E., Sayre, J. & Coulter, M. *Pediatrics* 65, 226-231 (1980).
4. Heards, M.J. & Chamberlain, A.C. *Hum. Tox.* 1, 411-415 (1982).
5. Farber, B.T. & Wei, E. *Tox. appl. Pharmac.* 27, 685-691 (1974).
6. Bushnell, P.J. & DeLuca, M.F. *Science* 211, 61-63 (1981).
7. Thomas, H.F., Elwood, P.C., Toothill, C. & Morton, M. *Lancet* i, 1047-48 (1981).
8. Thomas, H.F., Elwood, P.C., Welsby, E. & St Leger, A.S. *Nature* 282, 712-713 (1979).
9. Moore, M.R., Meredith, P.A. Campbell, B.C., Goldberh, A. & Pocock, S.J. *Lancet* ii, 661-662 (1977).
10. Elwood, P.C., Phillips, K., Lowe, N., Phillips, J.K. & Toothill, C. *Hum. Tox.* (in the press).
11. Pocock, S.D. *et al. J. epidem. Commun. Hlth* 37, 1-7 (1983).

Table 1 Lead levels in areas with differing dust lead levels

Area	n	a	b	c	d
High soil lead	61	348	20.4	1.09	0.57
Major road	42	200	15.1	0.80	0.43
Culs de sac	30	177	12.9	0.71	0.43
Village	32	177	14.1	0.85	0.38

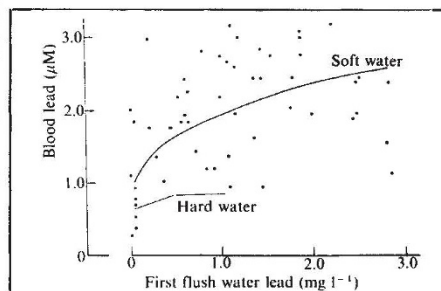Key: *a*, Household dust Pb (μg per g); *b*, children's hand Pb (μg per g); *c*, children's blood Pb (μM); *d*, maternal blood Pb (μM).

Table 2 Mean milk consumption and blood lead levels in women and children and the correlation coefficient (*r*) between them

	Women ($n = 175$)	Children ($n = 39$)
Milk consumption (ml per day)	346 ± 222	625 ± 358
Blood lead (μM)	0.60 ± 0.32	0.48 ± 0.19
Correlation coefficient	0.09	-0.08

± Indicates standard deviation.

known that calcium interferes with the absorption of lead[4], we have examined the relationship with milk as a potential inhibitor of lead uptake. Table 2 shows data for children under 14 years and their mothers in a village in North Wales. No support for the hypothesis that milk consumption affects blood lead was found. There are several possible explanations[5,6] but the dietary inhibition of lead absorption by milk is certainly not a simple matter and the control of dietary lead could be accomplished only by more expensive controls on processing and packaging or by the addition to food of lead absorption in-

Pyrex, quartz and "polywater"

SIR — Professor B. Derjaguin states[1] that certain samples of polywater "were products of leaching of quartz in the water condensate. This is the most reliable confirmation of the need to explain why *the dissolving power of water formed by condensation of vapour is many times greater than that of liquid watewr at the same temperature*" (emphasis added). The statement in italics would be important, if correct, because it proposes differential solvent properties of water, as a function of elapsed time since condensation. If this were the case, all capillaries in a Derjaguin experiment would contain "polywater". In fact "polywater" columns are found in only about 10 per cent of quartz capillaries occupying only about 20 per cent of the interior volume[2].

I have proposed[2], an alternative interpretation of the phenomena in Pyrex and quartz capillaries. My interpretation was that Pyrex contains hygroscopic alkaline compounds partly localized in microregions of the inner surface of the capillary tubes in which "polywater" is produced. These microregions preferentially attract water molecules from the vapour phase, forming microdroplets of highly concentrated alkaline solution which attack the adjacent Pyrex surfaces, forming a hygroscopic silicate solution. Droplets of the latter attract more water molecules from the vapour phase, until a

visible liquid column develops. This liquid has the composition and properties of a sodium silicate solution, in accordance with the analytical determinations. The effect is not observed when the capillaries are filled with liquid water as the alkaline solution is too dilute.

A similar sequence of events may occur in purified quartz capillaries if the extremely low proportion of impurities is represented by alkaline compounds segregated in microregions. In addition, there is the possibility[2] that regions of "Silica W" are formed when fused quartz is heated to about 1,665°C, during the drawing of capillary tubes. Silica W reacts rapidly with water vapour to form amorphous silicic acid and with liquid water to form unstable metasilicic acid which disperses into the liquid phase. This interpretation is also in accord with the consistent observation that columns of polywater do not form in all capillaries, do not fill the capillaries in which they do form, and form in a higher proportion of Pyrex capillaries than quartz capillaries. Thus there is no anomaly to be explained and no need to invoke special solvent properties of freshly condensed water.

ARTHUR CHERKIN

Veterans Administration Hospital,
Sepulveda, California 91343, USA

1. Derjaguin, B. *Nature* 301, 9-10 (1983).
2. Cherkin, A. *Nature* 224, 1293 (1969).