

The Lost Control and Other Mysteries: Further Revelations on New Zealand's Fluoridation Trial

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The Hastings fluoridation trial in the 1950s is listed in textbooks as an important study confirming the effectiveness of fluoridation. A paper to the 56th (1987) Congress of the Australian and New Zealand Association for the Advancement of Science co-authored by one of us (JC) showed, from government archives obtained under the Official Information Act, that the claimed tooth decay reductions were mainly the result of local changes in diagnostic procedure in school dental clinics, which were not mentioned in published versions of the study. The experimental control town, at first described as 'ideal', was abandoned following the discovery that after fluoridation commenced younger children had less tooth decay in the unfluoridated control town. Proponents claimed in explanation that a previously unknown soil factor had resulted in the control town having below average tooth decay. Opponents claimed that fluoride had worsened the teeth in the fluoridated town. This paper comments on reactions to the earlier published findings, and reports some further discoveries which help to answer questions concerning the old debate over the lost control, the behavior of those concerned and some other mysteries.

Key words: Fluoridation; government archives; Hastings; official information; suppression

1. INTRODUCTION

Most New Zealand public water supplies were fluoridated following reports of 'spectacular reductions' in tooth decay during

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the county's first fluoridation trial at Hastings. The trial is listed in textbooks as an important study confirming the effectiveness of fluoridation. A paper presented to the 56th (1987) Congress of the Australian and New Zealand Association for the Advancement of Science (Colquhoun and Mann, 1987) showed, from government archives obtained under the Official Information Act (Department of Health files on fluoridation), that the claimed tooth decay reductions were brought about partly if not mainly by local changes in diagnostic procedure in the school dental clinics. The changes, made after the trials began and in the area of the experiment only, were not mentioned in the published versions of the study. An earlier version of this paper (Colquhoun and Mann, 1986) was published in the international environmental journal *The Ecologist*. The findings were also publicized in the New Zealand media. This paper comments on reactions to the findings, and reports some further discoveries. Firstly, the background is briefly described.

2. BACKGROUND

The Hastings fluoridation experiment was planned in 1951, and commenced after being approved by the New Zealand government in 1952. The Hastings Council had already decided to fluoridate its water supply, and the neighboring town of Napier, using essentially the same unfluoridated ground-water (fluoride content: 0.15 parts per million), was chosen as 'an ideal control' (Cabinet decision, 1952). In 1952 initial dental examinations of the children were carried out by Dr. R.E.T. Hewat, Dental Research Officer of the New Zealand Medical Research Council, who at that time was responsible for the conduct of the experiment.

The experiment was taken over in 1954 by Hewat's successor, Mr. (later Dr.) T.G. Ludwig, who worked under the direction of the Fluoridation Committee of the Department of Health. The Department managed and controlled school dental clinics throughout New Zealand. A Dental Association representative, Colonel (now Brigadier, ret.) J.F. Fuller, was co-opted to that committee and eventually became its chairman. The experiment was later termed a 'demonstration'. The experimental control was abandoned after the discovery that younger children in the control town had less tooth decay (Ludwig, 1958; Fuller, 1962).

Although Hastings was already fluoridated early in 1953, Ludwig's 'initial' dental surveys of children in the two towns were not carried out, according to published accounts, until September 1954 in Hastings and March 1955 in Napier. The published versions explain that new and more effective equipment had been installed in September 1954, and that in the earlier period until then the water had been fluoridated 'only intermittently' and 'below an optimal level'. The 'optimal' level would have been 1 part per million (1 ppm). A Health Minister's press release reported that the 1957 follow-up dental survey showed a dramatic reduction in Hastings after only 27 months of 'continuous fluoridation'. However the results of both the 'initial' and the 1957 surveys had shown that the younger (under 10-year-old) control children had significantly less decay than children of the same age in fluoridated Hastings.

Further investigations led to the suggestion that a special protective factor—the trace element molybdenum in recent marine soil in Napier—had caused this reduced Napier decay, claimed to be for that reason below the average for the country (Ludwig *et al.*, 1960; Healy *et al.*, 1961; Ludwig, 1963). The decision was made to discontinue the use of Napier as a control and to convert the planned Hastings-Napier experiment into a before-and-after study in Hastings only. Child dental decay rates were extremely high in New Zealand. It was believed that further continuous and marked reduction of dental decay among Hastings children would demonstrate, even without a control community, the effectiveness of fluoridation.

This decision meant acceptance of dental decay levels at Hastings as 'the national average'. It was explained: 'Anti-fluoridationists had a field day and went so far as to claim that the short period of fluoridation at Hastings prior to the base-line studies when the plant was being tested had destroyed the teeth of Hastings children, an assertion that was repeated when results were announced following examinations at a later date. On the other hand, available information showed that Hastings in 1954 reflected the average New Zealand picture of dental disease, Napier being the exception rather than the rule.' (Fuller, 1962).

Although no control community's decay rates were ever published as part of the Hastings study, it was reported that the 'average dental disease' status of Hastings had been confirmed by comparing with another town, more suitable than Napier: 'For this reason Palmerston North was chosen, a city comparable with

Hastings and situated above all on soil of a recent alluvial origin similar to those at Hastings. Examinations were made in 1957 and these confirmed the statement that Hastings in 1954 reflected the average picture ...' (Fuller, 1962).

Local opposition to the fluoridation experiment had persuaded the Hastings Council to hold a poll on whether fluoridation should continue. Such a poll required central government approval. When it was realized that such a poll would probably lead to termination of fluoridation the government, on the urging of the Dental Association, set up instead a Commission of Inquiry. The Commission (1957) strongly recommended continuation and extension of water fluoridation before the Hastings results were known, being persuaded by United States evidence of the success of the procedure. The Commission did, however, examine Hastings fluoridation, including local complaints of ill-health, and tried to reassure residents about the safety of the water fluoride levels.

Some discoveries about the Commission, made from the released archives mentioned in the Introduction, are described in greater detail elsewhere (Colquhoun, 1987). The Health Department's Fluoridation Committee, in addition to directing the Hastings experiment, also advised and supplied information to the Commission of Inquiry. A 1960 letter in the Department's files from Sir Ernest Marsden, a former President of the Royal Society of New Zealand, explained his attitude to fluoridation ('on the evidence so far brought forward I am against it') and stated of the Commission: 'I am sure they would not be prejudiced, but would bring in a finding according to the evidence *submitted*' (Emphasis Sir Ernest's. File 125/299/10).

3. REVELATIONS AND REACTIONS

The New Zealand Official Information Act 1982 has made available Department of Health files (1951-1973) now held in National Archives, Wellington. These and other official and professional sources reveal information not in agreement with the published versions of the Hastings fluoridation study (Ludwig, 1958-1971; Fuller, 1962).

In the earlier papers Colquhoun and Mann (1986, 1987a) showed that the Hastings fluoridation study did not, as it was purported to do, demonstrate the effectiveness of fluoridation in reducing

tooth decay. The reported reductions were partly, perhaps almost entirely, the result of changes in diagnostic procedure, affecting the definition of 'decay' and the number of teeth filled, in the School Dental Clinics which treated the children. The changes were made after the start of fluoridation, after the reported initial dental examinations, and in the area of the experiment only. Throughout the rest of New Zealand, where diagnostic procedures were unchanged and water was not fluoridated, a reduction in dental decay also occurred, but was not publicized.

The only published responses to the above findings were, at first, claims that the change in diagnostic procedure applied only to occlusal (biting) surfaces of teeth, and that diagnostic criteria for other ('smooth') tooth surfaces, which are now claimed to be the ones most affected by fluoridation, were not changed (*Otago Daily Times*, January 29, 1987; Brown, 1988). In response, the authors pointed out (1987b, 1988, 1989) that the claims of 'spectacular reductions', in Health Department press releases between 1958 and 1965, were for 6- and 7-year-olds' occlusal tooth surfaces. Only later was it claimed that smooth tooth surfaces showed the greatest reductions. In effect, it has been admitted that the earlier claims were exaggerated and untrue. In fact, the surprisingly uniform early claims of around 50% to 60% reduction in decay of permanent teeth, made by other fluoridation trials, were also for occlusal tooth surfaces of 6- and 7-year-olds. Since children of that age have only four such permanent tooth surfaces erupted, a slight subjective change in diagnostic procedure, by examiners or operators, can easily produce an apparent large percentage 'decay reduction'.

Colquhoun and Mann also pointed out, however, that the released files make clear that the diagnostic change in Hastings was not restricted to the early one affecting occlusal surfaces. Ludwig's 1957 report on the diagnostic change to the Fluoridation Committee opened: 'At the commencement of the Hastings fluoridation project steps were taken to ensure that the practice of preparing prophylactic type fillings by dental nurses was discontinued. However the dental research officer has been concerned for some time that the meticulous diagnostic standards of the dental nurses in Hastings might overshadow any improvement in the caries prevalence resulting from fluoridation. During the latter part of 1955 he met each nurse working in Hastings and Napier and explained to her the diagnostic standards required by the study ...' (file 124/30/33).

Thus the general exhortation to the school dentists (called 'dental nurses' in New Zealand) to change their judgement of when a tooth required filling began in 1956 and was in addition to a 1954 instruction affecting only 'prophylactic' fillings on occlusal surfaces. The diagnostic changes appear not to have been enforced in Napier. A letter in the same file from Ludwig reporting on which operators were and were not 'co-operating' referred only to Hastings dental clinics. More recently Brigadier Fuller wrote: 'We had set out to replicate the North American studies and on their advice had adopted their diagnostic criteria and protocol, especially the diagnosis of caries which necessitated, ipso facto, the cessation of fillings in teeth that were not carious.' (letter to JC, 1986).

The stage at which a tooth became carious was, of course, debatable at that time, as it still is. In the North American studies teeth were not classed as carious (that is, 'decayed' when calculating 'DMF'—the number of decayed, missing and filled teeth) until the decay had penetrated the outer enamel of the tooth. At the commencement of the Hastings study teeth had been filled at the much earlier stage of a slight softening of the enamel surface. No explanation has been offered for the inexcusable omission, from all published versions of the Hastings study, of any reference to the significant changes in diagnostic and treatment procedure, which must have influenced the results.

A further response (since published: Rugg-Gunn, 1989) to the findings has been to claim that the Hastings results must have been real because they are consistent with the results of the many other studies in other countries. Colquhoun and Mann replied (1987b) 'We agree about the consistency. Our article showed one way such consistency was achieved.' Various critics have described the inadequacies of the other fluoridation trials (Exner and Waldbott, 1957; Sutton, 1960, 1996; Diesendorf, 1990). Diesendorf has pointed out (personal communication, 1988) that the reported decay reductions were nearly always the same whether one measured the difference between test and control groups at a fixed time or, as with Hastings, among the same test group at different times. There is no way that the independent variables involved could always be the same. The uniformity of results is not a confirmation of their reality.

According to the files, Dr. Hewat, although willing to submit fluoridation to a fair trial, had informed his colleagues: 'There is still doubt in my mind whether the benefit claimed to result from this measure is fully supported by scientific evidence. In New Zealand

we have found that many factors are interrelated with the caries rate, and I am not aware that any consideration has been given to such influences in the published data on caries and fluorine.' (file 125/299 1953).

We believe that Hewat's perception of that fundamental flaw—the range of variables which make the uniform results of fluoridation trials so improbable—should be recognized.

4. FLUORIDE OVERDOSING

In the early period of Hastings fluoridation, for approximately 18 months before September 1954, many technical problems were encountered with the 'dry-feed' equipment first imported (Ludwig, 1958; Fuller, 1962). The Commission of Inquiry reported, from information supplied by the Department of Health, that the average fluoride level was 'kept down' to 0.8 ppm. The files do show that most fluoride levels assayed lower than the expected 1 ppm. However the files also show (125/299/1 1954) that the professional engineer responsible for the operation had reported to the Medical Officer of Health: 'from the amount of powder being used, the dose must be closer to 1 ppm than tests indicated.' Far from merely 'being tested', as Fuller later claimed (1962), the plant was intended to raise the water fluoride level from 0.15 to 1 ppm. Also, analysts' reports and correspondence in the files reveal that water fluoride levels were on occasions very high, from 4 to 8 ppm.

The cause of this erratic overdosing was explained in a 1954 letter from the local Medical Officer of Health to his Head Office (file 125/299/1). The plant was unattended at night, when the dry fluoride powder tended to stick in the hopper, later causing sudden overdosing of citizens' water supply in the morning. Mixing within the water-supply system would of course smooth these fluctuations to some extent. Workmen employed at night by the local Electric Power Board undertook to relieve the blockages when they noticed them. But as they were not employed by the Hastings Council, they could not be so instructed and, according to the Medical Officer's letter, the Council's Engineer was 'dependent on their goodwill for such night supervision as is given.' That situation was not reported to the Commission of Inquiry by the Department, but it was reported in the submission of a lay person, J.S. Hannah, who also alleged that Hastings had been unofficially fluoridated 'per media

of the shovel', much earlier than 1953 (see section 9 below). His information had come from workers involved. He appears to have caused some amusement to the Commission, who acknowledged his sincerity but, after hearing testimony from professional officers of the Health Department, the Hastings Council and the Electric Power Board, concluded that there was no substance to the allegations. The Commission reported: 'No employee of the power board took any part in the physical application of the chemical to the water supply or to any part of the plant.' (p. 107).

The overdosing, not mentioned in the Commission's report, did not end with the installation of the new equipment in September 1954. In 1958 a dental faculty member wrote to the Fluoridation Committee: 'I must confess that I found the tables disturbing which accompanied the copy of the letter which had been sent to people overseas. I had imagined that all the analyses done since September 1954 were within the range of 0.9 to 1.1 parts per million... however, 23 to 33 per cent of the readings were outside these limits. Furthermore, the major proportion of these outside readings indicate overdosing...' (file 125/299/2).

But the Commission of Inquiry in its report assured the public that since the installation in September 1954 of the new equipment 'the concentration of fluoride has been maintained at 1 ppm as is established by the water analyses' (p. 108). It went on to discount complaints of fluoride-induced ill health by 38 Hastings citizens, stating it was satisfied that 'their disorders were not due to the fluoridated water at Hastings but to their acceptance of inaccurate and misleading information on the subject' (p. 114), and 'We think that in some cases they have been affected by the nature of certain propaganda to which they have been subjected.' (p. 116)

5. WERE NAPIER TEETH BETTER BEFORE FLUORIDATION?

The discovery following Ludwig's dental surveys in the two towns—that younger children, the ones expected to show the greatest benefit from fluoride, had up to 58% less decay in the nonfluoridated control town—was at first kept from the public, but was later reported to the Commission of Inquiry, though not included in its report. The suspicions of opponents were justified. The discovery was not made until well after fluoridation had commenced. There was hesitancy and delay by the authorities in announcing the discovery, and

confusion about the date of commencement of the experiment, as well as about the official commencement date of fluoridation.

Opponents alleged, as Fuller indignantly reported to his fellow professionals (1962), that the fluoride added to Hastings water in the early years must have damaged the children's teeth—because there had been no earlier reports of any difference in decay rates in Napier, which had been proclaimed 'the ideal control'.

Ludwig reported to the Commission that dental clinic records of young Hastings and Napier children in 1950 showed that decay rates were lower in Napier before Hastings was fluoridated. One of us (JC) examined the national collection of school dental service patient history charts, held in Wellington, which were used for an earlier study (Hollis, 1970). Charts for Hastings and Napier for the 1950s, unlike those for other centers, were unaccountably few in number. The small sample of charts remaining did suggest that, up to seven years before the commencement of Hastings fluoridation in 1953, significantly more children were caries-free in Napier, and younger children's primary and permanent teeth required significantly more fillings or extractions in Hastings than in Napier. These results concur with Ludwig's report to the Commission of Inquiry.

At first, as reported in their earlier paper, Colquhoun and Mann were inclined to accept that conclusion also. But the question remains: why was the discovery not made in 1952, following Hewat's pre-fluoridation dental examinations? As explained, the experiment had been commenced by Hewat. Following his replacement there was in 1954 a complete new start because, according to Fuller, Ludwig 'could not calibrate against Hewat.' Hewat's pre-fluoridation results were not published, and are not in Department of Health or Medical Research Council files. Fuller, when he sought to examine them years later, found they had been destroyed in one of the Department's 'periodical purges of records' (letter to JC).

A letter of May 1954 from the Director of the Health Department's Dental Division, in answer to a request from Hastings that Hewat's initial dental examinations be published, stated: 'generally speaking, the dental condition of Napier-Hastings children is very similar to that which obtains elsewhere in New Zealand. It is not significantly better or worse than the average for the whole country, and it is very doubtful whether anything would be gained by publicising the results at this stage.' (file 125/299/1).

There is no mention of any difference between the two towns, in that letter or anywhere else in the files, until Ludwig reported it

in 1956. If Hewat's 1952 surveys showed no difference, then the suspicions that fluoride had worsened young Hastings children's teeth, relative to Napier, would be supported. The question is still open.

6. WAS TOOTH DECAY IN NAPIER BELOW AVERAGE?

On the claim that Napier decay rates were below average, the evidence clearly supports opponents' suspicions. Subsequently published national statistics on the dental status of 5-year-old new clinic patients, from samples drawn from the entire population of such children (Health Department files on School Dental Service and Annual Reports 1956–1972; Hewat *et al.*, 1952; Hollis, 1970; Commission of Inquiry, 1957), show that Ludwig's 5-year-old decay rates (Ludwig, 1958–1971; Healy *et al.*, 1961) were little below the national average in Napier, but were well above average in both Hastings and Palmerston North (see Tables I and II). As explained in section 1, decay rates in the last-named city were supposed to support the claim that Hastings was typical of New Zealand. Similar decay rates in Lower Hutt, the city next to be fluoridated

TABLE I 5-year-old decay rates ('dmft'—average number of decayed, missing and filled primary teeth) for Napier, Hastings and Palmerston North compared with national figures for the same period for 5-year-olds enrolled in School Dental Clinics which had similar diagnostic standards (except in Hastings after 1955)*

	National average	Napier	Hastings	Palmerston North
1950	7.45			
1954			8.40	
1955	7.34	6.74		
1957		7.07	7.24*	8.32

TABLE II Percentages of 5-year-olds free of decay, nationally and in Hastings around time of commencement of study (percentages for Napier and Palmerston North not known)

	National average	Hastings
1950	14.35%	
1954		4.1%
1955	14.5%	

and also reported on without a 'control' community for comparison (Hollis and Knowsley, 1970), were atypical and well above average.

7. WAS TOOTH DECAY DECLINING ANYWAY?

The above-mentioned national 5-year-old dental statistics also show that decay of younger children's teeth were steadily declining throughout New Zealand well before the introduction of fluoridation (Health Department Annual Reports).

It is now known, from studies in many parts of the world reviewed by Diesendorf (1986, 1990), that permanent tooth decay also declined independently of fluoridation. In New Zealand, according to a letter in the files, the Health Department's dental research officer reported in 1965 that there had been a reduction in caries throughout the country before widespread fluoridation. But the public was not informed. So the dilemma of Dr. Leslie (File copy 1) is understandable. From dental records of the entire primary school population of New Zealand, he was unable to produce convincing statistics showing any advantage from Hastings fluoridation.

8. SOIL OR FLUORIDE? THE REASON FOR THE DIFFERENCE

The official explanation for the decay difference between the two towns after fluoridation started (the trace element molybdenum in Napier recent marine soil, making dental decay there 'below average') was simply not believed by opponents. They pointed out that the theory ignored two facts (letters of W.A.G. Penlington, file 124/30/33 1961-1962). First, the recent marine soil originated from a Napier earthquake over 20 years earlier, yet only the younger age group was affected. No precise evidence was offered in explanation. Second, vegetables grown on the soil were distributed to shops and consumed in both Hastings and Napier, which are only 16 kilometers apart. In support of their view, the official census for 1956 (see Table III) shows that only a minority of households in each town less than half in Hastings and about a quarter in Napier, not all of whom would live on recent marine soil) grew more than a quarter of their consumed vegetables. Exponents of the molybdenum hypothesis had claimed, from results of questionnaires issued in 1959 to parents of children aged 5 to 13 years, that 80 to 90% of householders

File copy 1. Memorandum from Director of Dental Division, New Zealand Department of Health, to Secretary of the Fluoridation Committee.

12 October, 1962.

Mr Swann:

I have delayed acknowledging receipt of Dr Roche's letter to you and replying to your minute in the hope that I would by now be able to give a positive reply to your enquiry. I still cannot.

No one is more conscious than I am of the need for proof of the value of fluoridation in terms of reduced treatment. It is something which has been concerning me for a long time. It is only a matter of time before I will be asked questions and I must have an answer with meaning to a layman or I am going to be embarrassed and so is everyone else connected with fluoridation. But it is not easy to get. On the contrary it is proving extremely difficult. Mr Espie is conferring with Mr Beck and Mr Ludwig and I am hopeful that in due course they will be able to make a practical suggestion.

I will certainly not rest easily until a simple method has been devised to prove the equation fluoridation = less fillings.

(G.H. Leslie)
Director
Division of Dental Health

... to Espie ...

*Discussed with Beck.
who is to look at 'f' component
of the Ludwig's figure*

in both Hastings and Napier grew all or some of their vegetables in kitchen gardens (Ludwig and Healy, 1962). Ludwig, Fuller and the other decision makers were obviously genuinely convinced that a special protective factor must have been operating in Napier.

If in fact young Napier children had less tooth decay than in Hastings, another explanation is possible. The New Zealand official

TABLE III Figures for Napier and Hastings from 1956 official census: 'Inhabited private dwellings—home garden production—cities and borough'

City or Borough	Total dwellings	Proportion of requirements grown													
		Potatoes							Other vegetables						
		All	3/4	1/2	1/4	<1/4	Nil	N.S.	All	3/4	1/2	1/4	<1/4	Nil	N.S.
Napier	6032	143	159	355	502	982	3832	59	146	293	519	595	1210	3211	58
Hastings	5423	408	308	512	542	896	2710	47	291	593	833	662	1062	1934	48

N.S. = Not specified.

census for the period does not show income levels of centers, but does show population growth. Since World War I Hastings has grown from a smaller country town on the outskirts of the long-established provincial center of Napier, into a town of the same size. This rapid growth is described in a history of the city (Boyd, 1984). In the thirty-year period from 1921 to 1951, during the latter half of which the children examined in the 1954-55 and 1957 dental surveys were born, Napier's population had increased by only 37%, which was less than the national rate of increase, while Hastings' population had increased by 75%, more than twice as fast (see Table IV). Many more of the Hastings children had thus been born into families who, over a generation, had been uprooted from their previously largely rural environment. Such recently urbanized populations tend to have poorer health, and more dental disease, than more stable populations. This underlying demographic reality seems to have been completely overlooked when it was decided in 1951 that Napier would be 'the ideal control' for the Hastings experiment. Lower Hutt and Palmerston North, the next two cities to be fluoridated, which also had 5-year-old decay rates well above the national average, had experienced similar rapid population growth (Official Census, 1957).

9. WAS HASTINGS SECRETLY FLUORIDATED?

As mentioned in section 4 above, one opponent of fluoridation alleged to the Commission of Inquiry that Hastings was fluoridated earlier than the official date of commencement. The Commission stated that the date of commencement of fluoridation was February 1953, countering that opinion. In the opening remarks of the Commission's legal counsel it was stated of some complainers of ill effects, who had alleged that their complaints started in 1951 when they believed fluoridation had started: 'these manifestations or physical discomforts had arisen long before the water supply in fact was treated in this way'. However, not reported to the Commission was a mysterious and never-explained 1951 Hastings water sample, one of only five collected between 1949 and 1951 by Health Inspectors and sent to the Health Department for analysis, which contained 1 ppm fluoride, 20 times the concentration of earlier samples (file 125/299). The notion of unofficial covert fluoridation does seem bizarre and improbable. Yet the files reveal also that a plan to

TABLE IV Figures from 1956 official census showing urban population increases nationally, and in Napier, Hastings, Palmerston North and Lower Hutt

Urban area	Populations in urban areas, 1911-56 (excluding Maori)*							
	1911	1916	1921	1926	1936	1945	1951	1956
Napier	13,896	15,610	17,504	18,309	18,893	20,228	23,930	26,795
Hastings	8,948	11,936	13,150	14,450	17,677	19,721	23,067	26,719
Palmerston North	12,107	14,245	17,225	20,050	24,258	27,610	32,555	37,281
Lower Hutt	13,387	17,046	20,587	25,091	37,055	55,272	74,044	84,938
Totals, New Zealand urban areas	479,080	539,185	618,516	716,973	799,433	926,398	1,054,838	1,174,358

* Maori children not included in the Hastings-Napier study.

fluoridate a part of Auckland's water supply without residents' knowledge had been seriously proposed, by the city's Health Department and Dental Association officers, in 1951. A 1955 letter from Sir Charles Hercus, then Dean of the Otago Medical School and a keen exponent of fluoridation, states: 'the Borough of Hastings introduced the fluoridation of their water supply in March, 1951, and the experiment is still in progress ...' (file 125/299).

We do not suggest that one water sample, plus the above statement, conclusively prove that Hastings was fluoridated in 1951. But we believe that, in fairness to the Hastings citizens who had complained of ill effects since that year, the evidence should have been presented to the Commission.

10. WHEN DID THE EXPERIMENT REALLY RECOMMENCE?

One other intriguing mystery emerged from the files. Ludwig did not report on his 'initial' examinations of Hastings and Napier children (according to published accounts carried out in September 1954) until early in 1956, and the statistical analyses were then still uncompleted. Both typed versions of his report on different files (125/299/1 and 124/30/33, File copy 2) gave the date of his first Hastings examinations as October 1955. That was over a year later than the date later published (and 2.5 years after fluoridation officially started, not after 18 months of 'below optimal' fluoridation, as published). Ludwig arrived in New Zealand, after participating in fluoridation trials in the USA, late in August 1954, when he took over the experiment started by Hewat. Yet Ludwig claimed he 'immediately' commenced examination of Hastings children in September that year. He would have had insufficient time to study Hewat's 1952 pre-fluoridation dental surveys, decide to commence new 'initial' dental examinations, and then set about organizing them. However, an assurance has been given that the dates in both these first typed reports of Ludwig were typing errors (J.F. Fuller, letter to JC).

11. DISCUSSION

Possibly neither side in the controversy was entirely right in its explanation for the poorer teeth of younger Hastings children. It is probable that the period of erratic and occasionally excessive fluoridation

File copy 2. Two copies on different files of Ludwig's first report on his initial dental examinations for the Hastings study. Both show dates a year later than in the published version.

REPORT UPON DENTAL SURVEYS CONDUCTED IN CONNECTION WITH
HASTINGS FLUORIDATION PROJECT

The dental surveys conducted in connection with the Hastings fluoridation project were performed in the test city of Hastings during October/November 1955 and in the control city of Napier during March and April 1956.

In Hastings a total of 1,852 children aged 5-16 years were dentally examined and in Napier a total of 1,671 children were examined.

Selection of Subjects. The requirements for subjects to be included in the study were as follows.

- (a) The subjects were to be of European or predominantly European extraction.
- (b) They were to be life-long residents in the particular city in which the survey was being conducted.
- (c) The subjects were to be consuming only drinking waters furnished by the town supply.

Selection was confined to children of European extraction since the number of Maori children resident in the cities was too small to enable a determination of the effectiveness of fluoridation for this racial group to be made. A similar situation was represented for the small number of Chinese children resident in the area.

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did some damage to the younger children's forming tooth enamel. One recognized toxic effect of drinking fluoridated water—even when only at 1 ppm—is damage to enamel-forming cells resulting in dental fluorosis, a particular symmetrically arranged kind of tooth mottling. Ludwig reported 'no cases' of dental fluorosis up until 1963, after 10 years of fluoridation. One year later he reported

5% prevalence of the 'very mild' form (Dean classification). The current prevalence of the same kind of mottling in fluoridated Hastings is reported to be 23%, albeit from a different method of classification (de Liefde and Herbison, 1985), while some Hastings teeth are reported to be unsightly from fluoride (de Liefde, 1988). It seems highly probable that Ludwig, like most zealous fluoridation proponents, under-estimated the damage caused in this way.

The suggestion that excessive fluoride could actually increase decay rates was at the time scoffed at, but does not sound so far-fetched today. Indian researchers have reported increased caries prevalence in children as fluoride levels rise (Ray *et al.*, 1981, Teotia and Teotia, 1994), while African researchers have reported 'more caries in those with fluorosis than those without' (Chibole, 1988). Recent reports, from New Zealand, USA and other lands, similarly suggest that fluoride in drinking water may be impeding, rather than promoting, the continuing decline in tooth decay (Colquhoun, 1985, 1987; Jones *et al.*, 1994; Ziegelbecker and Ziegelbecker, 1993).

The conclusion reached by opponents, that the early fluoridation of Hastings had actually damaged teeth of younger children, seems to have never been entertained by those conducting the experiment. They had faith in their theory that fluoridation provides an immense benefit and is perfectly safe. Such was their confidence in the soundness of the United States findings that when the facts did not fit the accepted theory they unitedly sought and found an explanation. It was the facts, not the theory, which were questioned.

Their self-righteous indignation at the continued questioning of their plans, by members of the public and by a few scientists, is evident from statements and actions of the professionals involved. They bitterly resented such questioning, and called in the police to investigate secretly the activities of fluoridation opponents (File copy 3). When Hewat from his retirement questioned the Hastings results, Fuller responded: 'I think we all realise this is largely a question of point of view and unfortunately Dr Hewat does not see it from the viewpoint of a fluoridationist.' (file 124/30/33).

The reason for the manipulations and withholding of relevant information was apparently to educate the New Zealand public about a 'truth' which the professionals in charge already believed was basically established. Their actions were taken for what the actors considered were the best possible reasons and purposes. There appears to have been no conscious fraud like that in the Piltdown skull hoax, which was first exposed by a New Zealand

File copy 3. Memorandum from Head Office of New Zealand Department of Health to the Medical Officer of Health responsible for Hastings.

125/299/1

CONFIDENTIAL

2nd August, 1954.

The Medical Officer of Health,
PALMERSTON NORTH.

Hastings Fluoridation Scheme

You will recall passing on to this office some time ago a reference to the possible political motives of those opposing fluoridation in Hastings, which were especially called into question when an outside organisation joined in the controversy for no apparent reason. It was considered desirable to ask the Police to look into this.

The Commissioner of Police has now stated that the enquiries of his Department do not suggest that opposition has been engineered by Communist Party members or that the Communist Party is interested in the result of the campaign. Some brief notes have been supplied on the Secretary of the group opposing fluoridation in Hastings and also on the Secretary of the Auckland group to which you referred but these notes are of no particular consequence to this Department.

The fact that enquiry was made, and its result, should of course be kept confidential.

(H.W. Carter)

for Director, Division of Public Hygiene.

File 124B

V



dental scientist (Taylor, 1937) to another ANZAAS Congress just 50 years before our exposure of the Hastings experiment.

Yet the picture which emerges is a classic one of an elite power group wielding professional and scientific power in order to influence public opinion and policy. This exercise of power involved suppression, manipulation, spying and other improper behavior. What could have been done to prevent these improprieties? At the time, there was no Official Information Act in force, which might have restrained such behavior to some extent. However, to fully understand the lack of accountability which seems to have characterized the early fluoridation research, one would have to understand the

*Minor S 54/173
of 26/7/54
Signed by Mr. [unclear]
Hastings Secret
- destroyed
by me.
H.W.
2/3/54*

origins of fluoridation promotion. Recently disembargoed US government documents (Griffiths and Bryson, 1997; Wilson, 1997) have revealed startling facts about those origins, which appear to have been linked to the US development of nuclear weapons during the second world war. Secrecy and concealment, an essential feature of such wartime activities, were apparently applied in the development and promotion of fluoridation. But that is another story, and could be the subject of another article.

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