

An historical perspective on early progress of Queensland water fluoridation 1945-1954: Sheep, climate and sugar

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Abstract

Background: Queensland's virtual rejection of artificial water fluoridation sets it apart from other Australian states, yet the early fluoride environs has been scantily recorded.

Methods: This paper used archives, literature review, personal interview and the traditional historic method.

Results: The connection between Queensland artesian bore water and caries resistance was postulated as early as 1912. Four decades later, two Queensland-specific factors influenced the planning to fluoridate community water supplies. The first (1945-1950) was confusion between the high levels of fluoride in artesian water supplying the pastoral industry and the scientific concept of artificial water fluoridation of communal supplies. The second (1952-1954) involved further scientific investigation involving water consumption patterns, occupational dehydration and fluid homeostasis within a sub-tropical climate. The role of the Australian Dental Association Queensland Branch (ADAQ) in early fluoride politics was minimal. Four early protagonists are identified – two dentists, an engineer and the sugar industry.

Conclusions: Queensland had its advocates for artificial water fluoridation of communal supply as a means of caries prevention. Interest came from the dental, medical and engineering professions, and from the sugar industry. However, these efforts met with indifference based on confused extrapolation of the artesian experience (1945-1952) and hesitancy (1952-1954) due to contemporaneous concerns about human fluid homeostasis in Queensland's sub-tropical climate.

Key words: Artesian water, Queensland, fluoridation, climate, history.

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This paper emphasizes some of the less well recorded, but nonetheless important, influences on Queensland bureaucracy in the period to 1955. It identifies four poorly acknowledged advocates – MA Simmonds (chemical engineer), C Tsikleas (dentist), EW Haenke (dental inspector of schools) and the sugar industry. This quartet encountered a lack of response, even rejection, which reflected legitimate Queensland-specific concerns about two issues. The first was the result of inter-departmental equivocation over fluoride content of artesian water and its impact within the pastoral industry. The second issue, human water homeostasis in sub-tropical climates, caused reservations based on physiology. Throughout this paper, the scientific knowledge of the period under discussion (pre-1955) has been used. Whilst many of the concerns expressed by scientists of this era have been resolved and extensive research into water fluoridation has been undertaken since this time, no attempt has been made in this paper to include contemporary scientific opinions or findings.

MATERIALS AND METHODS

This study used the traditional historic method involving archival material from the Australian Dental Association Queensland Branch (ADAQ) and the University of Queensland (UQ), School of Dentistry. Additional research involved material from the University of Queensland Fryer Memorial, John Oxley, Bundaberg Municipal, Queensland Primary Industry and Queensland Health Libraries. Personal interviews and Bundaberg City Council Minutes augmented these resources.

RESULTS AND DISCUSSION

It is generally perceived that the initial phases of Australian fluoridation followed the proposals of Beaconsfield (1953) and Yass (1956). In the practical sense, this is valid. However, there were earlier phases, some of which involved Queensland. In 1912, Haenke postulated a connection between bore water and caries resistance in western Queensland, but without identifying fluoride as the link.⁵ Whilst Haenke was advanced in his observations of such a nexus, he was

INTRODUCTION

By its virtual rejection of water fluoridation, Queensland occupies a unique position within the milieu that constitutes Australian fluoridation politics.¹⁻⁴

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not alone. Loose assertions involving water, tooth-stains, caries resistance and fluoride had emerged as early as the nineteenth century.^{6,7} Cleary in 1904 had supervised debate within the Dental Association of New South Wales over 'lime . . . diet . . . drinking water and decay'.^{8,9} While Haenke was initially unaware of artesian fluoride and hence, in this context, not prophetic, by 1942 he had linked fluorosis and high caries resistance at Julia Creek to the reticulated bore supply with its fluoride ion concentration of 2.4ppm. Four years later, he astutely used the 1942-1946 School Health Service dental fluorosis reports to locate and verify high human fluoride consumption within Queensland children. These activities were recorded in 1947 in the Fluoride and Water Survey Committee (FWSC) report, henceforth referred to as the 'Interim Report'.¹⁰

It is widely acknowledged that Clements first documented Australian human dental fluorosis in 1937.¹¹ Several aspects of Clements' research were relevant to the evolving Queensland scenario. Clements was a medical practitioner from the Sydney-based School of Public Health and Tropical Medicine. His nutritional investigations noted dental fluorosis but did not record dental caries. His dental fluorosis research was published in the Sydney-based 'The Dental Journal of Australia'. He used the pseudonyms 'Community A' and 'Community B' to represent Julia Creek and Thargomindah. In 1938 Peirce,¹² an Adelaide-based researcher with the Council for Scientific and Industrial Research, undertook research on fluoride levels within phosphate licks consumed by sheep. The Interim Report revealed that the Queensland pastoral bureaucracy viewed Peirce's research as the literary benchmark on skeletal and dental fluorosis in animals.^{10,12} Peirce did not cite Clements as a reference. The Interim Report also confirmed that in 1945, the Department of Agriculture and Stock (DAS) thought human dental fluorosis 'was unknown in Australia'.¹⁰

The focus of attention towards dental and skeletal fluorosis in animals has to be placed in the contemporaneous context of the pastoral environs and the importance of the pastoral industry to the economy of Queensland. Closer settlement that concentrated grazing patterns on pastoral properties and utilized long bore drains, meant increased herd exposure to a single artesian supply. In areas of high fluoride artesian water, there was a potential for increased animal ingestion of fluoride. This affected pastoral economies and demanded greater attention to herd management policies. Furthermore, new worm infestations meant drenching (the administration of medicine to stock by mouth) increased. Consequently, pastoralists became more conscious of the extent of dental fluorosis in their sheep. In 1945, Legg, Seddon and Moule confirmed dental fluorosis in some artesian-watered Queensland sheep.¹³⁻¹⁵ An era of intense artesian investigation and water analysis had begun. A broad multi-departmental bureaucratic committee – the FWSC – was formed in

1946 with 130 support staff from four Departments. They were the DAS, Department of Public Lands, Department of Irrigation and Water Supply, and Department of Health and Home Affairs.

The FWSC now received submissions, which expressed concern about Julia Creek. It was a township with a reticulated supply of potable bore-water, low annual rainfall and few domestic rainwater tanks. The FWSC noted in the Interim Report that the Department of Chemical Analysis had recorded reticulated fluoride levels at 2.75ppm as early as 1941. (The Interim Report gives two figures for reticulated ionic fluoride concentration at Julia Creek. The Government Chemical Analyst is cited at 2.75ppm. The Agricultural Chemist is cited at 2.4ppm. This could be 1941-1942 assessment deviation or a legitimate concentration difference between the two bores at Julia Creek.)¹⁰ Furthermore, medical practitioners also serviced Julia Creek's dental needs. Dr PA Stevens (medical practitioner, 1931-1936, Julia Creek) had reported, but not recorded, dental fluorosis.¹⁰ Dr DA Carter (medical practitioner 1941-1945, Julia Creek) was critical of inaction on dental fluorosis, especially at the school. He described cooking with the local artesian water 'charged with fluorides as dangerous . . . as the concentration of fluoride is thereby greatly increased'.¹⁰ This alluded to concerns about water evaporation during the cooking process from an already high fluoride baseline. The human ingestion of high fluoride was also perceived as a potential concern in meals that involved kidney, bone-based soups, stews and stocks. Dr Carter's apprehensions were so serious that he analysed 'mottled' teeth, personally addressed the FWSC in 1946 and presented it with extracted human teeth.¹⁰ Dr Carter also recommended that the use of bore water at Julia Creek be discontinued for drinking and cooking purposes and that the bore water be cut off from the school altogether. The FWSC also received a submission from the Chief Dental Inspector of Schools. Haenke confirmed dental fluorosis in Julia Creek school children from 1942 (Haenke E, written communication, September 1946). The submissions by Haenke, Stevens and Carter were revealed in the Interim Report and corrected the DAS's misconception that dental fluorosis was a condition limited to animals.¹⁰

The primary scientific parameters of the FWSC investigation were to examine the water that supplied the pastoral industry particularly relating to sheep. These water sources did not usually provide water for human consumption. Its concern in this regard was legitimate and necessary. In Queensland, the supply of water to animals was complicated by a hot climate, an artesian supply, high water consumption, surface evaporation, long open bore-drains and drought-induced grazing patterns all of which contributed to fluorosis in the dentition of sheep. A concentration of 1ppm fluoride ion at a bore-head significantly escalated as water moved down a 100-mile drain where

evaporation rates were 100 inches per annum. A worn dentition in sheep affected cropping, life expectancy and pastoral economics so afflicted sheep were culled. Furthermore, skeletal and dental fluorosis levels in sheep were exaggerated by misdiagnoses involving other nutritional disorders.¹⁶ Artesian fluoride affected property value, land administration and irrigation policy. Consequently, the pastoral community was exposed to authoritative and inter-departmentally administered research.¹⁷⁻²²

In Queensland the outcome of fluoride research focussed on the very high fluoride levels ingested by sheep and gave little explanation of the differences between animal water supplies and human water supplies. From the dental profession's perspective this focus was unfortunate. The Queensland experience may be compared with New South Wales which also conducted water investigations but with significant differences in study design. The NSW study was human orientated, restricted to potable water supplies and the results were more positive for those concerned with the introduction of fluoride for caries prevention.²³ Jones (1949) from the Institute of Dental Research, and with the support of a National Health and Medical Research Council (NHMRC) grant, did not mention sheep fluorosis in her publication.²³ In contrast, in Queensland the DAS gazetted many pastoral artesian bores 'for one reason or another, as not suitable for all domestic requirements' and even said that some were unfit for human consumption without noting whether or not there was a likelihood of using the water for such purposes (Simmonds M, unpublished personal paper, circa 1955 and Kruger B, written communication, November 2002).

Historically in Queensland there has been co-operation in research between medicine, veterinary science and agricultural science with water, soil and climate acting as a common links.²⁴⁻²⁶ Medical and DAS analyses often involved communal facilities. In the immediate post-World War II era, the Interim Report showed that the Queensland agricultural and medical bureaucracies viewed fluorosis, skeletal and dental, as overt, serious and a Queensland-specific phenomenon with human-animal dimensions.^{10,19} In 1946, Dr L Welch, Chief Medical Officer, Department of Health and Home Affairs, cited skeletal and dental fluorosis as a problem of 'immense importance'.¹⁰ The Chemical Analyst (1945) also criticized artificial water fluoridation saying, 'It would appear, however, to be fundamentally unsound to add a poison to the drinking water to correct a dietary fault'.²⁷ Concerns surfaced within Cabinet discussions, in the United Graziers' Association submissions, in the Department of Chemical Analysis figures and in the 1946 DAS Annual Report.

The pastoral bureaucracy in Queensland was respected, influential and, on fluoride, persuasive. The Chemical Analyst gave artesian fluoride a high priority and fluorosis herd management for sheep was an issue

in the agricultural journals until 1953. The ADAQ recognized some pastoral concerns and invited DAS officers to address one of its general meetings. The significance of sheep fluorosis and fluoride levels of farm products was discussed.^{28,29} Artesian investigation warranted landowner co-operation, with many fluoride enquiries being directed at DAS officers rather than health authorities. Investigation of the ADAQ archives indicated that the dental profession was generally oblivious to, or dismissive of, the opinions and importance of the pastoral industry's views. It may be that in recognizing the scientific differences between artesian fluoridation and artificial water fluoridation, the ADAQ proceeded to ignore the pastoral concerns about artesian water to the possible detriment of the water fluoridation debate.

In late 1952 in Mossman far north Queensland, three health professionals C Tsikleas (dentist), DJ Hodges (medical superintendent) and BJ Nahrung (pharmacist) proposed the autonomous fluoridation of Mossman's water supply.³⁰ Tsikleas, in response to recent questions about this period, said he was influenced by a series of factors including Harrington's presentation at the 1951 Far North Queensland Dental Convention titled 'Mineral Deficiency in the Northern Wet Belt, Its Effect and Possible Cure'.³¹ He also noted that H Jenkins, a UQ lecturer who emphasized preventive dentistry, was an additional influence. He felt that there was a potential for epidemiological evaluation given the local high caries rates. He said that he received 'support by Mr L Prince, Secretary Mossman Co-operative Sugar Mill who supplied supportive material written by Martin' (a NSW fluoride authority) (Tsikleas C, written communication, May 2002). Tsikleas said his motives were 'youthful zeal . . . a new graduate with an idealistic belief that fluoridation offered the most positive, efficient and economical method of reducing decay' (Tsikleas C, written communication, May 2002). As it transpired, the Douglas Shire Council had engineering problems at Mossman and more importantly, in the context of contemporaneous research, the sub-tropical climate was considered inappropriate for water fluoridation.

Several aspects of Tsikleas' timing were politically problematical. While the Federal ADA had embraced the November 1951 NHMRC statement of acceptance of American fluoridation data, it had not endorsed water fluoridation *per se*. In addition, fluoridation had ramifications for the sensitive National Dental Health Policy (NDHP), which was a blueprint for the Federal ADA's future aspirations on the direction of Australian dentistry. Federal ADA applied an embargo on NDHP discussions, below the level of State Branch Council.³² Any public debate by the ADAQ about water fluoridation could have potential ramifications for these sensitive federal negotiations. Lastly, unbeknown to Tsikleas, MA Simmonds who was an engineer with the Department of Local Government, had autonomously proposed a fluoridation scheme for

Townsville.³³ Tsikleas was enthusiastic, idealistic and naïve. By comparison, Simmonds was aware of the climate factor and was astutely advised by the American Water Works Association.

Tsikleas and Simmonds triggered a second impasse. This time it involved the health bureaucracy. There was no state artificial water fluoridation committee, no NHMRC implementation guidelines and the medical profession had not endorsed water fluoridation. The New South Wales Department of Health was not in favour of water fluoridation³⁴ and Dr D Johnson, Queensland's Deputy Director-General of Health and Medical Services pointed to a United Kingdom reticence.^{33,35} These reservations lingered after the 1951 Brisbane visit of Lady M Mellanby (caries researcher) and Sir Edward Mellanby (agene researcher – agene was a processing agent used in flour to improve the palatability of bread in the United Kingdom. After prolonged controversy, it was eventually removed. Sir Edward Mellanby was involved in this research and campaign).^{33,36,37}

Simmonds partly allayed DAS resistance and now concentrated on Johnson who still awaited NHMRC direction.³³ The ADAQ's reaction was to ignore Tsikleas and to reject Simmonds' plan. In response to a pilot proposal to fluoridate Townsville, ADAQ advised Simmonds:

'This Association believes that experimental results so far have been disappointing. One experiment in Canada has already been abandoned on the grounds that the results have not justified the cost . . . We would be loathe to advise any Local Government body to incur the expense involved since we believe the result would be a failure to achieve any significant reduction in caries.'³³

An examination of the role of Simmonds in the early public water fluoridation negotiations highlights the influence of the engineering profession in the emerging Australian debate. While Tsikleas' proposal was historic, he soon relocated to northern New South Wales where he participated actively in later campaigns for water fluoridation in that state whereas Simmonds remained in Queensland. It is highly probable that the engineering profession, not the dental profession, provided Queensland's first public water fluoridation advocate in Simmonds who provided an intellectual capacity, vision and commitment to water fluoridation.

The Tsikleas-Simmonds' legacy was the formation of a formal Fluoridation Committee to monitor artificial water fluoridation protocol. This Committee had a membership involving UQ School of Dentistry, NHMRC, Department of Health and Home Affairs and DAS. The ADAQ played an insignificant role in these embryonic water fluoridation protocols.

Around 1953, another Queensland factor emerged when the sugar industry expressed formal interest in fluoridation. The influence of the sugar industry on Queensland history was both perennial and

profound.^{38,39} It was a spatially dense, labour intensive and heavily unionized industry. It amalgamated big millers like the Colonial Sugar Refinery Corporation, individual small or large cane growers and The Sugar Growers' Council, and labourers who were members of the powerful Australian Workers' Union (AWU). Cane-cutters occupied a unique position within the Australian fluoridation debate. AW MacFarlane (Department of Physiology, UQ) had conducted dehydration research on Bundaberg AWU members and found they endured heavy dehydration and their high fluid intake was up to three gallons per day. This became relevant to protocols for fluoride dosage levels within sub-tropical climates.⁴⁰

The sugar industry presented a potentially powerful liaison between government and industry on the issue of water fluoridation. The AWU had influence within the entrenched Gair Labor government in Queensland and E Barnes (AWU representative, Bundaberg) was in favour of water fluoridation (Francis J, written communication, May 1956).⁴⁰ Forgan Smith, the Chairman of the Queensland Sugar Cane Prices Board, was a former Labor Premier 1932-1942, and the member for the sugar electorate of Mackay 1915-1942. He was perceived as an influential rural protagonist and was open to the concept of water fluoridation as a means of removing the pressure from the sugar industry in relation to dental caries (Lumb S, written communication, March 1953). Forgan Smith approached Professor SF Lumb (Dean, UQ School of Dentistry) to find ways of easing the relations between the sugar industry and dentists. Lumb regarded the Queensland fluoridation moves as 'experimental' and courteously refused to promote the interest expressed by the sugar industry. He stressed that water fluoridation was not a universal dental panacea. The dental profession still needed to promote dietary reform and oral hygiene as fundamental tenets within preventive dentistry. In a very honest reply, Lumb gave Forgan Smith a solid scientific rationale for his recommendation that more Queensland research be undertaken before any pilot project was commenced in a regional town (Lumb S, written communication, March 1953). BJ Kruger was a Rotary Foundation Fellow and in this capacity had travelled, lectured and studied across the United States in 1949-1950. He then returned to UQ as a clinical instructor with research aspirations. Kruger appreciated that much of the epidemiological evaluation of water fluoridation in North America had been performed in a temperate climate (Kruger B, written communication, November 2002 and Davies G, personal interview, September 2002). Within the United States, there was still debate over adjustments to fluoride recommendations based on differences in fluid intake due to climate and age (Kruger B, written communication, November 2002 and Davies G, personal interview, September 2002).⁴¹

The timing of Lumb's reply to Forgan Smith in 1953 was highly relevant. Both Lumb and Kruger

appreciated that the 1953 NHMRC protocols for the implementation of artificial water fluoridation were restricted by a clause which stated that 'the amount of fluorine to be added must be carefully determined and adjusted to meet climatic and environmental changes'. Dehydration and fluid homeostasis were additional Queensland-specific issues for Queensland that were not fully addressed in the NHMRC provisional climatic adjusted dosage protocols of November 1954.⁴² Furthermore, the reservations about water fluoridation in the United Kingdom which were highlighted in the Mellanbys' visit, were of current interest.^{43,44}

As well as the scientific concerns which were outlined by Lumb and Kruger, practical difficulties occurred in selecting a site for a pilot project. Several potential locations did not have appropriate water quality, distribution networks or engineering infrastructure. This was another basis for Lumb's recommendation to Forgan Smith that a Queensland fluoridation proposal was premature.

In June 6, 1953 a Queensland newspaper, the *Courier-Mail*, published an article which included Kruger's scientific reservations and the Department of Health's failure to endorse fluoridation.⁴⁴ In the same article, The Colonial Sugar Refining Company countered these opinions by citing unnamed dental experts in New South Wales who favoured fluoridation as an alternative to the elimination of dietary carbohydrates. Three days later, Mr R Muir (General Secretary of The Sugar Growers Council) launched an acrimonious public attack on the dental profession.⁴⁵ Muir defended the nutritional value of sugar, questioned its relevance to caries and accused the dental profession of 'singular failure to improve the dental health of Australians'.⁴⁵ Former animosities between the sugar industry and the dental profession were ignited and Queensland's fluoridation cause lost a potential ally.

CONCLUSION

The failure of Queensland to achieve the same high level of water fluoridation as other states in Australia is often passed over as 'Queensland is different,' a convenient, but superficial, explanation of the state's low fluoridation uptake. In reality Queensland joined (and even anticipated) the interest in water fluoridation in the early decades of the twentieth century. This interest continued between 1945 and 1954 with advocates from the dental, medical and engineering professions, and from the sugar industry.

The commitment of early leaders Tsikleas, Haenke, Simmonds, Lumb and Kruger needs to be acknowledged. However, the research into fluoridation of community water supplies for caries prevention in tropical and semi-tropical areas was overshadowed by the research into the artesian water supplies and the impact of the high fluoride content on the pastoral industry.

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