

Documenting 30 years of technological change in the Australian wine industry

By Peter Godden

Manager – Industry Engagement and Application, The Australian Wine Research Institute,
PO Box 197, Glen Osmond, South Australia



To mark the *Wine & Viticulture Journal's* 30th anniversary issue, we asked Peter to review the technologies used to make wine in Australia when the *Journal* was first published in 1986, using the articles published during its first three years in particular as a reference, and comment on their significance both then and now.

The last 30 years has been a period of unparalleled technological change in the Australian wine industry. This has been uniquely documented by the *Wine & Viticulture Journal* and its forerunners, *The Australian and New Zealand Wine Industry Journal* and *The Australian Wine Industry Journal*. The AWRI congratulates the publishers, editors and staff of the *Journal* on reaching the 30-year milestone, and on the resulting body of work that has been an essential reference source for generations of winemakers, viticulturists, marketers, students, suppliers and academics.

On a personal note, I have found the *Journal* to be an incredibly valuable resource during my career in the wine industry. The early volumes were a crucial part of my oenology and viticulture studies at Roseworthy, commencing in 1989, and later, as the manager of problem solving and extension services at the AWRI,

Journal articles were a major component of the literature provided to industry as part of those services.

The past 30 years of extraordinary technological change have been captured in the *Journal's* particular editorial and visual style, which is as recognisable in the first issue as it is in the current edition. The *Journal* has been as successful in capturing the cultural evolution of our industry as it has in charting the development of technology. An important aspect of this has been the breadth and depth of contributing authors and their readiness to share information for the benefit of the whole industry, with the editorial of the first issue noting "those who understand the industry ... will be able to write for their colleagues". The personalities, industry politics, success stories, controversies, booms and busts, are all documented; it has certainly been an eventful 30 years.

Rehydration and Propagation of Active Dry Wine Yeast

P. B. MCKEON
Leader, Microbiology Group, The Australian Wine Research Institute

Introduction
The acceptance of dried wine yeast has grown over the last three years. This has occurred because the range and quality of dried wine yeast have improved, it is convenient to use and is relatively inexpensive at 2.7 to 3.5 cents per litre of wine.

Dried wine yeast has a role to play in improving the quality of wine, but this depends upon it being used properly. This report outlines some common problems encountered with use of dried yeast and how to avoid them.

Effects of rehydration of dry yeast
Active dry wine yeast strains are prepared from carefully selected strains, mainly *Saccharomyces cerevisiae* or *Saccharomyces bayanus*, with proven winemaking qualities. The yeast is prepared under specific propagation conditions to control the composition of the yeast cell. Adequate dissolved oxygen and nutrients are provided and the growth rate is controlled by the rate of addition of sugar solution. The yeast culture at the end of growth contains an optimum content of protein, inorganic and unsaturated fatty acids in the cell membrane, and of the reserve materials glycogen and lipid. The yeast composition allows efficient drying with minimal loss of viability and maximum retention of compounds required for rapid onset of growth and maintenance of fermentative ability when reconstituted and added to must.

Drying reduces the moisture content of the yeast cell from 70% to 85% by using controlled air temperature in a fluidised bed. Drying removes not only the extracellular water but also most of the water inside the cell and bound to the cell components. In the dry state the cells shrink and desiccate, which is a stressful condition for a living organism. Fortunately, dried yeast can maintain viability and lasts about 10% activity per annum if stored dry under vacuum or in the absence of oxygen.

To ensure function, yeast cells must rehydrate all of their cellular water. This step of rehydration is perhaps the most critical phase in using dry yeast cultures. Only proper rehydration can ensure healthy cells which retain good fermentative activity. Cells must be rehydrated with water or aqueous solutions of the culture substrate, absorbing the needed moisture. Rehydration is a relatively slow process. If carried out, the cell can take up water and restore its cellular components through the cell membrane, which is normally permeable at the time of rehydration. As a consequence the yeast will have a high viability and the remaining population will be able to initiate a rapid fermentation. Difficulty will also be experienced in dispersing the yeast as the granules will clump

and stick together. Addition of dried yeast to cool water (15°C) or must can decrease cell viability by as much as 80%.

Proper rehydration of dried yeast
Important points in dry yeast rehydration are:

- The volume of water used is 5 to 10 times the weight of the yeast to be rehydrated. For 50g of dry yeast the correct amount of water is 2.5 to 5 litres.
- Rehydration in warm water at 40 to 45°C. Do not add yeast to cold water and then heat to 40 to 45°C.
- Add the yeast slowly and evenly to the water, not the reverse. Adding water to yeast can cause uneven rehydration and clumping of the granules.
- Allow the yeast to sit in the warm water for 5 to 10 minutes before mixing. Do not allow the yeast to remain longer than 30 minutes in water as longer periods will reduce the activity of the cells. However, it is important not to add the yeast to cold must, and the rehydrated mixture should be cooled slowly to a temperature no greater than 32°C above the temperature of the must to which it is added.
- It is preferable to rehydrate in water rather than in must. The must does contain sugars which suppress dispersion; however, it is important to use a must which contains a low concentration of sulphides which could be lethal during the rehydration stage. Once rehydrated, the cells must be added to the must at a low concentration of sulphides, but not during water uptake.

Rehydration of must for white wine
Current technology for making white wine often involves clarification of must by filtration or centrifugation at low temperatures. Juice might also be stored at low temperature for considerable time before inoculation with yeast. Inoculation followed by fermentation at low temperature. Reconstituted dry yeast or winery prepared yeast culture should not be added to must at temperatures lower than 15°C. If a gradual fermentation is desired, the yeast should be added to must at temperatures lower than 15°C. While the rate of fermentation is slow, the yeast can be controlled by decreasing or raising the temperature, yeast cannot tolerate temperatures below 10°C. It has been documented that a sudden change in temperature of 2°C or greater can cause yeast populations which exhibit a greatly reduced rate of fermentation.

If a commercial dry yeast is used, rehydrated dry yeast should be slowly cooled to about 20°C before addition to the must. At 20°C, yeast will begin to grow. Yeast begins the rate of growth and sugar fermentation can be controlled by adjusting the temperature of the fermentation. A sudden

The very first article in the first issue of the *Journal* discussed the use of dried wine yeast - a new technology for the time that is now taken for granted.

WHERE **CUTTING EDGE** MEETS SUSTAINABILITY

SAVE PRODUCTION COSTS BY MULTI-TASKING

FISCHER GL4 & GL4K

INTER-ROW TO UNDERVINE MOWERS

OFFERS GROWERS A TOTAL SOLUTION FOR EFFECTIVE WEED CONTROL

- Acclaimed by Australian Vineyard Managers
- Offering various configuration options
- Available for flat and delved vineyard rows

FISCHER BV2 & TWISTER W2

FINALLY IT'S HERE! MEET THE ULTIMATELY CLEAN, CHEMICAL-FREE UNDERVINE SOLUTION

A NEW WAY WITH A CERTAIN TWIST

- Seamless weed control from inter-row to undervine
- Using expandable deck technology
- Durable high speed bio-brush weeders
- Mechanical removal of basal water-shoots




FOR A PERSONALISED RECOMMENDATION, PLEASE CONTACT JURG MUGGLI ON 0409 572 581
OR THE OFFICE ON 08 9433 3555. FIND US ON FACEBOOK OR AT WWW.FATCOW.COM.AU

WWW.FISCHERAUSTRALIS.COM.AU

fischer
AUSTRALIS Pty Ltd

FROM 1986 TO 2016

A comprehensive review of the technological changes that have taken place over the last 30 years is beyond the scope of this article. Instead, this paper examines technologies being used to make Australian wine when the *Journal* was first published in 1986, mainly with reference to papers published in the first three years of the *Journal*'s life, in order to provide a snapshot of the time. Many technologies examined in early *Journal* articles now form the core of Australian winemaking, and have had an incalculable positive effect on wine quality and winemaking efficiency. However, in the mid-1980s, many of those technologies were either in their early stages of development, or perhaps more commonly, were merely very new to Australia. Therefore, while the early volumes of the *Journal* provide the impression that this was a period of rapid development of hardware and new processes, further investigation demonstrates that many of the technologies examined were already well established in other parts of the world. Nonetheless, it is clear that the *Journal* was an important vehicle by which information on those developments was communicated and spread through our industry, fostering the uptake of the technologies. This was surely a factor in igniting and supporting the industry boom that was to begin a few years later.

A large number of AWRI staff members, past and present, have made a prominent contribution to the *Journal* over its 30-year history, and the very first article in the first issue was authored by Paul Monk, who was then leader of the AWRI's microbiology

group (Monk 1986a). As with so many of the papers that appeared during the first years of the *Journal*, the article discusses a new technology which is now absolutely taken for granted: the use of dried wine yeast. This was a very new technology in 1986, with the article noting that, "The acceptance of dried wine yeast has grown over the last three years." Thus, the use of yeast slopes, many of which were supplied by the AWRI, remained the dominant yeast propagation technology in 1986.

PROFILING TECHNOLOGIES AND PRACTICES

As well as documenting new technologies, the first issue contained the first of what were to become regular 'Technological Reports', titled 'Barrel fermentation – an ancient technique becomes modern technology' (Anon 1986a). With contributions from Geoff Schahinger (Schahinger coopers), Adam Wynn (Mountadam), Mark Turnbull (Saltram) and Chester Osborn (d'Arenberg), it is apparent from the article that widespread recognition and appreciation of barrel-fermented Chardonnay in particular was a relatively new phenomenon. While the first Australian Chardonnay wines fermented in small European oak had been made by Tyrrells in 1973 (French Oak), (Fowler pers. comm. 2016, Spinaze pers. comm. 2016), and Wynns Coonawarra in 1981 (German oak), (Hodder pers. comm. 2016), the 'Chardonnay boom' began in earnest in the mid-1980s. Notably, Sauvignon Blanc was the subject of the 'Varietal Report' in the first issue; at this time a 'new variety' to many, with the first and ground-breaking Cloudy Bay Sauvignon Blanc having been released a year earlier.

DO YOU UNDERSTAND THE PICTURE?

If you don't, then talk to Liquid Air. We're pursuing the development of today's technology for tomorrow's wine, find out how Liquid Air is working on a world-wide basis to improve your production, transportation and bottling techniques.

With new systems like **Snow Pulse**, **Stabigas Pneumatic** and **Polar Bric Dry Ice** (for tank inerting), and grape cooling.

Equipment like **Snow Drop**, **Gas Rummager**, **MGV Gas Mixer**, **Diffusers**, **Venturi**, **Variable bubble size spargers**.

Also providing complete back-up with Technical Seminars and advice, Gas systems analysis and specialised equipment design and installation.

Talk to Liquid Air - and understand our picture.



LIQUID AIR

INNOVATORS IN GAS SYSTEMS

Then and Now: Liquid Air's advertisement from Issue 1 of the Wine Industry Journal in 1986 (Above) and today (right)



AIR LIQUIDE™

Wine Solutions: gas, equipment & services



your needs:

Improving wine quality, achieving repeatable results, respecting the environment, implementing efficient solutions: Your needs are numerous; Air Liquide solutions are diverse.

our solutions:

Quality, safety, innovation, efficiency: We offer comprehensive solutions for gas, equipment and services, tailored to your needs with the help of our global expertise and technical experts.

our value creation:

Air Liquide solutions assist you in your operations, maintaining quality, providing economical performance and sustainable development.

A new wine technical reference book, *"Paths to the peak"* is available now. It covers technology associated with the management of dissolved oxygen and CO₂ in the wine process



AIR LIQUIDE

Head Office	(03) 9697 9888
Melbourne	(03) 9290 1100
Sydney	(02) 9892 9777
Adelaide	(08) 8209 3600
Brisbane	(07) 3246 6363
Perth	(08) 9494 9600
Tasmania	(03) 6334 9666
New Zealand	+64 9 622 3880

WINE INDUSTRY JOURNAL

MAY/JUNE 1986 41

Protease Enzymes for Protein Stabilisation

RICHARD L. GIBSON
Quality Control Manager, Penfolds Wines

Proteins in wine are mainly derived from the grape where it forms during ripening. Like all other proteins it is made up of amino acids.

Under normal conditions of grape ripening, proteins are removed from wine by fine filtration. This may be due to the combination of proteins with other wine components such as tannins, copper and iron, or to coagulation caused by exposure to elevated temperatures.

Both white and white wines in wood storage, often self-stabilise due to co-precipitation of tannin and protein. The introduction of ultra-filtration of wine wines and the development of heat storage containers has led to an increase in problems with proteins. Fine filtration is the first line of defence.

Successful removal of proteins by heat treatment requires alteration of pH to wine temperature approximately 10°C for two minutes. Precipitation occurs and separation of the material particles dissolved protein can take place. This treatment has been used in Australia due to the steep costs, the capital required for effective plant and the modification of juice and wine character caused by the process.

Bertram is a colloidal clay containing negatively charged sites. Positively charged proteins are adsorbed onto the surface of the bertram particles, and co-precipitation can occur. Although bertram is cheap and effective, its use does have several disadvantages. It is non-specific and can remove from wine any molecule with a negative charge. The reduction of wine fineness compound concentration by bertram treatment has long been observed, and has recently been demonstrated in studies of aroma profile changes during wine processing.

Bertram is the sodium form, as used in Australia, generates highly low. Large amounts may remove wine from these low but it is low in quality. Smaller amounts often do not have the same economic loss as full on solution problems. Some wineries inject bertram into the wine immediately before bottling. This can lead to excessive centrifuge level wine and a high volume loss through increased fining requirements.

Recently, several alternatives to these conventional protein removal processes have been developed. These include protein adsorption onto synthetic alumina silicate or immobilised tannic acid, removal of proteins by ultrafiltration, and the degradation of proteins by protease enzymes.

Protease enzyme treatment
Protease enzymes have been used in other industries for many years. They can be derived from animal sources, e.g. rennet, used in cheese production, or from vegetable sources, e.g. papain, used to break down proteins in beer. Protease enzymes

can also be obtained as by-product of fungal metabolism. Protease enzymes work by breaking down proteins into

subunits of peptides and amino acids which have different properties to the parent proteins.

Many proteins in wine are not capable of breaking down proteins in wine or grape juice, probably due to a lack of components. Recently, however, more potent enzymes have been developed, which are capable of breaking down proteins in wine or grape juice.

The United States studies have shown that the effective protease preparations are capable of reducing protein levels in grape juice by 50–70% after the addition of 50 ppm of enzyme and incubation for twelve hours at 40°C. The degree of degradation is also possible after the addition of 100 ppm of enzyme and incubation at 20°C, provided the juice has been flash heated to 80–100°C for 10 to 15 minutes prior to enzyme addition. This flash heating may break down bonding between proteins, causing them and other components, or small globular proteins, making the proteins molecules more susceptible to enzyme degradation.

Results obtained in Australia also demonstrate that certain acid fungal protease preparations are capable of breaking down grape-derived, heat-unstable proteins. Laboratory scale trials have shown that the enzymes are more effective in wine than in water. Depending on the brand of enzyme, concentrations may be 10–20 ppm. Protease degradation occurs at temperatures as low as 4°C. Levels of free sulphur flash heated to 80–100°C for 10 to 15 minutes prior to enzyme addition. Production scale trials results have verified some aspects of these laboratory experiments.

Testing for heat stability (50°C for 6 hours) has shown that bertram fining wines are greatly reduced but that heat-unstable proteins breakdown is not complete. A varying amount of instability remains which is more dependent on the enzyme used than the dose rate or incubation time.

Advantages of enzyme treatment

The reduction in the bertram treatment for heat stability can be as high as 90%. The use of protease during bertram fining should reduce the volume of wine produced by bertram fining, as well as minimising the risk of wine flavour loss or contamination.

The enzyme cost is \$30 to \$50 per kilogram. Use at a rate of 25 ppm will cost \$1.25 to \$2.50 per 1000 litres. Offsetting this is the increased volume of quality wine, decreased loss recovery costs and a possible increase in wine quality.

Continued development of the enzymes and the way in which they are used should enhance the application of protease treatment to the wine industry. Further screening of

This article, from the second issue of the *Journal*, discussed the potential use of protease enzymes for the protein stabilisation of wines - written more than 20 years before the Aspergillopepsin 1 and 2 enzymes were demonstrated to be effective for protein stabilisation by the AWRI.

The Technological Report in the second issue of the *Journal* addressed stabilisation and clarification (Anon 1986b), a topic that has been periodically revisited over the life of the publication. This feature contained articles on several technologies that again were new to Australia at the time: the contact process for tartrate removal (Bott 1986), Silica Sol as a fining agent (Bearzatto 1986) and the use of carboxymethylcellulose (CMC) for the inhibition of tartrate crystallisation (O'Brien 1986). This was very new technology with important implications for winemaking worldwide, with the first systematic study having been reported in a German publication in 1984 (Wucherpfennig *et al.* 1984). Australian trials commenced in January 1985 (O'Brien 1985, O'Brien 1986), and as an indication of the grape varieties that were of importance for bulk wine production at the time, those trials were conducted on Muscat Gordo Blanco, Sultana and Shiraz. Another article in the second issue of particular interest was written by Richard Gibson, who was then the quality control manager for Penfolds Wines and an AWRI council member (Gibson 1986a). The article discusses the potential use of protease enzymes for the protein stabilisation of wines, and was written more than 20 years before the Aspergillopepsin 1 and 2 enzymes were demonstrated to be effective for protein stabilisation by the AWRI. The article speculates that 'flash heating' might be a necessary part of a protease-induced stabilisation process, "as it may ... uncoil globular protein, making the protein more susceptible for enzyme degradation", which later proved to be the case.

Another notable but brief article in the second issue of the *Journal* concerns the formation of the AWRI's first online library database (Benjamin and Baldwin 1986). This was cutting-edge technology in its own right, being well before the availability of the internet, and even email in Australia for all but a small number of staff of some universities, as illustrated by a heading in the article 'What is a computerised database?' The database, which was established with the support of the Thomas Walter Hardy Memorial Bequest, was hosted on the CSIRO's AUSTRALIS public access network, and the search costs of \$1 per minute of 'logged-on' time were estimated to be between \$15 and \$30 for an average search, a considerable sum in 1986. The article noted that the database would "eventually incorporate the holdings of

the John Fornachon Memorial Library”, which is now the case, including the first 30 years of the *Wine & Viticulture Journal*.

PACKAGING TRENDS

From the very first issue the *Journal* included articles on packaging, with advances in packaging technology charted over its 30-year history. Notably, however, the only article related to packaging technology, as opposed to packaging design, in the first year of the *Journal* concerned the introduction of the now ubiquitous pressure-sensitive labels, as an alternative to the ‘wet glue’ technology that was still predominant in 1986. Articles on closures did not appear in the early years of the *Journal*, and perusal of the advertising in early issues and in its sister publication *Australian Wine Industry Directory*, leaves no doubt that cork (including technical cork) was the dominant closure and the four-litre wine cask was an entrenched packaging option. However, while the initial introduction of screwcaps in the late 1970s had been abandoned by several leading companies by the mid-1980s, the 1986 edition of the *Australian Wine Industry Directory* does carry a full-page colour advertisement for screwcaps, which displays a number of leading brand names of the time. The first of what became many AWRI articles related to cork-related taints and other problems did not appear until the February 1989 edition (Amon *et al.* 1989), despite Lee *et al.* (1983) having discussed the formation of 2,4,6-TCA and subsequent tainting of wine in a review presented at the Fifth Australian Wine Industry Technical Conference, and a comprehensive review of “cork related problems” (Amon and Simpson 1986) having been published in the April 1986 issue of the *Australian Grapegrower & Winemaker* – which would become a sister publication to the *Journal* in the mid-2000s. That paper was referenced in a *Wine Industry Journal* article in the sixth edition in August 1987, which discussed taints in barrel-matured wine (Amon *et al.* 1987).

WINERY CRUSHERS, PRESSES AND FERMENTERS

The subject of the Technological Report in the third issue of the *Journal* (November 1986) was another recurring theme over its history: Crushing and pressing (Anon 1986c). Much of the article is dedicated to descriptions of what are implicitly recently installed continuous-presses in large wineries, with Buronga Hill being described as “a newly established winery”. The nature of the article suggests that membrane-press technology was a new concept for many Australian winemakers, despite the Willmes company having introduced the first horizontal rubber-bladder press in 1951, and the first air-pressurised membrane press in 1974 (Nordestgaard 2015). The August 1988 edition of the *Journal* noted, “The membrane press was developed by the German manufacturer Josef Willmes as a logical refinement to their airbag press” (Anon 1988b). The same issue included a report on the first Australian-made tank-press, being built by F. Miller and Company for the 1989 vintage (Anon 1988a). An associated article (Anon 1988b) suggests that the first Australian winemaker to install a membrane press was Brian Croser, who installed a Willmes TP4 at Petaluma in 1981. The article reports that Ralph Fowler had installed a Diemme rubber-bladder water press at Hungerford Hill in 1984, and states that Fowler considered the extra cost of air-pressurisation was not justified. The article then lists other winemakers who had installed air-bag presses as

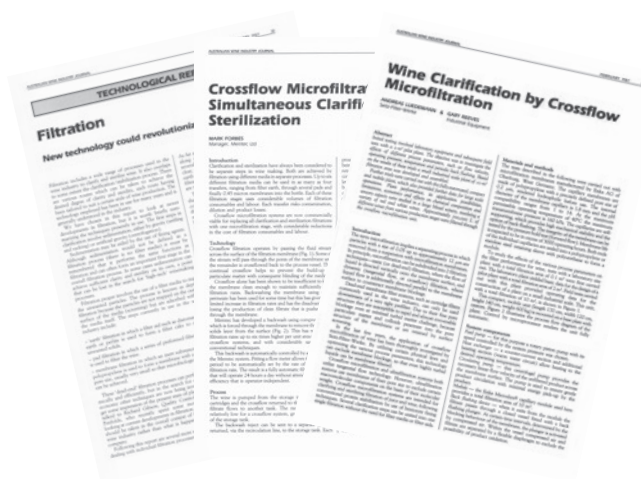
John Middleton at Mount Mary in 1986 and Nigel Catt and Andrew Garrett at Andrew Garrett wines, and also Andrew Mitchell of Mitchell Cellars in 1987. The article discusses the cost of membrane presses having been the limiting factor in their uptake to that point, but states that the increased yield of high quality juice being achieved by many producers meant the payback period was comparatively short, with Andrew Mitchell estimating that it was less than one year.

The November 1986 edition also contained other notable technical articles such as ‘Quantifying the effect of pH and sulphur dioxide on young red wine colour’ (Iland and Bruer 1986), and ‘The Vinimatic Rotary Vessel: A new tool for the Australian winemaker’ (Woodland 1986), which stated that these fermenters had already been installed in the Hunter Valley, Mudgee, the Murrumbidgee Irrigation Area, south-east Victoria, Coonawarra and McLaren Vale. However, as with membrane presses, the horizontal rotary red-fermenter was not a new concept, with Rankine (1986) stating, “The first rototanks (revolving horizontal red-wine fermenters) were installed at the Hermitage Hunter Valley winery in 1973”, and the classic French text *Traité d’oenologie Sciences et Techniques du vin* published in 1977 including diagrams of various rotary-fermenters, including what would now be recognised as a ‘Vinimatic’ (Ribéreau-Gayon *et al.* 1977).

WINE MICROBIOLOGY

Several of the most in-depth technical papers in the first year of the *Journal* examined wine microbiology, and usually approached their subject from an avoidance of spoilage perspective; as was the case in the third issue, with reviews of ‘hydrogen sulphide formation, utilisation and excretion’ (Monk 1986b) and acetic acid bacteria (Drysdale and Fleet 1986). While these topics continue to be of relevance for each new generation of winemakers, the degree of spoilage caused by them is now undoubtedly far lower than in previous years, with the information provided by the *Journal* over three decades likely to have contributed substantially to winemaker education and the downward trends.

A similar stance is taken in the fourth issue, with a Research Report on yeast ‘killer factors’ (Heard and Fleet 1987), and an article on ‘Yeast and bacteria’ (Anon 1987a) which notes, “Selection of yeast strain is at this stage more important in avoiding poor quality than in enhancing wine. Points to consider are the avoidance of the production of nuisance compounds, such as hydrogen sulphide and acetic acid.” The article contains only two short paragraphs in relation to bacteria; however, the following issue contained a four-page Technological Report on malolactic fermentation (Anon 1987b). That article refers to ‘freeze dried’ ‘commercially available cultures’ of malolactic bacteria, but was published seven years before the first direct-inoculation malolactic bacteria, Viniflora Oenos, was released in 1993, the USA patent for that preparation having been granted in December 1991. Beelman and Duke (1984) had described a method for producing freeze-dried cultures of malolactic bacteria, which was the basis of the techniques used to produce the freeze dried commercial cultures referred to in Anon (1987b). However, the 1991 patent application claims, “The reactivation of those strains takes at least 24 hours and up to several days and requires special facilities in the winery”. It further claims,



The fourth issue of the *Journal*, February 1987, contained a number of articles on the use of crossflow filtration for wine. The technology was revisited by the *Journal* three issues later, and again in the second issue of 1988. While the articles were all enthusiastic about the technology, its widespread uptake did not apparently occur for approximately another 20 years.

"(previous) attempts have been made to inoculate wine directly with lyophilized malolactic bacteria However, this resulted in quite a lengthy lag phase (where no malic acid was converted) ... and reactivation of the cultures was therefore recommended". While those assertions might be challenged by some of the producers or users of those early freeze-dried preparations, the availability of reliable direct-inoculation malolactic bacteria can be considered an important advancement on the methods being used in 1986.

WINE ANALYSIS

The technology of wine analysis has also developed greatly over the last 30 years, and the AWRI has been a leader in that development. The fourth issue of the *Journal* contains a short

article (Anon 1987c) regarding the AWRI's purchase of its first automated analysis instrument, a SCALAR seven-channel segmented flow analyser. It was reported that as a result of this purchase, the cost of VI-1 analysis, which was required for export to much of Europe, had been reduced from \$150 to \$100. At that time, the AWRI's Analytical Service laboratory was possibly the only NATA-certified laboratory for VI-1 analysis, although Lindeman's' NATA certification was transferred from its Sydney laboratory to its newly completed Karadoc winery at about the same time (Goad pers. comm. 2016). The *Journal* article (Anon 1987c) noted that the SCALAR instrument included "a computer with an 80Mb hard disk for storage of data which will provide a database of analytical information concerning the composition of Australian wines". That database of results of analysis of commercial wines has been maintained and built on since the mid-1980s, and is periodically mined in order to produce information on the composition of Australian wines. The most recent publication (Godden *et al.* 2015) plots the evolution of Australia's wine offering between 1984 and 2014, neatly coinciding with the 30-year life of the *Wine & Viticulture Journal*.

FILTRATION

The fourth issue of the *Journal* (February 1987) is notable because the Technological Report contains a number of articles concerning the use of cross-flow filtration for wine (Anon 1987d, Forbes 1987, Luedemann and Reeves 1987). As with protease treatment for protein stability, Penfolds Wines QC manager and AWRI council member Richard Gibson was at the forefront of the investigation of this technology, stating in Anon (1987d) "the time has come where winemakers are looking closely at the total filtration process, which can run to D.E., two grades of pad, a membrane pre-filter and a final membrane. There is now available one technique which can replace all of these steps, especially for white wine production. It is crossflow microfiltration". The previous year, Gibson had also authored another paper on crossflow filtration in another publication (Gibson 1986b). Anon (1987d) notes, "Crossflow microfiltration



Also manufacturers of

- S G Spur Pruners
- Single Side Pruners
- Vine Cane Sweepers
- Hydraulic Power Packs
- Double Acting Cutter Bars

AUSTRALIAN MADE PRUNERS



WINTER PRUNING




For further information visit our website
at www.spagnolo.com.au or contact:
Ph (03) 5021 1933 Fax (03) 5021 5233
Email sales@spagnolo.com.au
Mildura Victoria Australia

S G Pruner

- Full electric over hydraulic controls from your tractor seat
- Totally adjustable for different cordon spacings
- Spur prunes between vine cordons
- Prunes single cordon in VSP trellis
- SG Pruner patent app no. AUS 780431 U.S.A 6,523,337

Vineyard & Orchard Sweepers

- Single and double sided
- Spring-loaded head enables it to glide around posts and vine trunks.
- Optional hydraulic lift, tilt and side shift cylinders.
- Ideal for cleaning up uneven terrain
- Durable powdercoated finish

systems have been commercially available for only 2-3 years, but with several wine companies having now successfully trialled systems, they are set to take off. If European experience is any guide, they could become standard equipment in about five years for white wine filtration". This technology was revisited by the *Journal* three issues later (Tarring 1987), and again by Richard Gibson in the second issue of 1988, where, in an article titled, 'Crossflow microfiltration – four years on', he reviews trials performed around the world (Gibson 1988). However, while all of these articles are enthusiastic about the technology, its widespread uptake did not apparently occur for approximately another 20 years.

CONCLUSIONS

To conclude, most of the technologies reviewed in this paper originate overseas, and it is their introduction and development in Australia which is charted by the *Journal*. However, the final technical article in the fourth edition of the *Journal*, which marked the conclusion of its first year, concerned a new piece of Australian winemaking technology that has seen near complete worldwide uptake: the silicone barrel bung (Anon 1987e). While the first line of the article states, "Some of the greatest inventions are also some of the most simple", the five-piece bung described in the article was later simplified to the single piece of silicone that is nearly ubiquitous in cellars worldwide today. While this invention was certainly simple compared with many of the other technologies discussed here, its advantages compared with what it replaced could be seen to symbolise the degree of change that has taken place in our industry over the life of the *Journal*. When the first edition of the *Wine & Viticulture Journal* was published, wooden shives were the norm for sealing barrels. These were circular, tapered pieces of wood that were hammered into the bung-hole, and made airtight with the aid of strips of hessian or calico, with the addition of 'bung putty'. We have certainly come a long way in 30 years.

ACKNOWLEDGEMENTS

The author gratefully acknowledges the time and assistance of the many industry personnel who provided their knowledge and recollections during the preparation of this article, as well as the help of Simon Nordestgaard and Michael Downie of the AWRI.

REFERENCES

- Amon, J. M. and Simpson, R. F. (1986). Wine corks: a review on the incidence of cork related problems and the means for their avoidance. *Australian Grapegrower & Winemaker* 286:63-80.
- Amon, J. M.; Simpson, R.F. and Vandepuer, J.M. (1987) A taint in wood-matured wine attributable to microbial contamination of the oak barrel. *The Australian and New Zealand Wine Industry Journal* 2 (2):35-37.
- Amon, J. M.; Vandepuer, J.M. and Simpson, R.F. (1989) Compounds responsible for cork taint in wine. *The Australian and New Zealand Wine Industry Journal* 3(4):62-69.
- Anon (1986a) Barrel Fermentation - An ancient technique becomes modern technology. *The Australian Wine Industry Journal* 1(1):10 -13.
- Anon (1986b) Stabilisation and clarification: 'Turbid or not turbid...'. *The Australian and New Zealand Wine Industry Journal* 1(2):27-34.
- Anon (1986c) Crushing and pressing. *The Australian and New Zealand Wine Industry Journal* 1(3): 33-43.
- Anon (1987a) Yeast and bacteria. *The Australian and New Zealand Wine Industry Journal* 1(4):24- 27.
- Anon (1987b) Malolactic fermentation. *The Australian and New Zealand Wine Industry Journal* 2(1):39- 42.
- Anon (1987c) AWRI analysis fees to be reduced. *The Australian and New Zealand Wine Industry Journal* 1(4):27.
- Anon (1987d) Filtration: new technology could revolutionize filtration. *The Australian and New Zealand Wine Industry Journal* 1(4):33-35.
- Anon (1987e) Filtration: hiving off shives, or cask sealing made simple. *The Australian and New Zealand Wine Industry Journal* 1(4):83.
- Anon (1988a) An Australian-made tankpress – the Miller membrane press is ready for the 1989 vintage. *The Australian and New Zealand Wine Industry Journal* 3(2):10-11.
- Anon (1988b) Membrane presses. *The Australian and New Zealand Wine Industry Journal* 3(2):12-16.
- Bearzatto, G. (1986) Wine fining with Silica Sol. *The Australian and New Zealand Wine Industry Journal* 1(2):39-40.
- Beelman, R.B. and Duke, G.R. (1984) The development and utilization of freeze-dried malolactic bacteria cultures for inoculation of wine. Malolactic Fermentation. Proceedings of Australian Society of Viticulture and Oenology seminar, Melbourne. Lee, T. H., ed.
- Benjamin, J. and Baldwin, G. (1986) The Australian Wine Industry Database. *The Australian Wine Industry Journal* 1(2):65.
- Bott, E. (1986) Centrifugal separation of tartrate from wines stabilised by the contact process. *The Australian Wine Industry Journal* 1(2):35-38.
- Drysdale, G. and Fleet, G. (1986) Acetic acid bacteria in wines. *The Australian and New Zealand Wine Industry Journal* 1(3):44-47.
- Forbes, M. (1987) Crossflow microfiltration – simultaneous clarification and sterilization. *The Australian and New Zealand Wine Industry Journal* 1(4):43-45.
- Gibson, R. (1986a) Protease enzymes for protein stabilisation. *The Australian Wine Industry Journal* 1(2):41-42.
- Gibson, R. (1986b) Cross flow membrane technology for the wine industry. *The Australian Grapegrower and Winemaker* 286:17-23.
- Gibson, R. (1988) Crossflow microfiltration – four years on. *The Australian Wine Industry Journal* 3(1):31-35.
- Godden, P.; Wilkes, E. and Johnson, D. (2015) Trends in the composition of Australian wine 1984-2014. *Aust. Journal of Grape and Wine Research* 21(S1):741-753.
- Heard, G.M. and Fleet, G.H. (1987) The occurrence of killer character in yeasts during the fermentation of Australian wines. *The Australian Wine Industry Journal* 1(4):68-70.
- Iland, P. and Bruer, D. (1986) Quantifying the effect of pH and sulphur dioxide on young red wine colour. *The Australian Wine Industry Journal* 1(3):48-51.
- Lee, T.H.; Simpson, R.F.; Vandepuer, J.M.; Fleet, G.H.; Davis, C.R.; Daly, N.M. and Yap, A.S.J. (1983) Microbiology of wine corks. Advances in Viticulture and Oenology for Economic Gain. Proceedings of the fifth Australian Wine Industry Technical Conference. Lee, T.H. and Somers, T. C., eds.
- Luedemann, A. and Reeves, G. (1987) Wine Clarification by Crossflow Microfiltration. *The Australian Wine Industry Journal* 1(4):47-51.
- Monk, P. R. (1986 a) Rehydration and propagation of active dry wine yeast. *The Australian Wine Industry Journal* 1(1):3-5.
- Monk, P. R. (1986 b) Formation, utilisation and excretion of hydrogen sulphide by wine yeast. *The Australian and New Zealand Wine Industry Journal* 1(3):10-16.
- Nordestgaard, S. (2015) The history of wine presses. Part 1: batch presses. *Australian and New Zealand Grapegrower and Winemaker* 619:64-71.
- O'Brien, K. J. (1985) Inhibition of tartrate crystallization in wine with carboxymethylcellulose. physical stability of wine. Proceedings of Australian Society of Viticulture and Oenology seminar, Reynella, South Australia. Lee, T. H. ed.
- O'Brien, K. (1986) Carboxymethylcellulose and Inhibition of Tartrate Crystallisation. *The Australian Wine Industry Journal* 1(2):43-45.
- Rankine, B.C. (1986) Oenological research and technical development in Australia. Proceedings of the sixth Australian Wine Industry Technical Conference. Lee, T. H., ed.
- Ribéreau-Gayon, J.; Peynaud, E.; Ribéreau-Gayon, P. and Sudraud, P. (1977) *Traité d'oenologie Sciences et Techniques du vin* published, volume four; 554. Bordas, Paris.
- Tarring, S. (1987) Crossflow microfiltration in wine clarification. *The Australian and New Zealand Wine Industry Journal* 2(3):25-29.
- Wucherpennig, K.; Dietrich, H.; Goetz, W. and Roetz, S. (1984) Einfluß von Kolloiden auf die Weinstinkristallisation unter besonderer Berücksichtigung der Weinstinkstabilisierung durch Carboxymethylcellulose. (Influence of colloids on tartrate crystallization with special consideration to tartrate stabilization using carboxymethylcellulose). *Die Weinwirtschaft Technik* 1(13):13-23. Translated to the English by T. Henick-Kling, The Australian Wine Research Institute.
- Woodland, P. (1986) The Vinimatic rotary vessel: a new tool for the Australian winemaker. *The Australian Wine Industry Journal* 1(3):53-54.