

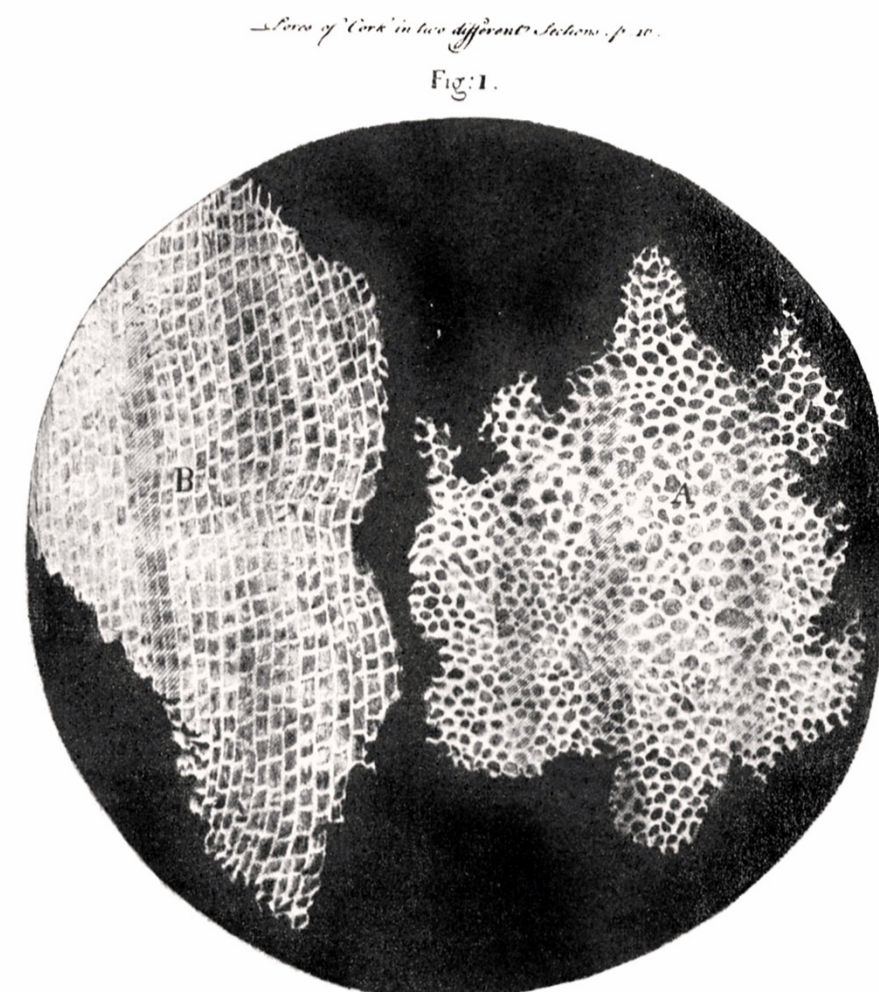
# Bottle closures: past and present



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## Cellular structure of cork

Cork has a cellular structure that makes it compressible and relatively impermeable to liquids and gases. Hooke published this microscopic image of cork in *Micrographia* in 1665 and coined the term cell for the compartments in biological organisms based on this.



## Cork production

Cork is mentioned in ancient texts, but it did not come into use as a close-fitting bottle stopper until the 17th century. It was not until the late 18th century that cork stopper production was common and only in about 1820 that regular stripping of the bark became a standard procedure.



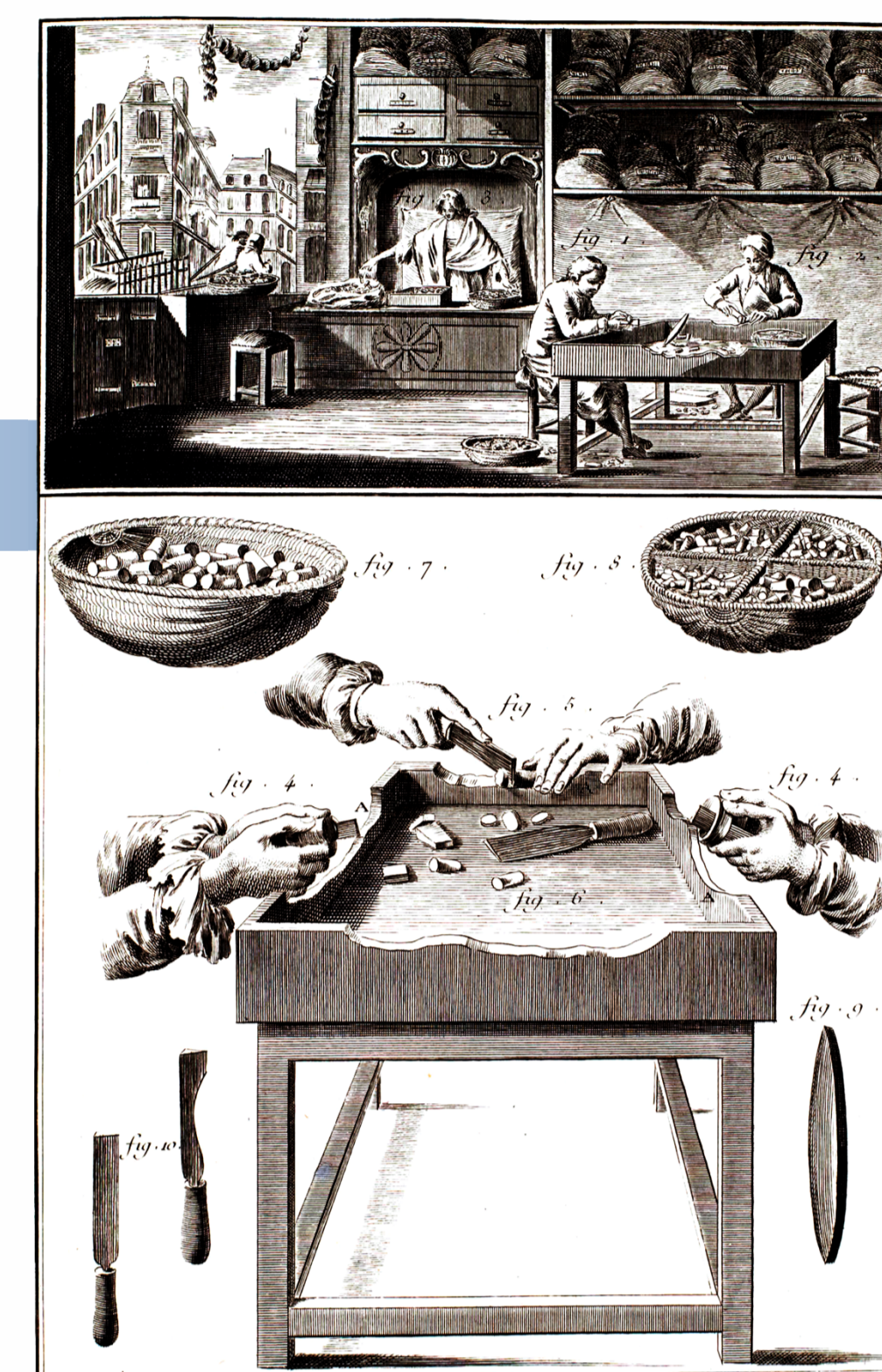
## Bark baths

This image from a 1907 article in *Lectures pour tous* describes how cork bark is initially softened in boiling baths of water, dosed with chlorine and oxalic acid (chlorine appears to have only been eliminated from use in bark or stopper bleaching baths in the 1980s when its risk in cork taint formation was better understood). Other authors from the era similarly note how the bark baths serve to soften and make the cork manipulatable and also that it extracts tannin and colour and kills 'insect life'.



Straight corks used to stopper long-neck bottles

Tapered corks used for medicine bottles and whisky flasks



Bouchoumer.

## Manual cork stopper production

Diderot's pioneering *Encyclopedie* (c. 1763) depicts the very manual techniques originally used to make cork stoppers.



## Cork adaptations

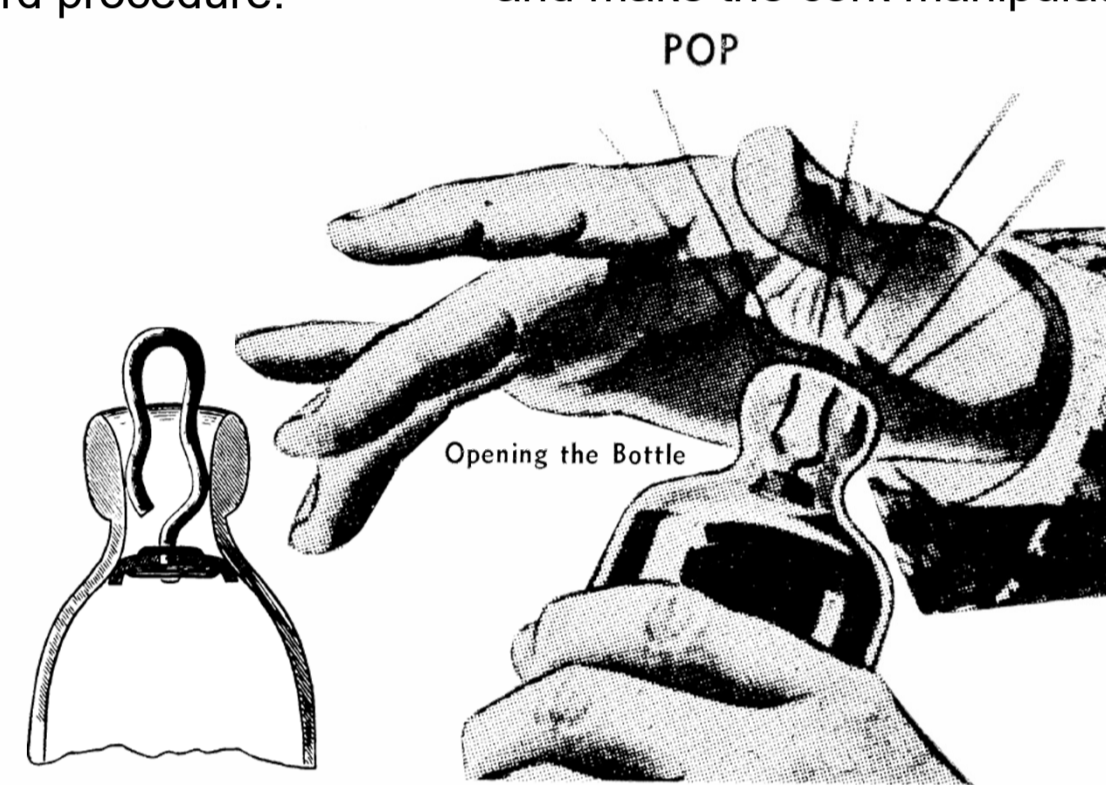
### Agglomerated corks

Cork shavings agglomerated with a binding mixture appear to have first been used as bottle stoppers around 1900. Even before this, the waste cork shavings from cork factories were recovered and used for other purposes, sometimes in agglomerated formats. This is not surprising given that cork shavings waste was often 65% of the total cork used.



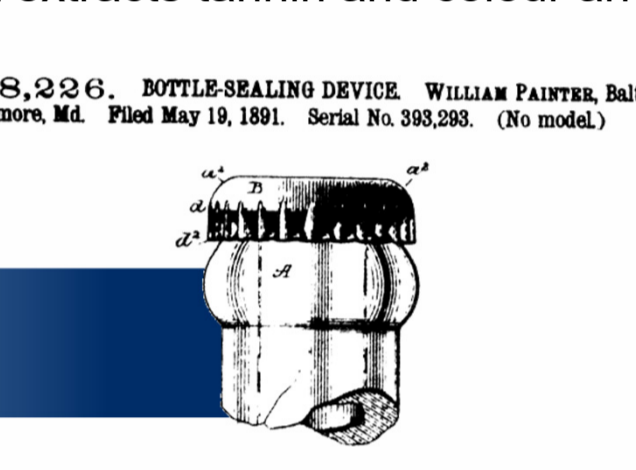
### Teachers T-top

In 1913 Teacher's patented a cork with a top that allowed it to be opened without a corkscrew. It was also tamper evident.

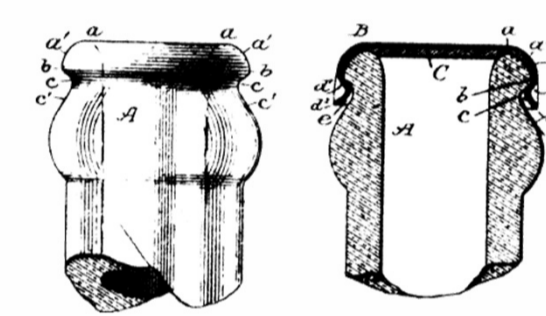


### Hutchison pop

In 1879, Hutchison patented a soda bottle stopper that became dominant in the USA. A sharp blow to the loop released the gasket and the gas escaped with a loud pop. The use of this stopper is the origin of the term 'soda pop'. The design was not particularly hygienic since any material in the neck is driven into the beverage upon opening.



### Soda

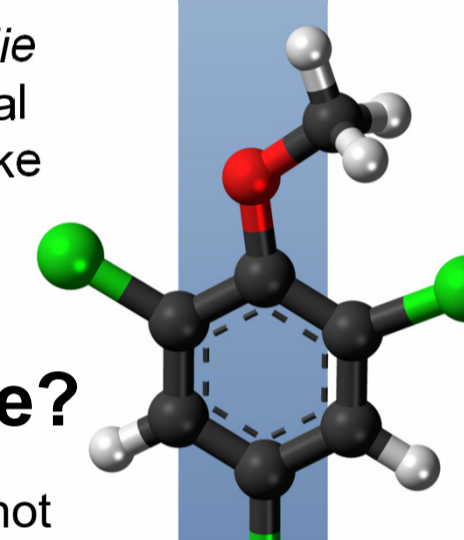


### Crown cork

In 1892, Painter was issued patents for the crown cork. This was a single use closure. A disc of natural cork was used as the liner, but around 1915 this changed to being a disc of agglomerated cork. Synthetic liners on crowns were only adopted much later – cork liners still dominated in the 1960s.

### Was TCA always there?

2,4,6-Trichloroanisole (TCA) was not identified as the compound responsible for cork taint until around 1980; however, intermittent issues with corks were well known prior to this. Early 20th century authors write of occurrences of 'corky flavour'.



TCA



### Vulcanised rubber internal screw-tops

Vulcanised rubber screw tops were commonly used on wine bottles. They fitted into a bottle with an internal thread (the stopper had a gasket that has worn away from the old stopper shown). Bakelite was later also sometimes used instead of rubber.



### Plastic plug under a metal cap

In the 1950s and 1960s many popular mass-market French wines (e.g. Kiravi) were bottled with a plastic stopper and a tamper-evident metal cap. Probably more French wine bottles were capped like this than with corks. Similar closures were also used on other products, such as Evian bottled water.

## Rubber & plastic

### Screw-cap with a plug

Launched in 1956, The famous Barossa Pearl was also bottled with a plastic plug held by a screw-cap. Initial trials with a cork held by a screw-cap leaked and delayed the planned release of the product for the Melbourne Olympics.

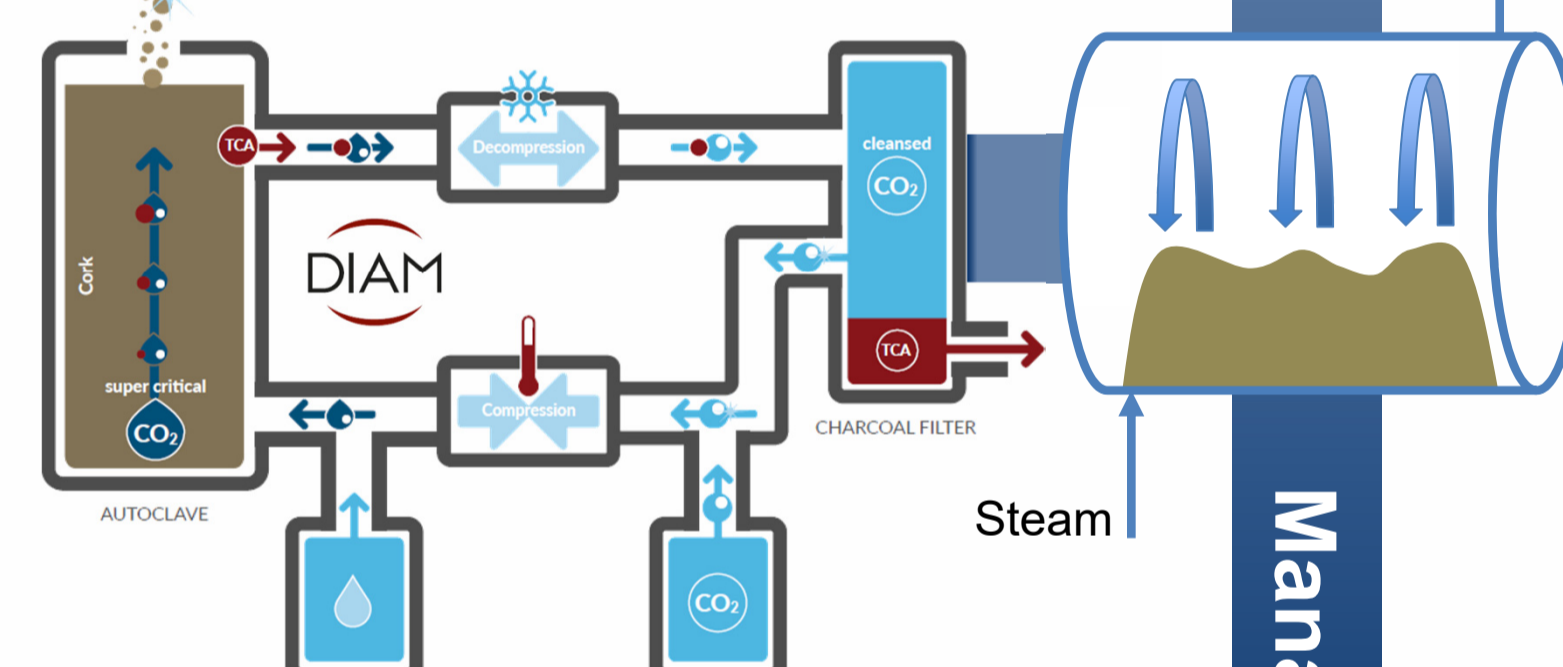


### Synthetic corks

Plastic cork-shaped closures were developed in the 1990s. They acquired significant market share, but their use has been in decline since 2007.

### Being 'natural'

Cork producers market the naturalness of their product. Some synthetic cork manufacturers are now using plant-derived polymers for their closure to counter this. Agglomerated cork manufacturers are also releasing versions made with plant-derived binders and natural structural modifiers.



### Steam or supercritical CO2

Facing pressure from the wine industry, cork producers made changes to their processes to try to reduce the occurrence of cork taint. This included the treatment of granules with steam or supercritical CO2 to extract and drive off undesirable volatiles. Supercritical CO2 extraction employs CO2 above its critical temperature and pressure, where it has properties between those of a liquid and a gas that are favourable to extraction.

Management

## Some early Australian and US wine screw-caps



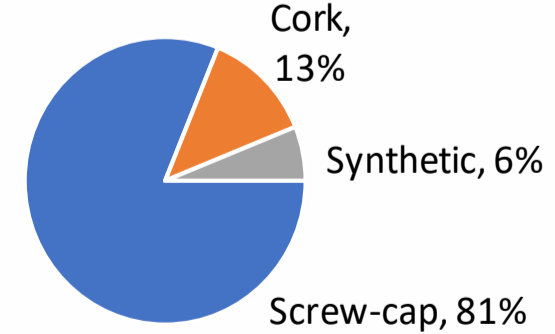
ALSECO ROLLED-ON SEALS Made of Alcoa Aluminum



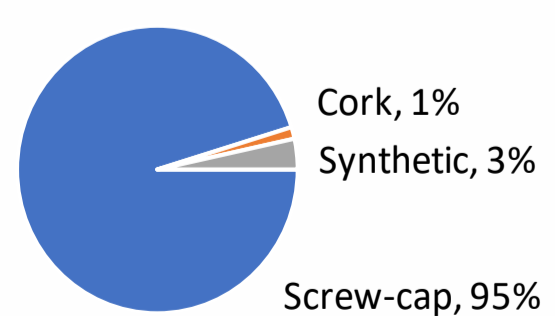
### Standardised threads and roll-on closures

The standardisation of bottle threads in the 1920s and development of roll-on aluminium closure led to the mass uptake of screw-caps for bottles. For a long time the liner was still cork.

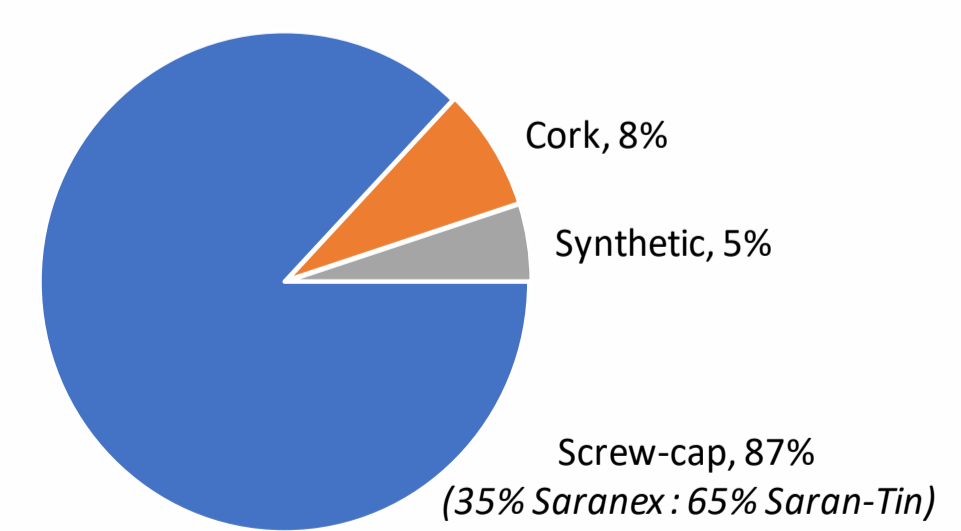
### Australia - red wine



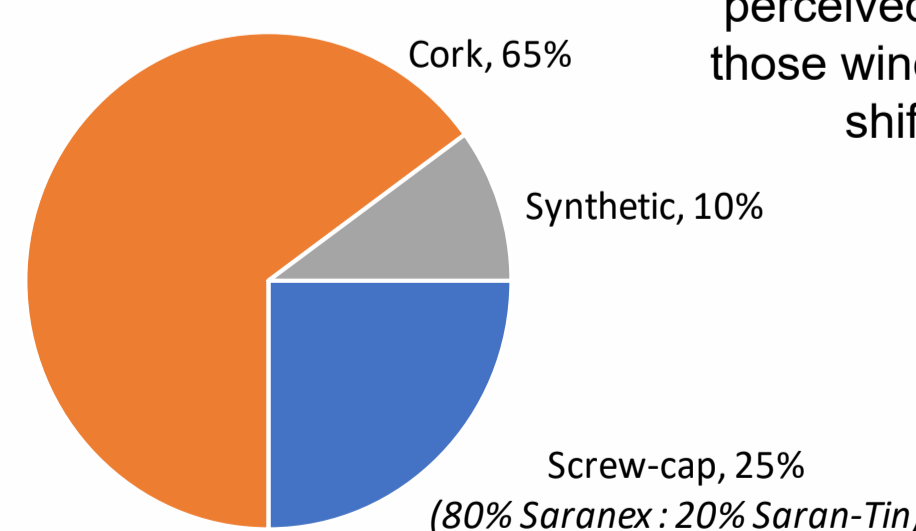
### Australia - white wine



### Australia



### World



## Closure market estimates, c. 2015

Australia is a much larger user of screw-caps than most other countries. A greater proportion of the screw-caps used in Australia have a Saran-Tin liner, which is more expensive and less permeable to oxygen than Saranex liners (Data for wine bottled in Australia is based on the AWRI Vineyard and Winery Practices Survey - [www.awri.com.au/survey](http://www.awri.com.au/survey). World data and liner data are estimates based on information from several suppliers for these products or equivalents).

## Long skirted screw-cap developed in France

In 1959, Le Bouchage Mecanique began developing the Stelcap-Vin, a long-skirted screw-cap for wines. Many trials were performed comparing the performance of different liner materials.

## Proven technically in Australia

In 1970, Australian Consolidated Industries (ACI) obtained the Australian rights to the Stelcap-Vin and shortened the name to Stelvin. Trials were established in conjunction with three major wine companies and the AWRI. Stelvins with three different types of liner were trialled against cork. Red and white wines sealed with the 358 liner scored equal to or better than the cork and other liners over 18 months. This liner was made from Saran and polyethylene (perhaps similar to Saranex).

## Adoption and failure

After having been proven technically as the superior closure, several Australian wineries adopted screw-caps in the late 1970s. However, the closure was perceived as cheap by consumers and those wineries that had adopted it, soon shifted back to using corks.

## Rise of the screw-cap

In the early 2000s, Clare winemakers led by Jeffrey Grosset launched their premium Riesling wines under screw-caps. This was a major success and screw-cap adoption accelerated in Australia from that point.

## Ridgeless caps

Around 2005, wine screw-caps with a plastic thread insert were launched. This provided a finish without the thread pattern visible on the outside of the rolled-on cap.

**Acknowledgements:** Winery staff and suppliers that provided information and the AWRI library.

**Article:** This poster is a summary only - a more detailed article may be written in the future.

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