



Walter H. Duda - Cement Data Book - 3 volumes - French & European Pubns.1988

Volume 1: International Process Engineering in the Cement Industry [Walter H. Duda](#) 1985

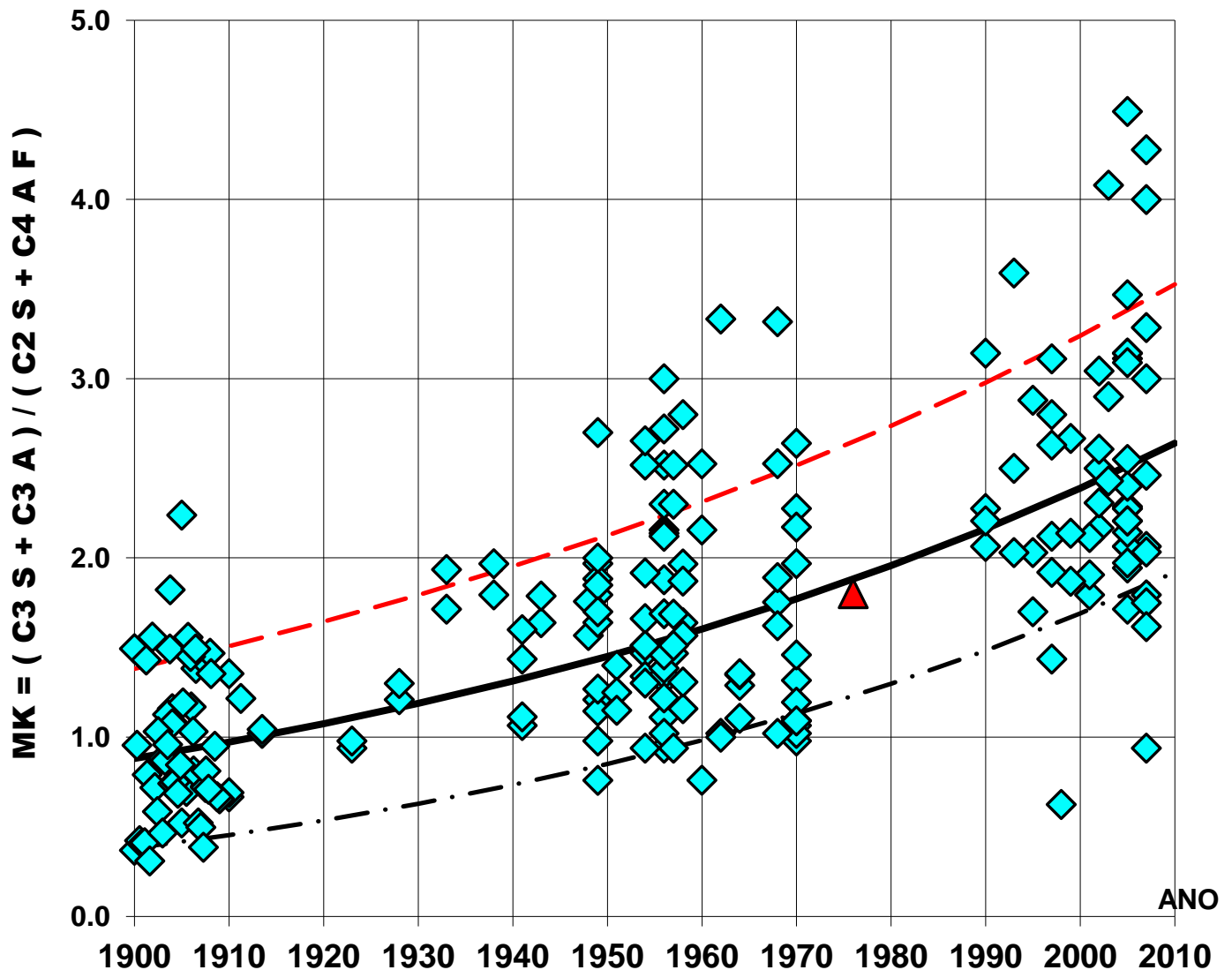
Volume 2: Automation, Storage, Transportation, Dispatch [Walter H. Duda](#) 1984

Volume 3: Raw Material for Cement Production 1988

Walter H. Duda - Manual Tecnológico del Cemento - Lexington, KY USA - 2010

[Walter H. Duda](#)

$$\text{M.K.} = \text{Módulo Calórico} = (\text{C3S} + \text{C3A}) / (\text{C2S} + \text{C4AF})$$



" Quanto maior M.K. maior o calor de hidratação do cimento."

" Em 1976 (▲) o valor de M.K. era de 1,80. Hoje já é maior que 2,6."

Obs: Gráficos feitos por Eduardo Thomaz com os dados coletados nos livros e artigos citados nas referências ao final do texto.

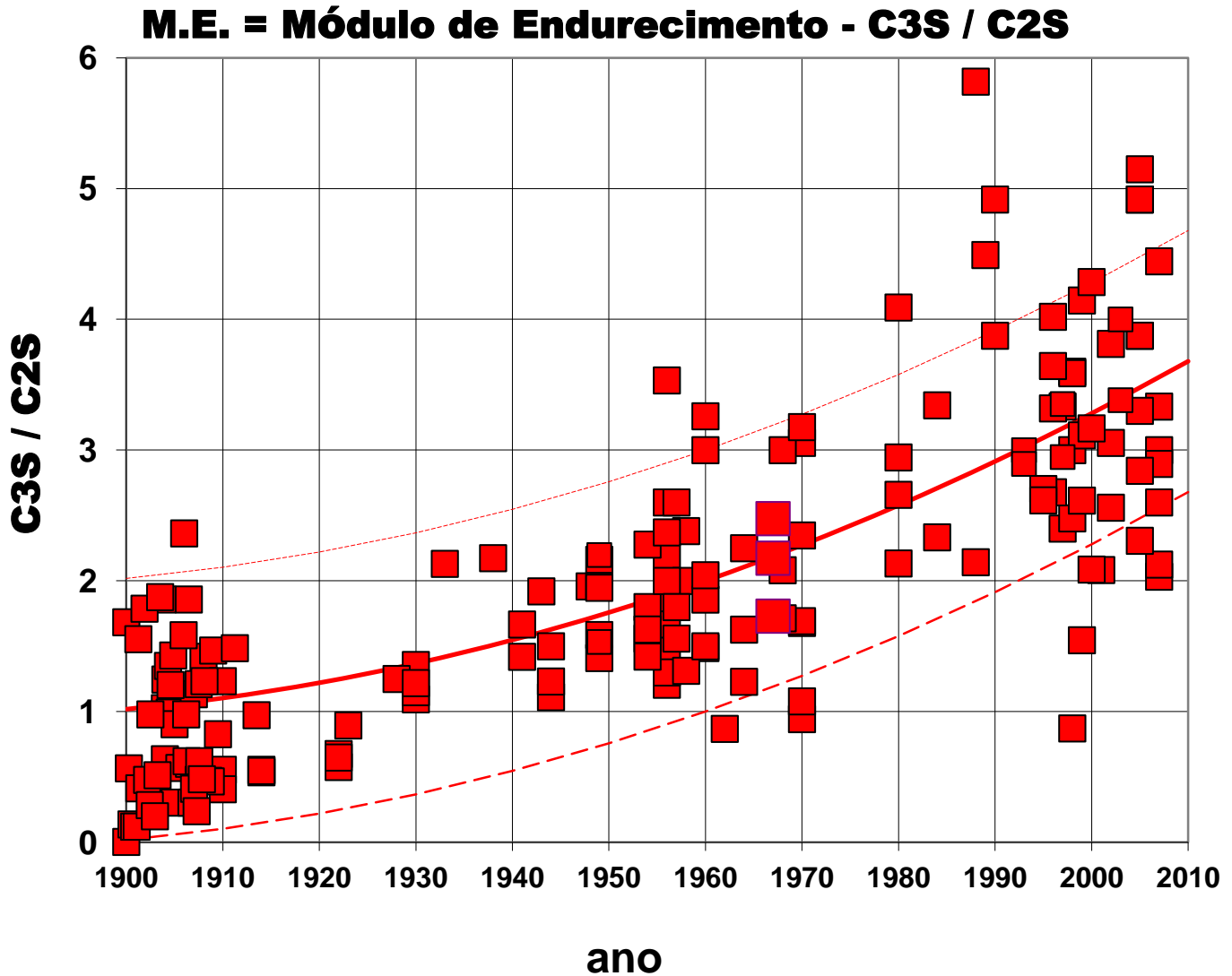
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Walter H. Duda

" Cement Data Book " - 3 volumes - 1988

Módulo de Endurecimento = ME

" Quanto maior ME, mais rápido endurece o concreto."



" Com M.E. crescente aumentam as resistências iniciais dos cimentos, cresce o calor de hidratação e decresce a resistência à agressão química.

Em cimentos com alta resistência inicial o valor de M.E. chega até 8,0 .

Em cimentos belíticos, com baixo teor de C3S e alto valor de C2S, o valor de M.E. fica abaixo de 0,5. Há tendência de auto-pulverização do clínquer."

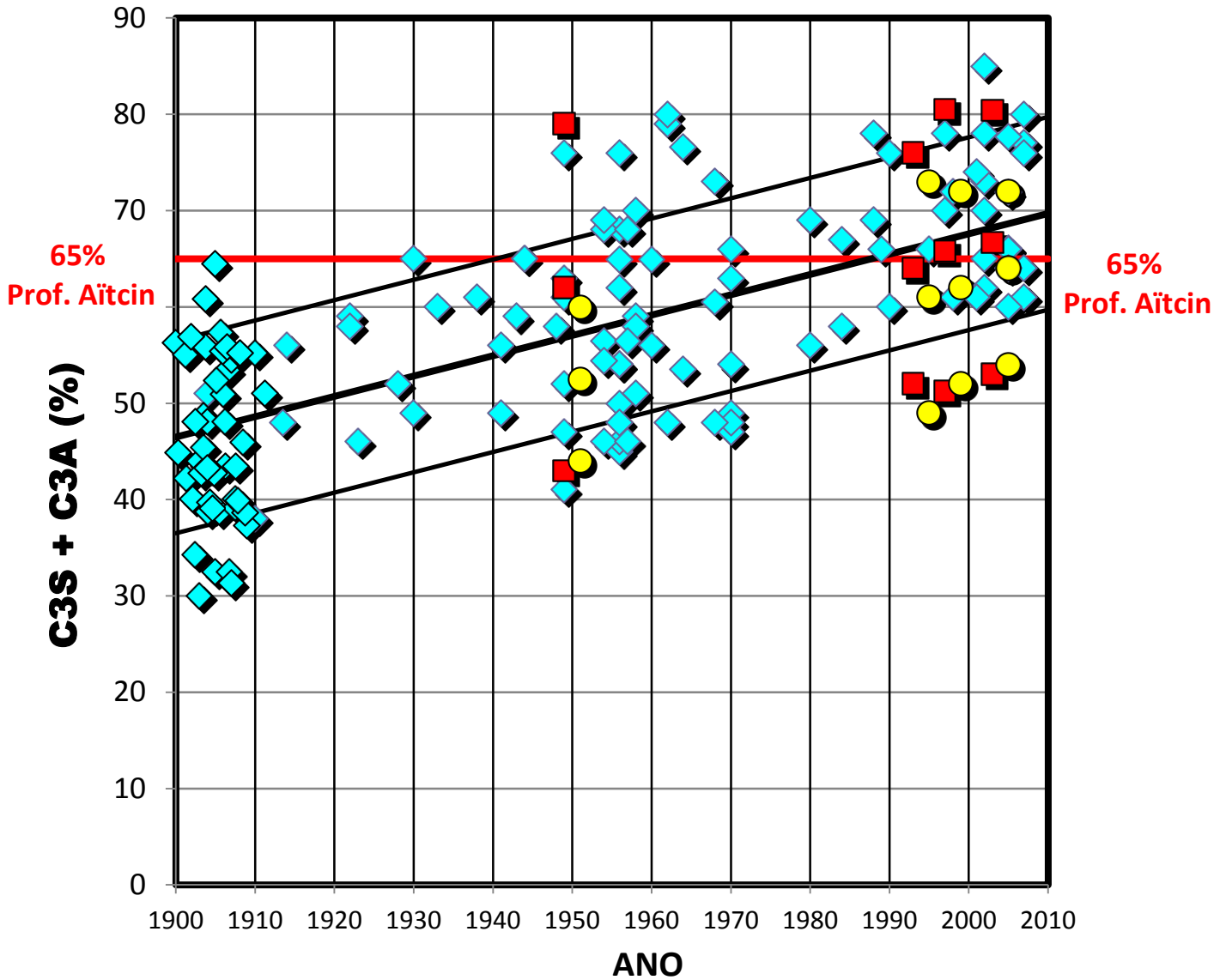
Prof. Pierre Claude Aïtcin

“Binders for Durable and Sustainable Concrete”

Série : Modern Concrete Technology – 15

Taylor & Francis -2008

Prof . Aïtcin 2009 : $C3S + C3A \leq 65\%$



O prof. Aïtcin limita $C3S + C3A$ a 65% em massa no clínquer do cimento

Pontos amarelos e vermelhos são da Portland Cement Association, publicados em 2008.

Gráfico feito por Eduardo Thomaz com os dados das referências ao final do texto

Cimento Portland Comum : Teor de C3S

C3S = endurecimento rápido, alto calor de hidratação,
alta resistência inicial

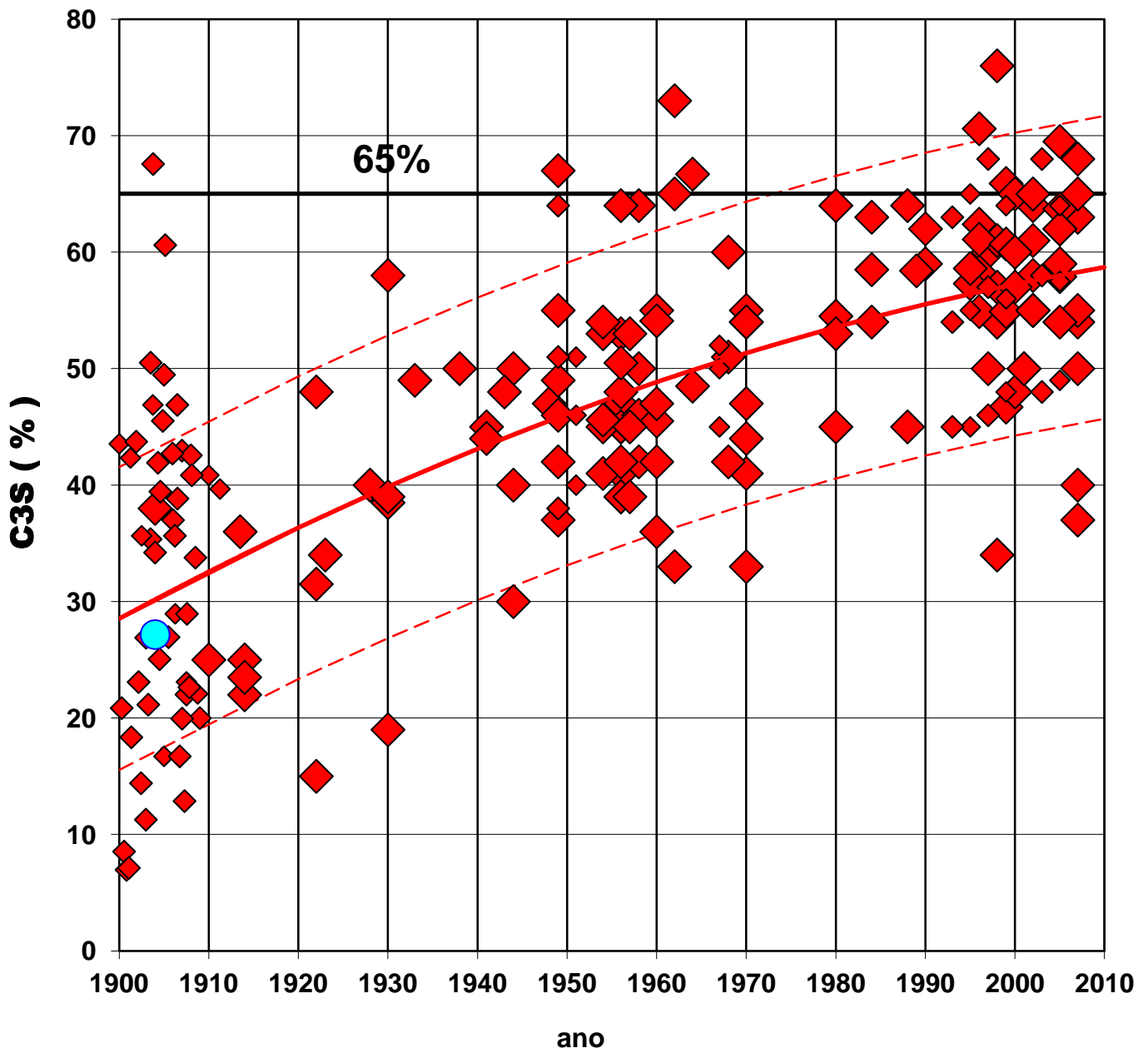


Gráfico feito por Eduardo Thomaz com os dados das referências ao final do texto

Cimento Portland Comum : Teor de C2S

C2S = endurecimento lento, baixo calor de hidratação,
baixa resistência inicial

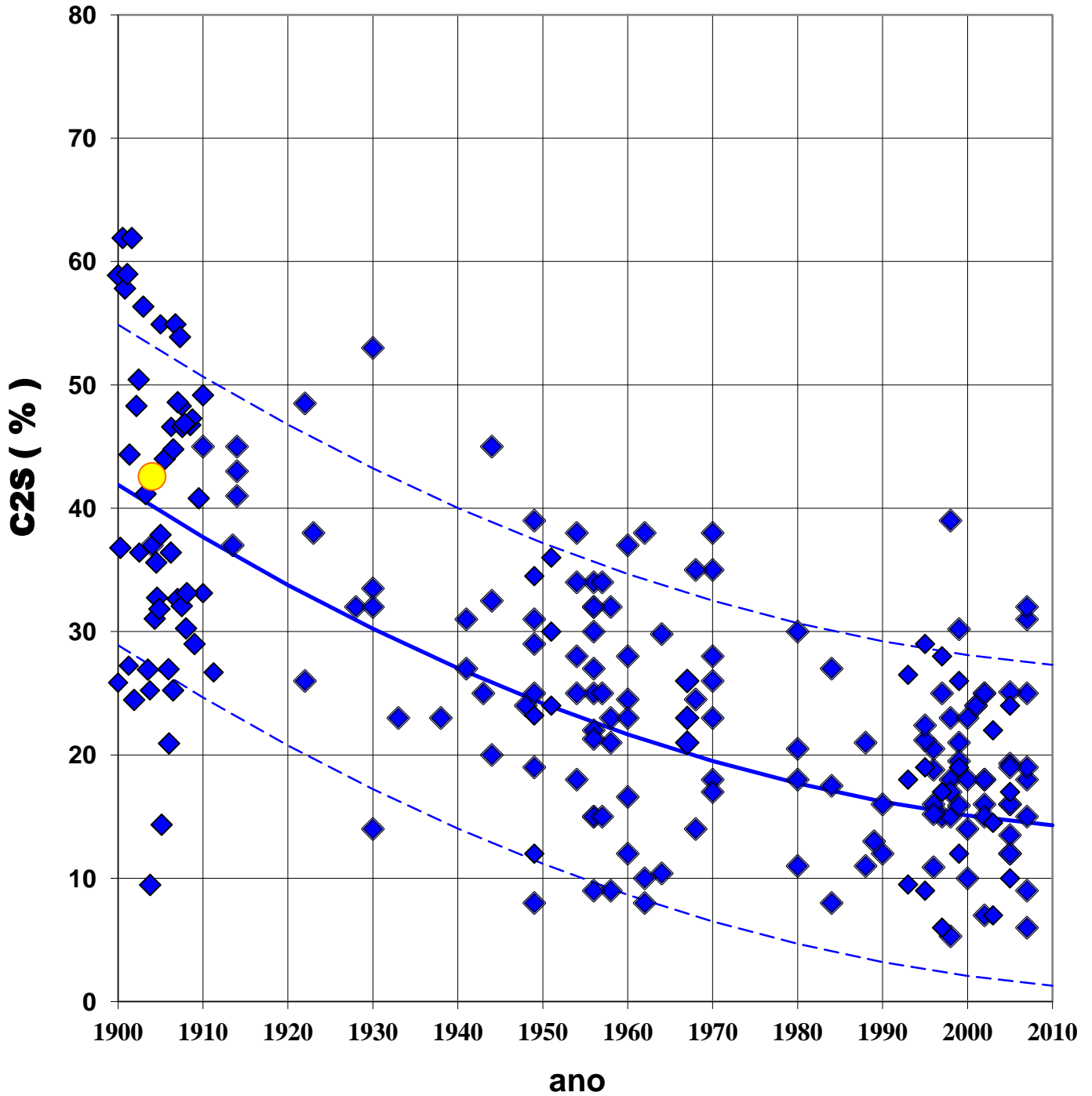
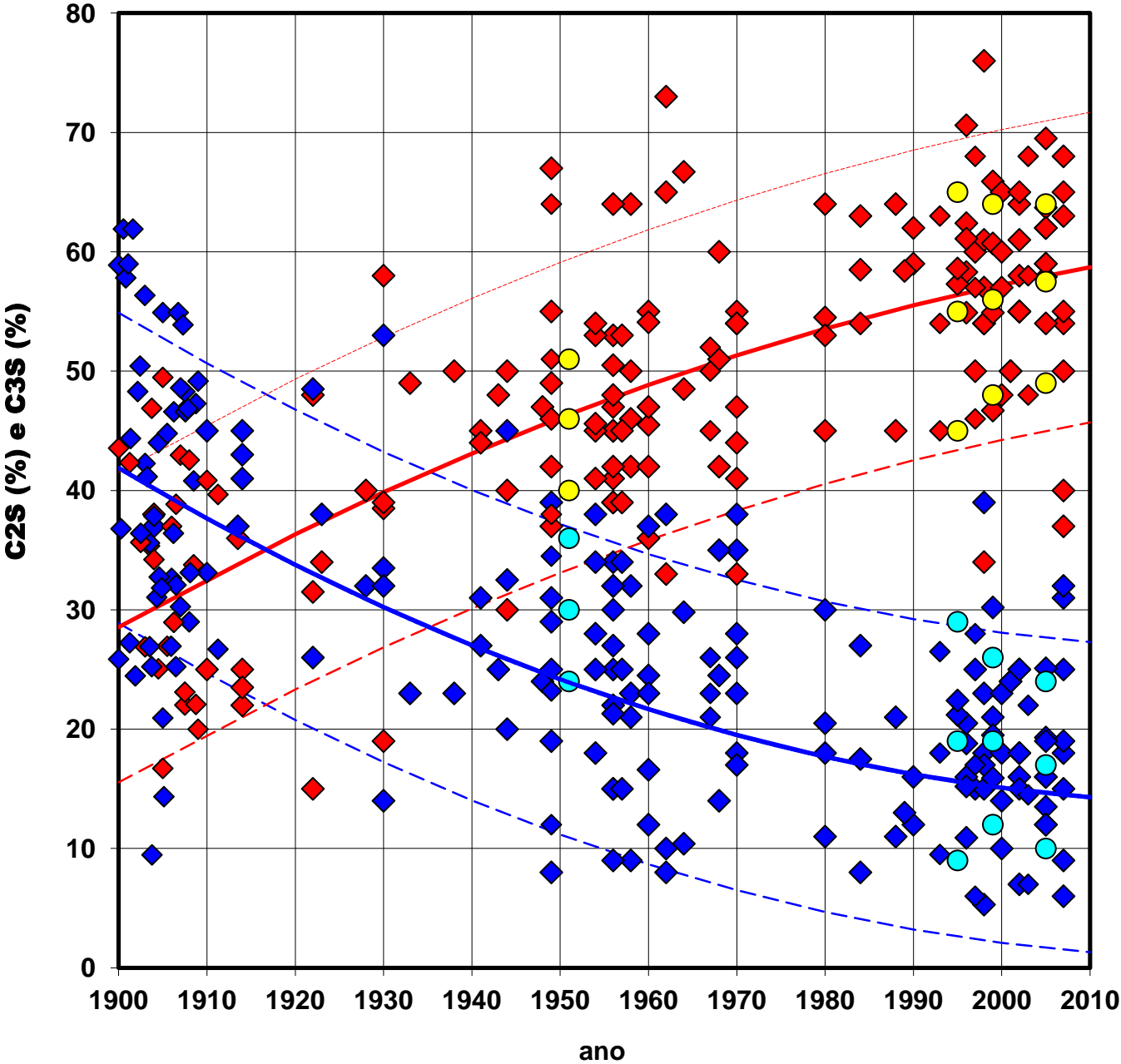


Gráfico feito por Eduardo Thomaz com os dados das referências ao final do texto

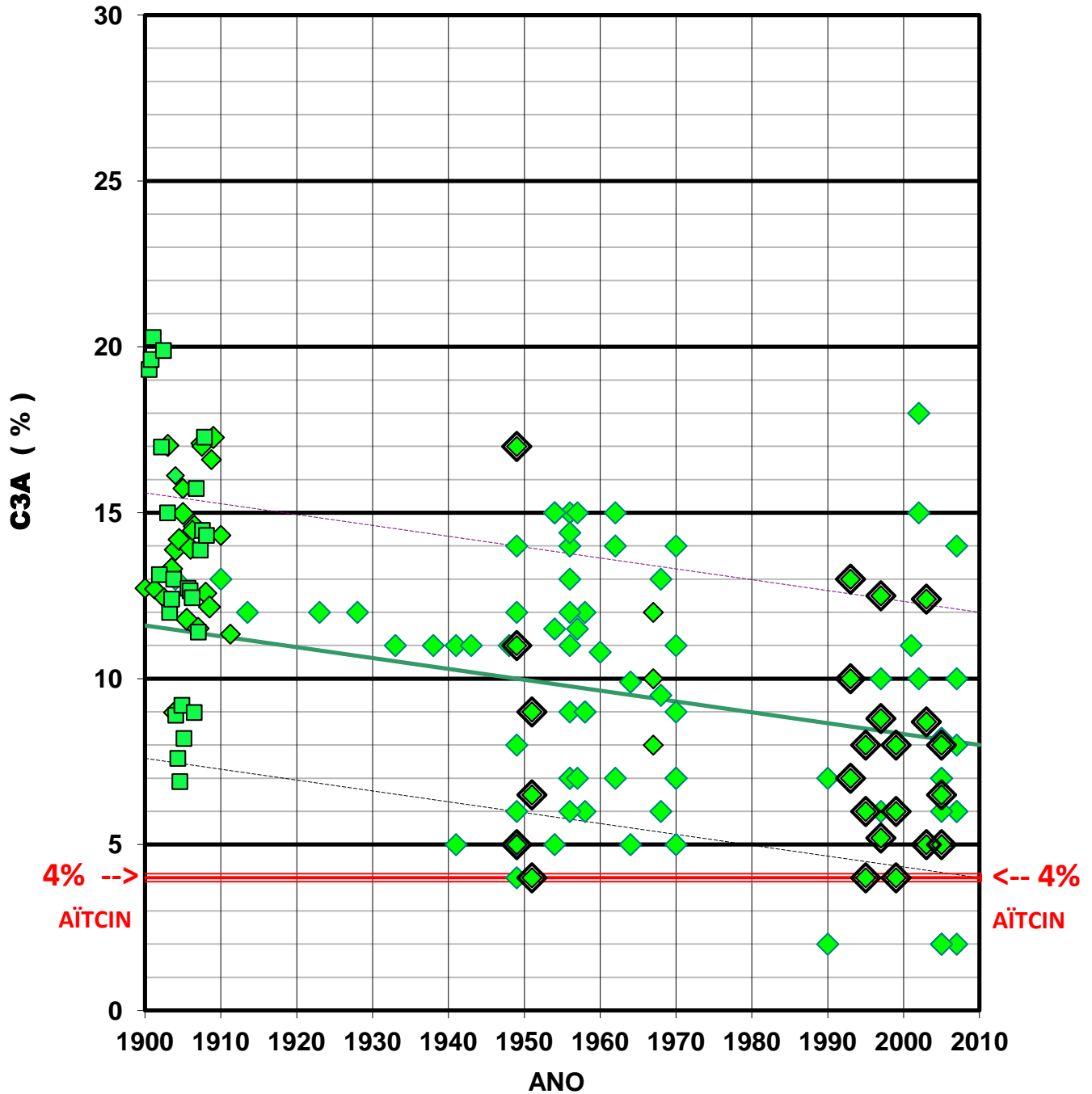
C3S e C2S



Obs : Pontos em azul claro e em amarelo são da PCA em 2008

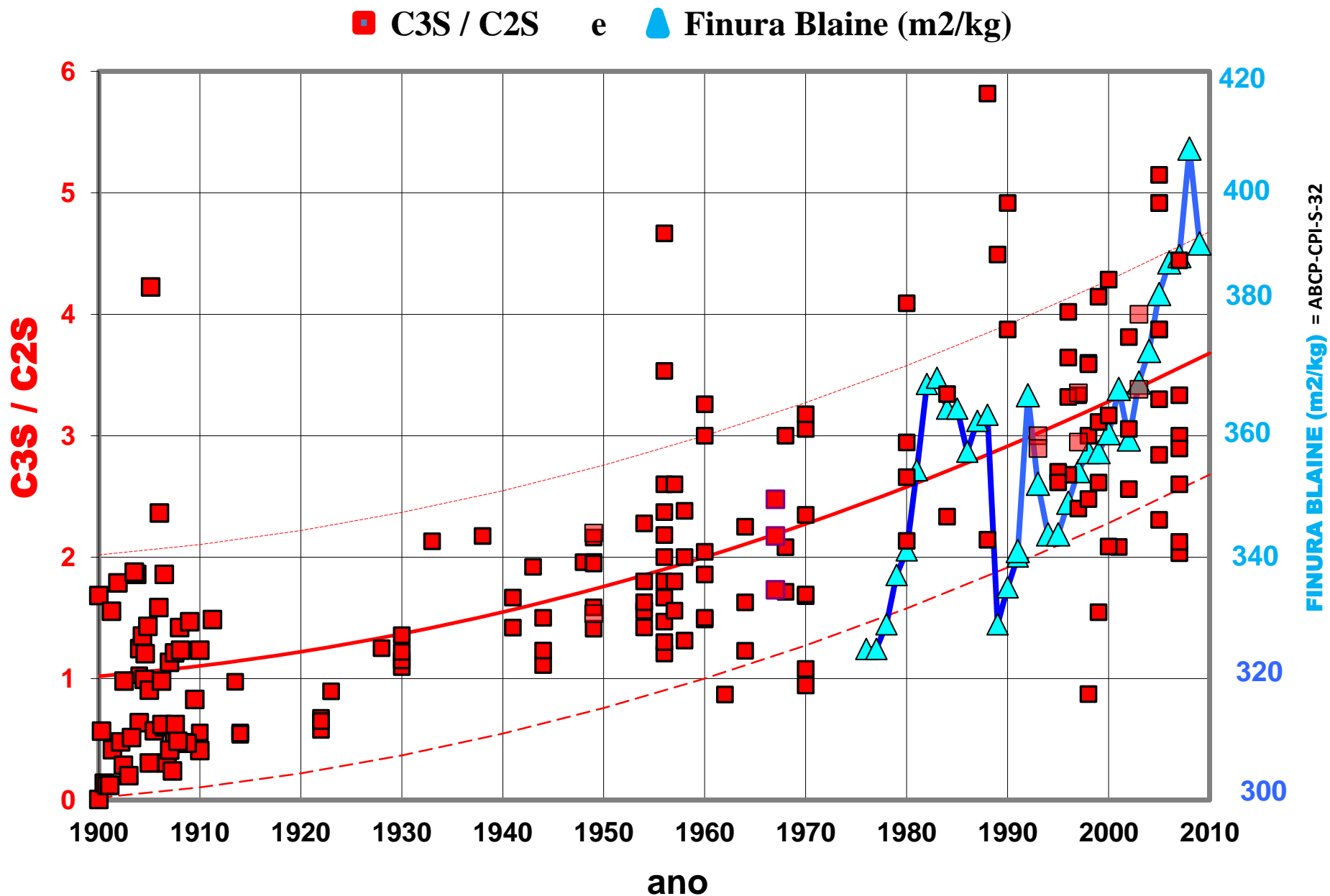
Prof. AİTCIN - 2009 - Cimento Portland - Teor máximo de C3A = 4%

C3A = Alta taxa de liberação inicial do calor



Obs : Pontos com moldura são da PCA em 2008

Gráfico feito por Eduardo Thomaz com os dados coletados nos livros e artigos citados nas referências ao final do texto.



CONCLUSÃO : OS CIMENTOS ATUAIS ENDURECEM CADA VEZ MAIS RÁPIDO LIBERANDO CADA VEZ MAIS CALOR A CURTO PRAZO. NA AUSÊNCIA DE CUIDADOS ESPECIAIS , COMO RESFRIAMENTO COM GELO, SURGEM FISSURAS.

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