Papal chemistry challenge

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We would like to invite you to participate in the Analytical Challenge, a series of puzzles to entertain and challenge our readers. This special feature of “Analytical and Bioanalytical Chemistry” has established itself as a truly unique quiz series, with a new scientific puzzle published every other month. Readers can access the complete collection of published problems with their solutions on the ABC homepage at <http://www.springer.com/abc>. Test your knowledge and tease your wits in diverse areas of analytical and bioanalytical chemistry by viewing this collection.

In the present challenge, ‘nomenclature of elements’ is the topic. And please note that there is a prize to be won (a Springer book of your choice up to a value of €100). Please read on...

Meet the papal chemistry challenge

It is not often that the elected leaders, political or religious, have had training in chemistry. Margaret Thatcher, Angela Merkel, and Xi Jinping come to mind, and the newly elected Pope Francis now joins this select list of few. To reflect on such a rare connection with chemistry, this challenge delves into the chemical aspects of the Vatican.

During papal conclaves, all eyes are turned impatiently to the rooftop of the Sistine chapel awaiting white smoke from the copper chimney which signals the election of a new Pope. Black smoke, on the other hand, signals a disagreement between the cardinals to elect a new Pope. The smoke, whether white or black, still remains the first public communication from the secret conclave. The all-important first message is not left to chance; since the 2005 conclave that elected Pope

Benedict XVI, the color of the smoke is engineered by means of chemistry [1]. Traditionally, wet straw has been added to the paper ballots which produce white smoke to signal the election of a new pontiff. This traditional method is now supplanted by a mixture of potassium chlorate, lactose, and rosin (an amber resin obtained from pines). A black conclave smoke is now obtained with help of potassium perchlorate, anthracene, and sulphur, instead of using the black pitch.

The production of conclave smoke and the early career path of Pope Francis are not the only crossroads of pontiffs and chemistry. This challenge seeks to find another, much lesser-known, connection.

The challenge

As with the election of a new Pope, once discovery of a new chemical element is officially recognized, a new name is adopted. The christening of an element, however, does not happen overnight as the assumption of regnal names by pontiffs. In fact, christening of elements can take decades. For example, the element 114 was discovered in 1999, this discovery was confirmed a decade later in 2009, the element was officially recognized in 2011, and the “new” element was officially named flerovium (symbol Fl) by the International Union of Pure and Applied Chemistry (IUPAC) in 2012 [2]. To facilitate the scientific communications regarding elements which lack a formal name, a nomenclature of systematic naming has been established by the IUPAC, the International body in charge of christening all new chemical elements. In this system, all unnamed elements, whether real or hypothetical, are known by their (atomic) numbers much like hotel rooms [3]. The systematic name of an element is formed by stringing Greek and Latin words for the numerals which form the atomic number of the element (see Table 1). The name is always followed by the suffix “-ium”. In addition to their names, chemical elements are also known by

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Table 1 IUPAC systematic nomenclature for naming newly discovered or elements that have not been discovered yet

Numeral	Prefix ^a	Symbol ^b
0	nil	n
1	un	u
2	b(i)	b
3	tr(i)	t
4	quad	q
5	pen(t)	p
6	hex	h
7	sep(t)	s
8	oc(t)	o
9	en(n)	e

^a Letters in parenthesis are omitted if they are followed by a the same letter. For example, the element with atomic number 902, or simply element 902, is named ennibium, and not ennnibium

^b The first letter of the element symbol is capitalized. For example, the symbol for the element 902 is Enb

their symbols, such as Hg for mercury or Cm for curium. In this vein, the symbol of an element in the systematic nomenclature is formed by stringing the first letters of the corresponding numeral prefixes. For example, until a proper name is adopted (if ever), the element with atomic number 266 is officially called bihexhexium (symbol Bhx), which literally means “the 266th” in the made-up hybrid of scientific Latin and Greek.

Now what has that to do with the Pope? Well, that is for a clever reader to find out. While searching for the sacred treasure, Robert Langdon of *The Da Vinci Code* encountered a cryptic clue: “a knight whose funeral was presided over by a Pope” [4]. Not much different from Langdon’s, the clue for this challenge is: “this element is Pope”.

Can you identify the mysterious “papal element”?

References

1. Vatican Information Service (2013) How the white and black “fumate” are produced. Vatican City, March 12
2. Loss RD, Corish J (2012) Pure Appl Chem 84:1669–1672
3. Chatt J (1979) Pure Appl Chem 51:381–384
4. Brown D (2003) *The Da Vinci Code*. Doubleday, New York

We invite our readers to participate in the Analytical Challenge by solving the puzzle above. Please send the correct solution to abc-challenge@springer.com by October 1, 2013. Make sure you enter “Papal chemistry challenge” in the subject line of your e-mail. The winner will be notified by e-mail and his/her name will be published on the “Analytical and Bioanalytical Chemistry” homepage at <http://www.springer.com/abc> and in the journal (volume 406/issue 1) where readers will find the solution and a short explanation.

The next Analytical Challenge will be published in 405/27, November 2013. If you have enjoyed solving this Analytical Challenge you are invited to try the previous puzzles on the ABC homepage.