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A note on Bailey pairs and q-series identities

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Abstract: In this paper, making use of Barley pairs and a general transformation formula we have established interesting q-series identities.
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1. Introduction

As usual, we employ the notations,

$$(a;q)_n = (1-a)(1-aq)...(1-aq^{n-1}), \qquad n \geq 1,$$

$$(a;q)_0 = 1, \qquad (a;q)_\infty = \prod_{n=0}^{\infty}(1-aq^r)$$

and

$$(a_1, a_2, ..., a_r; q)_n = (a-1;q)_n(a_2;q)_n...(a_r;q)_n.$$

An ${}_r\Phi_s$ basic hypergeometric series

$${}_r\Phi_s\left[\begin{array}{l} a_1, a_2, ..., a_r; q; z \\ b_1, b_2, ..., b_s \end{array}\right] = \sum_{n=0}^{\infty}\frac{[a_1, a_2, ..., a_r; q]_n z^n}{[q, b_1, b_2, ..., b_s; q]_n}, \qquad |z| < 1$$

Bailey is 1947 showed that

If $\beta_n = \sum_{r=0}^{n}\frac{\alpha_r}{[q;q]_{n-r}[aq;q]_{n+r}}$ and $\gamma_n = \sum_{r=n}^{\infty}\frac{\delta_r}{[q;q]_{r-n}[aq;q]_{r+n}}$
then

$$\sum_{n=0}^{\infty}\alpha_n\gamma_n = \sum_{n=0}^{\infty}\beta_n\delta_n. \tag{1.1}$$